Report Information from ProQuest

03 October 2023 02:27

TABLE OF CONTENTS

Search Strategy........ v

1. Roles for Health Care Professionals in Addressing Patient-Held Misinformation Beyond Fact Correction. 1

2. Content Themes and Influential Voices Within Vaccine Opposition on Twitter, 2019........ 5

3. Crowdfunding Cannabidiol (CBD) for Cancer: Hype and Misinformation on GoFundMe........ 13

4. Contrasting Misinformation and Real-Information Dissemination Network Structures on Social Media During a Health Emergency........ 22

5. Adapting and Extending a Typology to Identify Vaccine Misinformation on Twitter........ 32

6. Correction as a Solution for Health Misinformation on Social Media........ 41

7. Who Is Susceptible to Online Health Misinformation?........ 45

8. Facebook Pages, the "Disneyland" Measles Outbreak, and Promotion of Vaccine Refusal as a Civil Right, 2009–2019........ 49

9. Using a Global Pandemic as a Teachable Moment to Promote Vaccine Literacy and Build Resilience to Misinformation........ 59

10. HPV Vaccine Searches on Pinterest: Before and After Pinterest's Actions to Moderate Content........ 64

11. Tackling Online Misinformation: A Critical Component of Effective Public Health Response in the 21st Century........ 73

12. Twitter Communication During an Outbreak of Hepatitis A in San Diego, 2016–2018........ 75

13. Where We Go From Here: Health Misinformation on Social Media........ 85

14. Limited Role of Bots in Spreading Vaccine-Critical Information Among Active Twitter Users in the United States: 2017–2019........ 89

15. A Prologue to the Special Issue:Health Misinformation on Social Media........ 99

16. Breast Cancer Prevention and Treatment: Misinformation on Pinterest, 2018........ 103

17. Misinformation About Commercial Tobacco Products on Social Media- Implications and Research Opportunities for Reducing Tobacco-Related Health Disparities........ 112

18. Concrete Recommendations for Cutting Through Misinformation During the COVID-19 Pandemic........ 116

19. Ethical Considerations for Digitally Targeted Public Health Interventions........ 120

20. Social Media and Cancer Misinformation: Additional Platforms to Explore........ 124

21. Implementation of a Statewide Policy Mandating School-Based Fitness Assessment Screening, Georgia: 2018........ 128

22. Trends in Extreme Distress in the United States, 1993–2019........ 133

23. Community Resistance as Public Health Activism in Puerto Rico........ 141

24. Rural Legal Deserts Are a Critical Health Determinant........ 144

25. Katrina's Lesson:Time to Imagine an After COVID-19........ 151

26. Outbreak of Measles in a Residential Home for the Intellectually Disabled in Singapore in 2019........ 154

27. Pets in Comprehensive Disaster Planning: The Post–Hurricane Katrina Experience........ 159

28. Impact on Nonfirearm Deaths of Firearm Laws Affecting Firearm Deaths: A Systematic Review and Meta-Analysis........ 162

29. Identifying Incidents of Public Health Significance Using the National Poison Data System, 2013–2018. 173
30. Access to Firearms, Homicide, and Suicide: Role of the Mortality Multiplier.. 180
31. Speaking Truth to Power on How Hurricane Katrina Beat Us.. 184
32. Drug Shortages and the Defense Production Act... 189
33. Disability, Ethics, and Health Care in the COVID-19 Pandemic... 194
34. A Community-Based Participatory Research Approach to Hurricane Katrina: When Disasters, Environmental Health Threats, and Disparities Collide.. 203
35. Exploration of the STOP Act and Opioid Deaths in North Carolina, 2010–2018....................................... 210
36. Sow the Wind, Reap the Whirlwind: Katrina 15 Years After... 217
37. Global News.. 221
38. Water and Sanitation in Urban America, 2017–2019.. 224
39. Confronting American Misery: Learning From the Streets.. 233
40. The Environmental Health and Emergency Preparedness Impacts of Hurricane Katrina......................... 237
41. Food Access 3.0: Insights From Post-Katrina New Orleans on an Evolving Approach to Food Inequities 241
42. Colonial Neglect and the Right to Health in Puerto Rico After Hurricane Maria.. 246
43. COVID-19 Threatens Access to Oral Health... 256
44. Hurricane Katrina at 15: Introduction to the Special Section.. 257
45. Policy Views and Negative Beliefs About Vaccines in the United States, 2019.. 262
46. Public Health Integration Into Public Safety in Post-Katrina New Orleans.. 266
47. Leisure Activity Engagement Among the Oldest Old in China, 1998–2018.. 271
48. Frequent Cannabis Use and Cessation of Injection of Opioids, Vancouver, Canada, 2005–2018........... 276
49. Advances in Environmental Health and Disaster Research 15 Years After Hurricane Katrina................. 285
50. Prescription Drug Monitoring Programs and Overdoses: Advancing the Next Generation of Research... 289
51. The Paradoxical Effects of Hurricane Katrina on Births and Adverse Birth Outcomes............................. 293
52. Hurricane Katrina: A Signature Cascading Risk Event and a Warning.. 301
53. Disability Nondiscrimination: An Urgent Issue for Pandemic Justice.. 305
54. Community Health Worker Leadership In Louisiana, During and After Hurricane Katrina........................ 309
55. Reopening the United States: Black and Hispanic Workers Are Essential and Expendable Again........... 313
56. From Katrina to COVID-19: Hard-Learned Lessons and Resilience... 317
57. Inclusion of Disability Content in Graduate Public Health Curricula.. 321
58. Purchaser Licensing, Point-of-Sale Background Check Laws, and Firearm Homicide and Suicide in 4 US States,
1985–2017.. 325
59. Fifteen Years After Katrina: Paving the Way for Health Care Transformation.. 335
60. Meatpackers, Other Workers Face High COVID-19 Risks.. 339
61. The Environmental Health Impact of Hurricane Katrina on New Orleans... 341

TABLE OF CONTENTS

Bibliography 350

SEARCH STRATEGY

Set No.	Searched for	Databases	Results
S1	American Journal of Public Health	Ebook Central, Public Health Database, Publicly Available Content Database	595123*

* Duplicates are removed from your search, but included in your result count.

Roles for Health Care Professionals in Addressing Patient-Held Misinformation Beyond Fact Correction

Southwell, Brian G, PhD; Wood, Jamie L, PhD; Navar, Ann Marie, MD, PhD

ProQuest document link

ABSTRACT (ENGLISH)

Most patients trust their health care professionals,1 but many also turn to sources outside of the examination room for medical information. Although many resources provide accurate information (e.g., government health agencies, professional organizations, and patient advocacy groups), not all information that patients find is accurate. Patients may encounter medical misinformation from a variety of online sources, which can have important health consequences. Health care providers can play a critical role in addressing medical misinformation but have not yet had the opportunity to address medical misinformation fully. (Certain disciplines have made progress, such as pediatricians in mitigating vaccine misinformation.) Effectively addressing misinformation requires more than attempts to simply discredit misperceptions. Encountering patient-held misinformation offers an opportunity for clinicians to learn about patient values, preferences, comprehension, and information diets. Systematically training health care professionals to address patient-held misinformation with empathy and curiosity, acknowledging time and resource constraints, will be a crucial contribution toward future mitigation of medical misinformation.

FULL TEXT

Most patients trust their health care professionals,1 but many also turn to sources outside of the examination room for medical information. Although many resources provide accurate information (e.g., government health agencies, professional organizations, and patient advocacy groups), not all information that patients find is accurate. Patients may encounter medical misinformation from a variety of online sources, which can have important health consequences.

Health care providers can play a critical role in addressing medical misinformation but have not yet had the opportunity to address medical misinformation fully. (Certain disciplines have made progress, such as pediatricians in mitigating vaccine misinformation.) Effectively addressing misinformation requires more than attempts to simply discredit misperceptions. Encountering patient-held misinformation offers an opportunity for clinicians to learn about patient values, preferences, comprehension, and information diets. Systematically training health care professionals to address patient-held misinformation with empathy and curiosity, acknowledging time and resource constraints, will be a crucial contribution toward future mitigation of medical misinformation.

PATIENT EXPOSURE TO MISINFORMATION

Despite recent efforts by social media platforms to reduce or counter medical misinformation (e.g., https://bit.ly/3f4vBeE), patients can find a wide range of inaccurate medical information online with minimal effort. Some misinformation appears on Web sites advertising or selling alternative "natural" products and literature.2 Some misinformation lies in social media posts or carelessly written articles on various sites. A variety of misinformation about remedies, causes, and policy accompanied the arrival of the coronavirus disease 2019 pandemic, for example. At the same time, the potential consequences of medical misinformation also vary. Inaccurate claims that reach large audiences and encourage people to engage in damaging behavior are different from technically inaccurate but relatively inconsequential claims.3

Despite agreement as to the existence of problematic misinformation, patients and providers also face challenges in reliably characterizing high- and lowquality health information. One might attempt to judge information by assessing the scientific quality of research reported, transparency regarding research sponsorship, and the extent to which research limitations are described. (For examples of questions to raise, see https:// bit.ly/2D74fqY.) Effectively applying such a checklist approach, however, requires a baseline scientific understanding beyond what can be expected of most patients. Such questions best serve as a prompt for patient consultation with a health care professional rather than as a stand-alone tool for patients to use.

MITIGATING THE EFFECTS OF MISINFORMATION

We need to improve patient relationships with health care professionals, meaning we need tools and approaches for improving different types of patient-professional conversations about inaccurate medical claims. Here we can learn from a specific category of such efforts: those developed to address patient hesitancy about vaccines. Leask et al.4 developed a guide for health professionals to consider in addressing parental vaccination concerns. They emphasize a stance that offers parents assistance in decision-making rather than attempting to persuade parents directly or discredit specific information sources. Such an approach prioritizes offering informed advice on how to think about vaccine decisions rather than discrediting specific information sources. Importantly, we also know that in some instances even health care professionals themselves can offer inaccurate information.5 Leask et al.4 point to the opportunity for health care professionals to elicit parent concerns during such encounters and to acknowledge, listen, and empathize while pointing to appropriate information sources. Building on such an approach at Duke University with support from the ABIM Foundation and Craig Newmark Philanthropies, we have developed training for clinicians to address misinformation that emphasizes empathy and listening while acknowledging time limitations. Developing the capacity to listen to concerns, preferences, and values, as well as to monitor available information environments for inaccurate claims, requires effort. Although some have called for fact checking and social media response efforts by medical organizations to address medical misinformation, investing in scalable efforts to build individual relationships with patients will be crucial. Consider, for example, the experience of the US Centers for Disease Control and Prevention's effort to monitor travelers to the United States during the 2014 to 2015 Ebola outbreak. (For more information, see https://bit.ly/ 2CAM2lJ.) Evidence suggests that a key factor in traveler intention to adhere to requirements was trust-namely, the extent to which travelers trusted program staff with whom they talked at a US airport about the monitoring program. Interpersonal trust is most likely in situations in which people directly encounter a health care professional in person (at least virtually) rather than in situations in which people are presented with information in other ways. Trust involves relationships and not just facts.

To participate in a conversation (about information or what turns out to be misinformation), patients need to feel empowered to raise an idea that their health care provider may perceive as controversial or problematic. Rather than expect patients to raise concerns without prompting, health care providers should invite conversations about potential misinformation with their patients. For example, inviting patients to share what may be affecting their treatment choices with an open-ended question (e.g., "What have you already heard or learned about your treatment/condition?") could open useful conversational space.

Understanding misinformation as a force in a patient's life also calls for assessment of the patient's own lived context. Often patients' experiences or experiences of friends and family affect how they relate to medical information. Having a relative who experienced a medical error may lead a patient to be less trusting of the health care system in general and more likely to believe misinformation focused on the "dangers" of traditional therapies. Some patients may have less trust in the health care system and physicians because of health inequities and historic mistreatment.6 Religious or spiritual beliefs also can affect patients' beliefs about their bodies and may affect therapeutic choices, from choosing natural alternatives to declining therapies.

Providers should recognize that patients will continue to seek medical advice from the Internet, peers, and family members. Directing patients away from alternative sources altogether is unlikely to succeed. Mitigating the effects of misinformation requires providers to empower patients with accurate sources of information to meet patients' own needs for self-education. Patient educational materials should include information about trusted resources.

Although research on the effects of medical misinformation is increasing, we know relatively little about how to address it through clinician intervention. Just as research has helped determine optimal techniques for shared decision-making between patients and providers, we need a systematically developed evidence base for addressing misinformation in a clinical setting.

A PATH FORWARD

Health care professionals can address patient encounters with medical misinformation by leveraging opportunities to listen to patients, monitor existing electronic information environments, and guide patients toward enhanced understanding of peer-reviewed medical evidence, perhaps in concert with initiatives to enhance news and information literacy.7 Doing so will involve more than issuing corrective pronouncements about fallacies. Health care professionals will need to invest time in understanding what misinformation patients describe and value and work cooperatively with patients to prioritize credible sources. ÂfPU

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CONTRIBUTORS

All authors contributed equally to this editorial.

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CONFLICTS OF INTEREST

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Sidebar

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DETAILS

Subject:	Vaccines; Information literacy; Verbal communication; Medical personnel; Social networks; Families &family life; Immunization; COVID-19; Patients; Decision making; Trust; False information; Professionals; Information sources; Systematic review; Internet; Health care; Comprehension; Pediatricians; Health care industry; Mitigation; Health services; Information; Government agencies; Training
Business indexing term:	Subject: Social networks Professionals; Corporation: Amgen Inc Regeneron Pharmaceuticals Inc
Location:	United States--US
Company / organization:	Name: Duke University; NAICS: 611310; Name: Amgen Inc; NAICS: 325412, 541714
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Database:	Public Health Database

Document 2 of 61

Content Themes and Influential Voices Within Vaccine Opposition on Twitter, 2019

Bonnevie, Erika, MA; Goldbarg, Jaclyn, MPH; Gallegos-Jeffrey, Allison K, MPH; Rosenberg, Sarah D, MPH; Wartella, Ellen, PhD; Smyser, Joe, PhD

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ABSTRACT (ENGLISH)

Objectives. To report on vaccine opposition and misinformation promoted on Twitter, highlighting Twitter accounts that drive conversation. Methods. We used supervised machine learning to code all Twitter posts. We first identified codes and themes manually by using a grounded theoretical approach and then applied them to the full data set algorithmically. We identified the top 50 authors month-over-month to determine influential sources of information related to vaccine opposition. Results. The data collection period was June 1 to December 1, 2019, resulting in 356 594 mentions of vaccine opposition. A total of 129 Twitter authors met the qualification of a top author in at least 1 month. Top authors were responsible for 59.5% of vaccine-opposition messages. We identified 10 conversation themes. Themes were similarly distributed across top authors and all other authors mentioning vaccine opposition. Top authors appeared to be highly coordinated in their promotion of misinformation within themes. Conclusions. Public health has struggled to respond to vaccine misinformation. Results indicate that sources of vaccine misinformation are not as heterogeneous or distributed as it may first appear given the volume of messages. There are identifiable upstream sources of misinformation, which may aid in countermessaging and public health surveillance. (Am J Public Health. 2020;110:S326-S330. https://doi.org/10.2105/AJPH. 2020.305901)

FULL TEXT

Headnote

Objectives. To report on vaccine opposition and misinformation promoted on Twitter, highlighting Twitter accounts that drive conversation.

Methods. We used supervised machine learning to code all Twitter posts. We first identified codes and themes manually by using a grounded theoretical approach and then applied them to the full data set algorithmically. We identified the top 50 authors month-over-month to determine influential sources of information related to vaccine

opposition.

Results. The data collection period was June 1 to December 1, 2019, resulting in 356 594 mentions of vaccine opposition. A total of 129 Twitter authors met the qualification of a top author in at least 1 month. Top authors were responsible for 59.5% of vaccine-opposition messages. We identified 10 conversation themes. Themes were similarly distributed across top authors and all other authors mentioning vaccine opposition. Top authors appeared to be highly coordinated in their promotion of misinformation within themes.

Conclusions. Public health has struggled to respond to vaccine misinformation. Results indicate that sources of vaccine misinformation are not as heterogeneous or distributed as it may first appear given the volume of messages. There are identifiable upstream sources of misinformation, which may aid in countermessaging and public health surveillance. (Am J Public Health. 2020;110:S326-S330. https://doi.org/10.2105/AJPH. 2020.305901)

Vaccine opposition is a threat to global health,1 with digital and social media a primary source of misinformation and means of organizing vaccine opposition.2,3 Misinformation has reached a critical level, with provaccine and vaccine-opposing communities increasingly polarized.4 "Anti" messaging is increasing in communities that appear to be largely unaffected by traditional health promotion strategies and scientific information.5 In 2000, measles was declared eradicated in the United States as the result of an effective vaccination campaign; however, in 2019, the Centers for Disease Control and Prevention announced 1282 confirmed cases of measles, the highest since 1992.6 Vaccine opposition also has policy implications: dozens of state bills have attempted to supplant established population health practice by prioritizing personal liberties and appealing to ideology, rather than evidence.7 Misinformation erodes trust in science and public health authorities and is associated with a decrease in vaccination rates, risking further outbreaks and cases of vaccine-preventable disease.8 There are economic implications as well: treating measles outbreaks costs approximately $32 000 per case,9 and, in 2017, the reported cost to treat 1 child's case of tetanus was more than $800 000.10 Despite the established and evolving threat to public health that vaccine opposition poses, there has been no systematic, sustained effort to identify, track, and routinely report on it in the United States.

In 2019, public health nonprofit The Public Good Projects commenced Project VCTR (Vaccine Communication Tracking and Response) to identify and track vaccine-related communication on digital and social media. This study examines discourse on Twitter, given that the platform is a primary source of online vaccine misinformation.11,12 The aims of this study were to (1) determine the volume of conversation around vaccine opposition, (2) explore specific themes in conversation regarding vaccine opposition with a focus on vaccine-related misinformation, and (3) identify accounts that are drivers of vaccine opposition. We compared content themes employed by influential vaccine opposition accounts with general themes in vaccine-opposition discourse to identify message frames top authors use to drive conversation.

METHODS

We obtained data through a partnership with a media monitoring platform that collected 100% of publicly available Twitter tweets and retweets containing keywords identified by The Public Good Projects. The initial data collection process was based on a lengthy keyword search query using English-language Boolean operators to identify information related to vaccination conversation on Twitter in the United States from June 1 to December 1,2019. Keywords were selected based on a review of previously published scientific, gray, and white literature (Appendix A, available as a supplement to the online version of this article at http:// www.ajph.org) and deductive determinations based on familiarity with online vaccine conversation.

Initial data collection followed 2 processes: keywords could either be "standalone" or "co-occurring." Standalone keywords function so that any mention of a specific word would collect that post. The initial query consisted of 129 standalone words and 129 hashtag equivalents. Terms could also be co-occurring, meaning that a post was collected if 2 terms were present. Shortened forms of "vaccination" were collected if they also included a health condition treated by vaccines or terms referenced in vaccine discourse. The co-occurring search query consisted of 333 health condition- or vaccine-related words and hashtag equivalents, paired with 3 shorthand vaccine terms and hashtag equivalents. We employed 60 exclusion terms to exclude content related to animal vaccinations or medication instructions. Keywords can be found in Appendix B (available as a supplement to the online version of this article at http://www.ajph. org).

Identifying Vaccine Opposition

We gathered Twitter data continuously throughout the data collection period. With data collection ongoing, we selected a random sample of 1000 tweets from the total sample ofvaccine-related conversation (0.9% of the data collected at the time, in line with research conducting similar analyses13) and manually coded to identify messages in opposition to vaccines (step 2, Figure 1). In this process, retweets were not manually coded, given that they are often identical to the original tweet, and analysts focused on coding as many unique posts as possible. These messages were differentiated from those in the total sample, which contained all messages referencing vaccines, whether positive, neutral, or in opposition. Posts referencing vaccine hesitancy (i.e., those who do not vaccinate because of lack of access or those who do vaccinate but have questions) were not considered vaccine opposition. These posts generated an additional list of keywords specific to vaccine opposition, which were then added to the full keyword query that generated the total sample, allowing for messages to be identified and analyzed separately as vaccine opposing. All analysis in this study was conducted on posts containing terms related to vaccine opposition.

Theme Generation

We then categorized vaccine-opposing posts into themes. Using a 5-step interpretive process, 2 coders (E. B. and S. D. R.) manually coded 1000 randomly selected posts (step 3, Figure 1).14 Approximately 200 posts were cross-coded between analysts. Discrepancies were re-examined until reaching agreement on more than 90% of posts. Themes were created, compared, and combined until data saturation was achieved, defined as a theme comprising less than 1% of conversation. For this study, 74.8% of data pertaining to vaccine opposition were coded into a theme. Each theme was assigned its own unique list of keywords that identified a post as having met the criterion ofthat theme. To test the validity of each theme's keywords, keywords were turned into queries, as described previously. We reviewed 100 randomly selected posts automatically categorized to each theme. If 90% of automatically categorized posts were accurately coded, that theme's keyword query was approved and applied to the total sample. Theme definitions and sample keywords can be found in Appendix C (available as a supplement to the online version of this article at http://www.ajph.org). Applications ofsupervised automatic coding for qualitative analysis have been explored as a practical way of applying lessons from big data sets to public health.13,15

To identify misinformation promoted within themes around vaccine opposition, analysts reviewed 200 posts receiving the most engagement within each theme (step 4, Figure 1). Misinformation was organized into categories, with each category defined by unique keywords. These keywords allowed all posts within the theme to be automatically tagged if they contained a category of misinformation. Analysts manually verified the top 200 posts within each misinformation category, and keywords were amended to ensure that at least 90% of posts were tagged with the correct misinformation category. The operational definition of "vaccine misinformation" was considered any information that contrasted with the Centers for Disease Control and Prevention's Immunization Safety Office.16

Top Authors

As with other studies examining Twitter data for vaccine-related information,17,18 this study made use of metadata accompanying posts to perform social network analyses. We sorted accounts publishing messages by the number of engagements received to determine which accounts had the most influence in the vaccine opposition conversation (termed "top authors"). Engagement was defined as a like, comment, or share of a post. Analysts identified the top 50 authors each month. Defining engagement in this way allowed for discovery of accounts with the most frequent interactions, specific posts receiving the most interactions, and themes most commonly employed across these posts. Previous research has also examined the top 50 Twitter authors as a way of measuring trends.19 Top authors were manually examined to ensure they were promoting vaccine opposition, versus mocking or reporting on vaccine opposition. Results compare conversation from top authors with overall vaccine opposition conversation with top authors removed ("top authors" vs "non-top authors"). We used the %2 test to determine statistically significant differences between top authors and non-top authors for each theme.

RESULTS

From June 1 to December 1, 2019, we collected 356 594 Twitter posts mentioning vaccine opposition. We identified 129 unique Twitter accounts as top authors within at least 1 of the 6 months, generating 212 018 total engagements and 772.9 million potential impressions (the number of followers of the original author plus the followers of individuals who shared their content). Of those 129 accounts, 15 were top authors for at least 5 months, during which time they generated 124 243 engagements, which was 58.6% of the 212 019 engagements with top authors' content.

We identified 10 themes within posts about vaccine opposition, with the top 5 themes each comprising over 10% of mentions. (Table 1):

Negative health impacts were shown in 55.4% of mentions from top authors and 49.2% of the general opposition (non-top authors). Within this theme, misinformation around deaths attributable to vaccines and vaccine-caused autism was present in 66.5% and 43.8% of top author posts, respectively. Within general opposition, deaths were mentioned in 14.5% of posts and autism in 26.3%. Across references to death, top authors predominantly shared a journal article citing deaths reported to the Vaccine Adverse Event Reporting System from 1997 to 2013 to claim vaccines cause child death.20 Other misinformation related to health impacts included associations between vaccines and paralysis (5.9% top authors; 0.5% general opposition) and seizures (5.7% top authors; 0.8% general opposition).

Pharmaceutical industry mentions appeared in 16.9% of posts from top authors and 18.9% of general opposition. Vaccines were most often framed as a conspiracy by "Big Pharma" to increase sales revenue. Merck was referenced in 58.1% of posts from top authors, compared with 38.7% by general opposition, because of its manufacturing of the Gardasil vaccine.

Policies and political debates related to vaccination followed, in 15.0% of conversation from top authors and 17.7% from general opposition. Posts in this theme predominantly focused on the National Childhood Vaccine Injury Act, which eliminated potential financial liability of vaccine manufacturers from injury claims (27.2% top authors; 6.6% general opposition) and California's Senate Bill 276 which tightened vaccine exemptions (23.9% top authors; 17.5% general opposition). Political discourse regarding vaccines frequently mentioned the government's role in vaccine injury claims and allegations that the government deliberately conceals negative vaccine side effects.

Vaccine ingredients comprised 13.8% of conversation from top authors and 17.2% of general opposition, with posts mentioning heavy metals or ingredients disclosed in vaccine package inserts. Aluminum was the most frequent ingredient referenced, within 44.5% of posts from top authors and 6.4% of the general opposition, followed by mercury (34.1% top authors; 6.9% general opposition) and aborted fetal tissue (9.3% top authors; 2.6% general opposition).

Vaccine research was found within 15.5% of posts from top authors and 5.6% of general opposition. Posts most often criticized vaccine research or institutions conducting research or promoted pseudoscience as fact. The most frequently referenced studies were related to the human papillomavirus vaccine and its association with negative health impacts after vaccination.21 A commonly shared article was retracted in 2019 and is now found on vaccine opposition Web sites (29.0% top authors; 8.9% general opposition).22,23 This was followed by research about the influenza vaccine, highlighting studies showing associations with other respiratory infections, renal failure, and suppressed immune responses (20.0% top authors; 7.3% general opposition).24-26

Five of the identified themes amounted to approximately 7% or less of the total conversation:

Disease prevalence focused on measles outbreaks, with 83.2% of top author posts and 17.4% of general opposition posts mentioning measles or the measles, mumps, and rubella vaccine. Vaccine opponents frequently cited stories about vaccine-driven epidemics, such as the vaccine-derived poliovirus, to suggest the dangers of vaccines (19.5% top authors; 3.8% general opposition).27

Family members typically included mention of individuals who believe they have experienced negative health impacts attributable to vaccination, often from a parent sharing a vaccine adverse health event of their child (70.7% top authors; 57.2% of general opposition).

School conversation focused on policies related to mandatory vaccinations for enrollment.

Religion included references to any religion and most often discussed religious exemptions to mandatory vaccines (46.7% top authors; 44.5% general opposition).

Natural alternatives to vaccines included misinformation about the use of homeopathic alternatives to vaccination and "vaccine detox."

DISCUSSION

This study showed that major talking points used by vaccine opponents originated from a handful of accounts. A total of 129 accounts on Twitter appeared to be driving more than half of all conversation regarding vaccine opposition, and 15 accounts appeared hyperinfluential, generating a majority of engagements on top authors' posts. When top authors' posts were compared with other posts, misinformation themes were similar. While there were statistically significant differences in the proportions of most themes, this may have been attributable to the sample size; when themes were ranked by use, the most common themes used by top authors and all other authors were nearly identical.

When we examined themes for specific talking points, top authors promoted similar misinformation within each theme. For example, within conversation about negative health impacts, references to deaths and autism were mentioned in 67% and 44% ofposts by top authors, respectively. In posts made by non-top authors, these 2 conditions were both mentioned in approximately 15% of posts. Throughout all themes, results showed how vaccine opponents can manipulate facts and their sources. It can be challenging for even experienced public health researchers to verify each claim made by a vaccine opponent, particularly given the amount, variety, and often misleading nature. For example, information taken from the Vaccine Adverse Event Reporting System, a database created by federal health agencies to monitor vaccine reactions, is used by vaccine opponents as "proof" of the government admitting that vaccines cause child death. Critically important context, such as the fact that an adverse event can be reported even ifit is uncertain or unlikely that a vaccine caused it or the role of statistical significance or reporting bias in epidemiology, is lost. Misinformation is a complex issue involving not just what is said but also the intent behind it.

The finding that top authors share the same misinformation suggests that vaccine opponents rely on highly networked communities driven by leaders driving particular narratives.28,29 Influential vaccine opponents most likely select their messages based on the receptivity to those messages. By contrast, public health continues to repeat the same vaccination recommendations in the same manner, despite research demonstrating that these messages arrive in an echo chamber, received by those at little risk of vaccine hesitancy.2,4 The public health community should think critically and pivot messaging based on themes that receive the most engagement among those likely to be vaccine hesitant.

This study suggests that not only are vaccine opposition talking points discoverable but also that they can be quantified; there are only a handful employed at a given time. This aligns with research showing that a majority of Facebook advertisements opposing vaccination were funded by 2 groups.30 If these groups are passively monitored, as suggested by other researchers, public health may be able to counter the growing influence of vaccine opposition by quickly identifying and countering talking points.4

Limitations

The study had limitations. Tweets were collected containing keywords identified (Appendix B). Tweets about vaccines that did not contain these terms were not collected. It is possible that posts were miscoded, particularly for those sarcastically referencing vaccine opposition. Analysts manually checked each theme to ensure at least 90% fidelity and amended keywords to capture sarcasm when possible. In addition, engagement and shared talking points were used as measures of influence, and there are likely other unexplored means of quantifying the influence of individuals in social networks. Furthermore, it is possible that engagements with top author posts were critical of vaccine opposition, rather than supportive. To address limitations, the methodology for automatic coding was tested and checked during this study, and previous research on automatic sentiment analysis for vaccine opposition on Twitter was consulted.31,32

Although outside the scope of this study, research should explore the impact of seasonality on vaccine opposition. The data collection period spanned back-to-school season, flu season, and the legislative cycle. Seasonality was likely a contributing factor to misinformation. In addition, variables such as time or day of the week could be useful in understanding message spread.

Public Health Implications

Results highlighted common vaccine-related misinformation used by vaccine opponents. It will continue to be difficult for public health to effectively counter vaccine opposition without a greater understanding of opposition actors and narratives. It is also important to note that, while this study examined vaccine opposition collectively, pro- and antivaccination beliefs are better represented as a spectrum, not as distinct states.33 Additional research should segment audiences that may be susceptible to specific messages highlighted in this study. In doing so, researchers can identify ways of utilizing and sharing retrospective, real-time, and predictive media data to create messaging that effectively and quickly reaches individuals who are vaccine hesitant. /4JPI-I

CONTRIBUTORS

E. Bonnevie conceptualized the study, oversaw data collection and analysis, and led writing. A. K. GallegosJeffrey and S.D. Rosenberg analyzed the data. J. Goldbarg, E. Wartella, andJ. Smyser conceptualized the study and provided a critical review of the article. All authors approved the final version to be published.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

No human participants were involved in this study. Institutional review board approval was sought from IntegReview, and the study was found to be exempt from review.

Sidebar

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DETAILS

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Document 3 of 61

Crowdfunding Cannabidiol (CBD) for Cancer: Hype and Misinformation on GoFundMe

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ProQuest document link

ABSTRACT (ENGLISH)

Objectives. To use crowdfunding campaigns to better understand how cannabidiol (CBD) is represented (and misrepresented) as cancer-related care. Methods. We analyzed CBD-related crowdfunding campaigns (n = 155) created between January 2017 and May 2019 in multiple countries on GoFundme.com. Results. More than 81.9% of campaigns fundraised CBD for curative or life-prolonging reasons, and 25.2% fundraised for pain management. Conclusions. Most campaigns seeking funds for CBD for cancer-related care on GoFundMe are for curative or life-prolonging purposes and present CBD definitively asan effective treatment option. In general, campaigners supported their funding requests with anecdotal claims of efficacy and referenced sources of information that were either not evidence-based or that misrepresented existing evidence. Public Health Implications. Misinformation around CBD for cancer is widespread on medical crowdfunding campaigns. Given the potential adverse impact, crowdfunding platforms, like GoFundMe, must take steps to address their role in enabling and spreading this misinformation. (Am J Public Health. 2020;110:S294-S299. https://doi.org/ 10.2105/AJPH.2020.305768)

FULL TEXT

Headnote

Objectives. To use crowdfunding campaigns to better understand how cannabidiol (CBD) is represented (and misrepresented) as cancer-related care.

Methods. We analyzed CBD-related crowdfunding campaigns (n = 155) created between January 2017 and May 2019 in multiple countries on GoFundme.com.

Results. More than 81.9% of campaigns fundraised CBD for curative or life-prolonging reasons, and 25.2% fundraised for pain management.

Conclusions. Most campaigns seeking funds for CBD for cancer-related care on GoFundMe are for curative or life-prolonging purposes and present CBD definitively asan effective treatment option. In general, campaigners supported their funding requests with anecdotal claims of efficacy and referenced sources of information that were either not evidence-based or that misrepresented existing evidence.

Public Health Implications. Misinformation around CBD for cancer is widespread on medical crowdfunding campaigns. Given the potential adverse impact, crowdfunding platforms, like GoFundMe, must take steps to address their role in enabling and spreading this misinformation. (Am J Public Health. 2020;110:S294-S299. https://doi.org/ 10.2105/AJPH.2020.305768)

Health misinformation is an increasing problem forpublic health. Misinformation -understood here as any claim that is misleading or false based on the best current scientific evidence-has spread since the rise of social media, with substantial negative consequences.1,2 For example, diseases such as measles are reemerging in part because of misinformation about vaccine safety.3 Public health efforts to vaccinate those at risk are undermined by antivaccination misinformation on social media, which policymakers have acknowledged as a challenge. In Samoa, the effects of this misinformation have been deadly; approximately 63 persons died from measles there in December 2019 amid a large outbreak made possible by increased resistance to vaccination spurred by misinformation.4

While misinformation around vaccine safety is a prominent example of the challenges and impacts of health misinformation, this problem is not limited to vaccines and infectious diseases. Other forms of health misinformation surrounding a wide range of health issues are spread through online pathways. These include exposure to health misinformation on social media platforms such as Facebook, Instagram, Reddit, and Twitter; viewing ofonline advertisements for businesses selling products directly to consumers; and visiting "fake news" Web sites specifically peddling both health misinformation and intentional disinformation about the safety and efficacy of health products and procedures. These sources of health misinformation are easy to inadvertently access, as when individuals search symptoms or treatments of common conditions online and are then exposed to Web sites that appear credible but offer misinformation on the efficacy of alternative treatments and misrepresent the safety and efficacy of conventional treatments.5 More generally, search engine results, such as those provided by Google, can contain misinformation and can have an impact on public perceptions of an issue.6

One product now capturing widespread interest and, potentially, serving as a focus of health misinformation, is cannabidiol (CBD). CBD, a cannabinoid found in the cannabis plant, is commonly described online as a cure-all for numerous conditions or ailments.7 CBD is popular and under a so-called "health halo" because of the suggestive efficacy from its categorization as a natural health product.8 CBD is currently marketed, sold, and used for minor conditions and purposes such as pain relief and skin health, as well as more serious conditions such as Alzheimer's disease, attention deficit hyperactivity disorder, autism, anxiety, schizophrenia, menstrual pain, insomnia, eczema, erectile dysfunction, posttraumatic stress disorder, Crohn's disease, arthritis, and depression.7,9,10 However, there is little or no robust clinical evidence to support the use of CBD for any of these purposes.11 At this time, only Epidiolex-a CBD medication to prevent seizures-is accepted by US regulatory entities as having sufficient evidence of efficacy.12

Commercial businesses have cashed in on CBD's popularity, making available more than 500 CBD products.13 CBD-infused cosmetic products are available as shampoos, makeup, bath bombs, moisturizers, toothpaste, and soap.10 Food establishments and companies are presently offering CBD in a range of food products and beverages. The claimed effects ofCBD-infused products vary by product and manufacturer. For example, a CBD shampoo from Emera claims that CBD "naturally integrates with the body's endocannabinoid system to help reduce common dry hair conditions."14 These offerings are not limited to small or fringe companies as even the Coca-Cola Company is exploring introducing a wellness drink infused with CBD.15 Prominent celebrities are also entering the CBD business. Gwyneth Paltrow, the founder and owner of the controversial wellness brand Goop, is a business partner with a company that sells CBD called MedMen.13 Speaking to the benefits of cannabis, Paltrow comments: "[I]t can really be an alternative pain management system, and, in some cases, helpful for depression."16 Other celebrities such as Whoopi Goldberg and Willie Nelson have launched their own cannabis and CBD products for uses such as menstrual cramp relief, hormone balancing, increasing insulin sensitivity, reducing inflammation, and skin care.17,18

A particularly concerning form of misinformation around the efficacy of CBD is its representation as effective for cancer-related care. There is little evidence that CBD is an effective treatment of cancer and limited evidence for the side effects of cancer treatment, such as pain relief or nausea from chemotherapy.19,20 Nonetheless, numerous natural health Web sites and CBD companies make unsupported claims about the efficacy ofCBD for cancer treatment and therapeutic care. In December of2019, the US Food and Drug Administration sent notices to 15 CBD companies for misleading health claims on their Web sites and CBD products.21 Of these 15 companies, 12 had products or blogs claiming CBD as an effective cancer treatment. For example, Mr. Pink Collections, a Beverly Hills, California, CBD supplier, shared articles and social media posts with statements representing CBD as a "natural deterrent to cancerous cells" and claiming that it "arrests cancerous growth."22 Similarly, Koi CBD, another California-based CBD company, claims under a Web page titled "8 Proven Benefits ofCBD" that "CBD relieves pain and inflammation" and "inhibit[s] the invasion of lung and colon cancer."23

Limited research is available to determine how this misinformation is being received by people with cancer and incorporated into their cancer treatment regimens, how this misinformation is being replicated and spread by patient consumers of CBD, and the effects of this misinformation. As both public and private insurance generally do not provide coverage for CBD treatment, especially for cancer-related care, many would-be CBD users seek financial support for this intervention. Thus, a useful means of gaining insight into the understanding of potential users of CBD for cancer-related care is through analyzing medical crowdfunding campaigns appealing for help paying for CBD. Crowdfunding allows users to fundraise costs ofmedical treatment and share their campaigns on social networks, such as Facebook, to appeal for donations. To receive donations, campaigners need to share the details of their proposed treatment and rationale for seeking it. Unsolicited campaign descriptions allow for exploration into patient testimonials and explanations for treatment choices, as has been demonstrated by other analyses of crowdfunding data.24 Thus, the content of campaigns for those fundraising for CBD for cancer-related care can provide insight into why people with cancer are seeking this substance and whether they are well- or misinformed about its safety and efficacy, and help guide policy responses.

METHODS

We retrieved crowdfunding campaigns on GoFundMe.com on October 28, 2019, using targeted word searches for CBD term variants and "cancer" on a database ofcampaign data. This database, initiated in April 2019, was created using the GoFundMe.com sitemap to identify campaign URLs for data scraping. Continuously scraped data included the campaign title, description and updates, funding received, funding requested, geographic location of the campaigner, and number of Facebook shares. We selected GoFundMe because this platform is by far the largest host of medical crowdfunding campaigns worldwide.25 Terms searched with "cancer" included "cannabidiol," "CBD," "Rick Simpson Oil," and "RSO." Rick Simpson Oil is a cannabis oil product with both CBD and tetrahydrocannabinol (THC) and is used for cancer treatment purposes. We added it after an initial review of campaigns for cancer treatment with CBD included specific references to this form of CBD.

The initial search retrieved 955 campaigns. After we removed duplicate campaigns (n = 94) and campaign categories irrelevant to medical uses (n = 170), 691 campaigns remained. We excluded campaigns created before January 2017 to ensure campaigns were relevant to current CBD public discourse and debate, leaving 434 campaigns. The first author (M. Z.) reviewed each campaign to determine inclusion. Campaigns were included if they were crowdfunding CBD treatment of cancer-related care in humans. The second author (J. S.) reviewed campaigns flagged for inclusion. After reviewing each campaign, 155 remained for analysis. Campaigns were excluded for not crowdfunding for CBD (n = 231), not using CBD for cancer-related care (n = 24), using CBD for a nonhuman animal (n = 15), CBD for business ventures and legal issues (n = 8), or not available in English (n = 1).

The first and second authors independently reviewed half of the included campaigns and met to develop an initial coding framework. After discussing observed themes, an initial coding framework captured efficacy claims (curative or life prolonging; pain, symptom, and side-effect management; unspecified) and treatment regimen classification (complementary to mainstream treatment, elective exclusive of mainstream treatment, no other mainstream options rationale, or unspecified). After presenting the coding structure to the third author (T. C.), a third code was added to capture CBD efficacy presentation (definitive, possible, or not stated). The first author independently coded each campaign and recorded the specific cancer type and stage. Campaign codes flagged as unclear were reviewed by the second author and any disagreement was resolved through discussion orby the decision of the third author. The second and third authors each audited 50% of campaigns to ensure consistent coding.

RESULTS

The 155 included campaigns raised $904 750.39 (median = US $3015.00) from 12 362 donors (median = 39) and requested $2 748 785.96 (median = $7698.42). The campaigns were shared 67 641 times on Facebook, or averaged 442.1 shares per campaign (median = 262). Campaign host locations were the United States (n = 107), the United Kingdom (n = 28), Canada (n = 11), unknown (n = 3), Australia (n = 2), Ireland (n = 2), Germany (n = 1), and France (n = 1). Most commonly, campaign beneficiaries were patients described as experiencing stage 4 or terminal cancer (n = 71; 45.8%), with others facing unspecified stages (n = 66; 42.6%) and stages 1 to 3 (n = 18; 11.6%).

Campaigns using CBD for curative or life-prolonging reasons were observed in 127 campaigns, raising $757 551.52 (average = $5964.97; median = $3421.95) from 11 006 donors (average = 88 per campaign; median = 42) and shared 61 088 times on Facebook (average = 488.7; median = 272). These campaigns requested $2394 720.35, for an average request of $19 157.76 (median = $8500.00). Campaigns typically fundraised for CBD alongside other conventional or complementary cancer treatments. Most of these campaigns (n = 72; 56.7%) presented CBD as definitively effective in curing cancer or prolonging the recipient's life (Table 1). For example, a campaigner diagnosed with late-stage cancer stated that CBD "will kill the cancer entirely and also help deal with the after effects of other treatments." Often campaigns referenced the experience of others or themselves to justify these definitive efficacy statements. For example, one campaigner wrote

[After doing much research since the beginning of our Mothers diagnosis she read on about Cannabis oil and Rick Simpson's oil and about people healing themselves of tumours and cancer by ingesting very high levels of THC and CBD and all of the 66 different Cannabinoids to help eat and kill cancer cells.

Numerous campaigns reference research or statistics that allegedly prove CBD to be a viable cancer treatment, such as one campaigner from Colorado: "There have been amazing studies on CBD oil. Helps fight cancer . . . this approach I feel is way better than pumping your veins full of poison, at least this is natural."

A smaller group of campaigners raising funds for curative or life-prolonging reasons presented CBD as a treatment that may possibly cure or prolong their lives (n = 47; 37.0%). These campaigns, while still fundraising CBD for curative purposes, are more limited in their claims. Frequently, they are motivated by hope rather than certainty that CBD will cure their cancer or improve their health. For example, one campaigner raising funds for a family member with limited treatment options wrote: "One treatment we have recently become aware ofis CBD oil and although not scientifically proven, has shown signs to many people with cancer, of having remarkable reduction in the disease process." Eight campaigns raising funds for curative or life-prolonging reasons did not have enough information for categorization.

We observed crowdfunding CBD for pain, the side effects of treatment, or other symptoms in 39 campaigns, raising $159 702.56 (average = $4094.94; median = $1970.80) from 2013 donors (average = 51.6; median = 28) and shared 11 008 times on Facebook (average = 282.3; median = 205). These campaigns requested $486 609.09 (average = $12 477.08; median = $5000.00). Many of these campaigns sought to utilize CBD to lessen the side effects of conventional treatments such as radiation or chemotherapy orto use alongside other complementary cancer treatments. Reported uses ranged from stimulating appetite, general pain relief, assisting with sleep, countering nausea, or general recovery purposes. Most campaigners presented the efficacy of CBD for pain or symptom management purposes as definitively effective (n = 30; 76.9%). For example, one campaigner described CBD countering the effects of chemotherapy: "There is literally nothing else that helps more to get him through rough times like that. It truly helps him with appetite and pain." Another campaigner wrote: "Although CBD isn't a cure it's certainly something we've found to massively alleviate the symptoms and help to make him comfortable." A small number of these campaigns represented CBD as only possibly effective for pain and side-effect management (n = 7; 17.9%). For example, one campaigner who had not yet tried CBD wrote: "I have been reading up on the effectiveness of CBD oil for cancer sufferers and would like to take this to aid my recovery." Two campaigns did not have enough information for categorization.

Proposed uses of CBD for cancer-related care fell into 4 distinct categories: complementary to mainstream treatment (n = 97; 62.6%), elective exclusive of mainstream treatment (n = 28; 18.1%), no other mainstream options rationale (n = 22; 14.2%), or unspecified (n = 8; 5.2%; Table 2).

The most commonly observed category, complementary to mainstream treatment, refers to campaigns in which campaigners propose using CBD complementary to evidence-based cancer treatments to cure, prolong life, enhance the effectiveness of cancer treatment, or deal with side effects of cancer or cancer treatment. For example, a campaigner used CBD both to supplement chemotherapy and manage its side effects: "We started alternative therapies such as CBD immediately in June 2018 alongside what the oncologist prescribed. I'm pretty sure she wouldn't be here today without the oil."

Elective exclusive of mainstream treatment refers to campaigners using CBD on its own or as part of an alternative treatment regimen in place of mainstream treatment options and against medical opinion. These campaigns signify the choice to forgo conventional treatment. For example, the campaign of a terminally ill man living with cancer for the past 4 years wrote

We pulled together a huge benefit 4 years ago when he was given 6 months to live after refusing chemo and radiation, both industry recommended "fixes." [Name] decided to fight it holistically and with the original donation amounts rendered then, purchased CBD oil and it has prolonged his 'due date' to God for more than 3.5 years!

The no other mainstream options rationale category refers to campaigns in which CBD use is for curative or pain-relief purposes when no other evidence-based curative options are available. Those in this category are not opting out of traditional cancer treatments but rather have been told that no curative options exist, leading them to try CBD as an alternative. For example, a campaigner in the United Kingdom wrote

We are raising money for alternative treatment as her particular tumor is non-responsive to chemotherapy. Alternative treatments are very expensive and not coveredby insurance. We will order a customized CBD Oil, a strength not sold over the counter.

The majority of such cases are terminally ill patients trying something that could potentially cure orprolonglife.

Finally, we labeled 8 campaigns "unspecified," given that not enough information was available to categorize them.

DISCUSSION

Our results suggest that most campaigners seeking funds for CBD for cancer-related care purposes on GoFundMe are for curative or life-prolonging purposes and presented definitively as an effective treatment option. Campaigners support their funding requests with anecdotal claims of efficacy and reference sources of information that are either not evidence-based or that misrepresent existing evidence. This demonstrates that misinformation around CBD for cancer is widespread on GoFundMe.

The spread of CBD efficacy misinformation is compounded by sharing on social networks. Campaigns for curative or lifeprolonging purposes were shared more than 60 000 times or approximately 488.7 times (median = 272) per campaign. These shares may influence the treatment decisions of others who may, in turn, share misinformation about CBD. Campaign hosts must write compelling and sympathetic narratives considered worthy of donations by potential donors-an issue described previously.26 30 The financial success of the campaigns demonstrates the perceived credibility of claims of CBD's efficacy for cancer-related care. The campaigns were very successful and averaged $5946.97 (median = $3421.95) raised per campaign, indicating at least a minimum level of acceptance of campaign claims by donors. Campaign success also shows the power of crowdfunding narratives to persuade readers that unproven medical treatments are valid options.

CBD is primarily used as complementary to evidence-based treatment in our sample. Most campaigns were not relying on CBD as their sole or primary treatment option, but instead incorporating CBD into mainstream options such as chemotherapy or radiation to extend life expectancy or for pain relief. An additional 22 instances were of cases in which the campaign beneficiary did not have any standard treatment option available and thus was trying CBD as a last option. This is a somewhat positive finding because ofthe lack of evidence of CBD's efficacy for cancerrelated care. However, even incorporated as a complementary treatment, there are concerns. People with life-threatening illnesses are appealing for and spending substantial amounts ofmoney on CBD for purposes that are not evidence-based. Raising funds for CBD as a potentially curative or lifeprolonging treatment without appropriate evidence represents a context in which misinformation exploits hope in a particularly vulnerable group, spreads misinformation, and wastes resources. In addition, there is potential for CBD interaction with medications, and the side effects of CBD are still not fully known.10,13

We classified a sizable portion of campaigns using CBD as exclusive of mainstream treatment (n = 28). While these campaigns represent a smaller portion of the campaigns retrieved (18.1%), they are especially alarming. Most of our sample were persons with advanced stages of cancer, with approximately 45% describing a stage 4 or terminal cancer diagnosis. These campaigners were forgoing routine care to use CBD on its own or as part of an alternative treatment regimen for curative or life-prolonging treatment. Forgoing evidence-based treatment leads to potentially treatable cancer worsening and opportunities for positive outcomes diminished. The claims made by those within this category particularly heighten the risk of misinformation to others by advocating against cancer treatments such as chemotherapy or radiation in favor of "natural" or alternative treatment regimens incorporating CBD.

This study provides an example in which unproven cancer treatments are promoted on GoFundMe without intervention by this crowdfunding platform. It adds to crowdfunding research literature examining fundraising for scientifically unsupported or unproven treatments, such as unproven stem-cell interventions,31,32 homeopathy,24 and naturopathy, hyperbaric oxygen therapy, and long-term antibiotics for Lyme disease.33 The evidence presented provides a strong rationale to encourage or require GoFundMe to intervene by restricting the most problematic campaign types observed in our study. Researchers have proposed crowdfunding platforms to act as gatekeepers to deter campaigns for scientifically unsupported treatments.34 While all these campaigns include misinformation about the known efficacy of CBD for cancer-related care, campaigns making definitive statements about CBD's efficacy and promoting CBD as an alternative to available and evidence-based care are particularly dangerous. Unsubstantiated hype and inaccurate claims can cause people to forgo effective treatment and spread treatment misconceptions and distrust of conventional treatments, undermining public health systems.

GoFundMe directly enables and profits from the sharing of this misinformation and thus is responsible for ensuring content on its platform does not harm others. Facebook shares increase public exposure to misinformation and can inspire donations and the creation of new campaigns. While current mechanisms are in place to report campaigns, such as the "report fundraiser" button, these mechanisms are insufficient as they focus on fraudulent campaigns and do not include blocking the sharing of misinformation. GoFundMe should devote resources to identify campaigns with misinformation shortly after posting to their Web site, particularly those with implications for life-saving treatment decisions. Identifying campaigns at the early stages is crucial as this limits the spread of misinformation. Any activities to identify campaigns with misinformation should be transparent. To improve transparency and improve trust around these interventions, GoFundMe should share the process of campaign identification and report results, such as the number of campaigns identified as spreading misinformation. Relying on potential donors to report campaigns with misinformation is an inadequate response.

Crowdfunding platforms such as GoFundMe can work with recognized cancer institutions to determine acceptability of proposed fundraising asks. Other social media platforms have partnered with reputable health organizations to determine which content is appropriate or not. In 2019, Facebook announced that they would partner with the US Centers for Disease Control and Prevention to identify sources of vaccine misinformation.35 GoFundMe can take similar action with cancer and potentially other diseases or conditions about which misinformation is spread. If GoFundMe chooses not to take these actions on its own, then greater regulatory involvement preventing the hosting and spread of medical misinformation around CBD for cancerrelated care and beyond will be justified.

PUBLIC HEALTH IMPLICATIONS

CBD is associated with substantial misinformation. There are critical misconceptions about the current evidence base and acceptable uses, such as in the case of cancer. Crowdfunding platforms spread this misinformation. Campaign content is not checked for validity, and claims surrounding CBD efficacy for purposes such as curative or life-prolonging cancer treatment are shared widely on social media. This misinformation is dangerous; consequences include unnecessary financial strain and the delay and, in some cases, exclusion of evidence-based cancer treatment. GoFundMe must intervene to address its role in enabling and spreading this misinformation. ÂfPU

CONTRIBUTORS

AH authors reviewed the data, identified coding structure, and edited the article. M. Zenone wrote the article and coded data.J. SnyderandT. Caulfieldauditedcodeddata.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

Ethics approval was not required for this study because the data used were publicly available and posted without an expectation ofprivacy.

Sidebar

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DETAILS

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Document 4 of 61

Contrasting Misinformation and Real-Information Dissemination Network Structures on Social Media During a Health Emergency

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ABSTRACT (ENGLISH)

Objectives. To provide a comprehensive workflow to identify top influential health misinformation about Zika on Twitter in 2016, reconstruct information dissemination networks of retweeting, contrast mis- from real information on various metrics, and investigate how Zika misinformation proliferated on social media during the Zika epidemic. Methods. We systematically reviewed the top 5000 English-language Zika tweets, established an evidence-based definition of "misinformation," identified misinformation tweets, and matched a comparable group of real-information tweets. We developed an algorithm to reconstruct retweeting networks for 266 misinformation and 458 comparable real-information tweets. We computed and compared 9 network metrics characterizing network structure across various levels between the 2 groups. Results. There were statistically significant differences in all 9 network metrics between real and misinformation groups. Misinformation network structures were generally more sophisticated than those in the real-information group. There was substantial within-group variability, too. Conclusions. Dissemination networks of Zika misinformation differed substantially from real information on Twitter, indicating that misinformation utilized distinct dissemination mechanisms from real information. Our study will lead to a more holistic understanding of health misinformation challenges on social media. (Am J Public Health. 2020;110:S340-S347. https://doi.org/10.2105/AJPH.2020.305854)

FULL TEXT

Headnote

Objectives. To provide a comprehensive workflow to identify top influential health misinformation about Zika on Twitter in 2016, reconstruct information dissemination networks of retweeting, contrast mis- from real information on various metrics, and investigate how Zika misinformation proliferated on social media during the Zika epidemic.
Methods. We systematically reviewed the top 5000 English-language Zika tweets, established an evidence-based definition of "misinformation," identified misinformation tweets, and matched a comparable group of real-information tweets. We developed an algorithm to reconstruct retweeting networks for 266 misinformation and 458 comparable real-information tweets. We computed and compared 9 network metrics characterizing network structure across various levels between the 2 groups.

Results. There were statistically significant differences in all 9 network metrics between real and misinformation groups. Misinformation network structures were generally more sophisticated than those in the real-information group. There was substantial within-group variability, too.

Conclusions. Dissemination networks of Zika misinformation differed substantially from real information on Twitter, indicating that misinformation utilized distinct dissemination mechanisms from real information. Our study will lead to a more holistic understanding of health misinformation challenges on social media. (Am J Public Health. 2020;110:S340-S347. https://doi.org/10.2105/AJPH.2020.305854)

Social media have become real-time sources of information on various fields, including health and medical-related topics.1'2 Contents on a social media platform, such as Twitter, are mainly user-generated, and the lack of effective fact-checking mechanisms makes social media susceptible to propagations of misinformation. Infiltration and proliferation of health-related misinformation on social media, especially during health emergencies, is a serious threat to people and the entire society.3 Misinformation about vaccines,4-6 Zika,7 tobacco, vaping, and marijuana products8 are a few examples that demonstrate the health-related misinformation problem on social media.

While social media can be an effective tool to enhance people's health literacy, 9,10 they are also a rich resource to study the public's perspectives and reactions toward various topics.11 14 Infosurveillance systems aim to strengthen the capacity of the public health community by closely monitoring online discussions of health topics15-18 and detecting misinformation.19 State-of-the-art analyses of (mis)information dissemination on social media mainly seek 2 purposes: (1) analyzing the information cascade20,21 and (2) identifying misinformation.22-26 In the first direction, computational modeling is used to investigate the virality and spread of (mis)information. In the second direction, different attributes, mainly context-based, are examined to identify misinformation.23,24,27-33 Nevertheless, developing such systems based on textual content is challenging.34 The content can be altered to appear real to avoid being detected by automated algorithms.35 We suggest that content is only 1 aspect ofthe comprehensive health misinformation challenge on social media. Therefore, relying on textual content alone is not adequate. There is an emerging need to understand health misinformation from more aspects, including the content, the users who are involved, and the social media environment as an interconnected entity.

One of the key approaches to investigate an infectious disease outbreak is to track the trajectory of the epidemic. In this study, we defined the dissemination of a particular piece of (mis)information as a dynamic process in which the original post (e.g., a tweet) is propagated by retweeting in an information-dissemination network (colloquially referred to as "network" hereafter). Retweeting shows that the user recognizes the importance of the original post and is willing to disseminate the piece of information. Therefore, we focused on retweeting as the information dissemination method.35

We use the 2016 Zika epidemic as a case study when health agencies had prominent presence on social media to share the latest findings and guidelines. However, uncertainty about this epidemic and overlapping events such as the 2016 US presidential election and the Olympics in Rio de Janeiro, Brazil, opened the door for misinformation. In this study, we first established an operational definition of health-related misinformation and identified the most popular Zika misinformation tweets. We then developed an algorithm to infer and reconstruct information dissemination networks of top Zika misinformation and comparable real-information tweets. Afterward, we applied network analyses to extract network structure metrics for both groups. We investigated how network structures differed quantitatively. This study leverages our understanding on the mechanism of health misinformation dissemination on social media and how it might have outcompeted real information. Eventually, the insights from this project will help with the development of more effective health communication strategies on social media against various misinformation.

METHODS

We chose the entire year of 2016 (January 1-December 31,2016) as the sampling period for this study. This time period covered the major milestones in Zika epidemic timeline, including the World Health Organization's (WHO's) initial warning of Zika across the Americas, the official declaration of the public health emergency of international concern, and the end of the public health emergency of international concern. Using Zika as the keyword, we collected a total of 3.7 million Englishlanguage tweets in and retweets published in 2016 via the Gnip application programming interface through our university's data science program. This data set was complete, including all English-languge Zika discussions on Twitter in 2016. Therefore, our data set provided a more comprehensive and unbiased view of the public discourse of Zika on Twitter in 2016.

Misinformation Identification and Relevant Information Matching

We ranked all original Zika tweets on the basis of the number of received retweets, from highest to lowest. Following this descending order, we selected the top 5000 most retweeted tweets as the sample pool. Then we established an operational definition of misinformation such that the information in the tweet was not evidence-based. We used peer-reviewed journal articles and conference proceedings, government and health agencies' (e.g., Centers for Disease Control and Prevention and WHO) reports and statistics, and fact-checking Web sites to evaluate the validity of the tweet. After we identified misinformation in the top 5000 pool, we identified another group of comparable tweets with real information based on theirposting time and number of retweets. A detailed description of how this definition was operationalized, assurance of reliability, and examples are provided in Appendix A (available as a supplement to the online version of this article at http://www.ajph.org).

We acquired metadata of each original tweet as well as all its retweets, including posting date and time, user names involved, and followees-followers information. We used them to track information dissemination, construct networks, and conduct subsequent analyses.

Constructing Dynamic Information Dissemination Networks

Because Twitter did not explicitly publicize who-retweeted-whom information, we developed an algorithm based on posting or retweeting time and friends-follower relationship to infer and reconstruct the network of retweeting. A detailed technical report on this algorithm is in Appendix B (available as a supplement to the online version of this article at http://www.ajph.org).

We also investigated the temporal dynamics of information dissemination by calculating times to receive 50%, 75%, 90%, 95%, and 100% of all retweets in real and misinformation groups. This demonstrated the temporal variability within and between the 2 groups and gave the networks a temporal aspect as well.

Computing and Interpreting Important Network Metrics

Once the network was constructed for each tweet, we computed and compared important network metrics highly relevant to information dissemination both within and between the 2 groups. In this study, we extracted total of 9 metrics: network reach (REA), network influence (NIF), diameter (DIA), density (DEN), modularity (MOD), Wiener index (WEI), structural virality (VIR), top out-degree centrality (OUT) score, and top betweenness centrality (BET) score. These metrics quantified and characterized network structures from different aspects and across network levels. Here we provide a succinct description of these metrics; more detailed technical explanations are in Appendix C (available as a supplement to the online version of this article at http:// www.ajph.org):

* REA of a network measured the number of unique vertices (i.e., unique user accounts in this network).
* NIF (also known as network size) represented number of all vertices. If each user name retweeted exactly once, then REA should equal NIF. A larger difference between REA and NIF indicated that some user names in the network had retweeted more than once.
* DIA was the shortest distance between the 2 most distant vertices in the network.
* VIR measured average distance between all pairs of vertices in the network.
* DEN measured proportion of potential relationships that actually existed in the network.
* WIE was sum of the shortest paths between all pairs of vertices.
* MOD measured likelihood of dividing a network into potential clusters (i.e., subgroups), within which vertices were highly connected, but loosely connected among subgroups. MOD was a locallevel network metric.
* OUT measured how much influence a single vertex had in terms of generating retweets to further spread information. We calculated the entire OUT distribution and presented the largest OUT value of all retweeters in a network.
* BET quantified the importance of the vertex in terms of the connectivity of the network. Larger BET indicated a more critical role in maintaining network stability. We showed the largest BET value.

In summary, these network metrics comprehensively characterized different aspects of networks at multiple scales, from overall global network level (REA, NIF, DIA, VIR, DEN, and WIE) to local cluster level (MOD) and all the way down to individual vertex level (OUT and BET). Although there were other network metrics, these 9 metrics were especially critical for information dissemination from original posting user account to other retweeting vertices in the network.

Network and Statistica! Analyses

We compared network metrics between the 2 groups by using the Kolmogorov- Smirnov test to identify any significant differences in distributions of these metrics. We performed data retrieving, processing, and network reconstruction in Python version 3.7.3 (Python Software Foundation, Beaverton, OR). We carried out network and statistical analyses in R version 3.5.0 (R Foundation, Vienna, Austria) with additional packages. All input data and codes are freely available upon request.

RESULTS

We focused on the most popular tweets about Zika in this study. We defined popularity as number of retweets received of a given tweet. We considered a tweet to be popular if it was retweeted at least 50 times. About 5000 tweets in our data set had retweets above this cut off. Among the top 5000 most retweeted Zika tweets in 2016, we identified and verified a total of 400 tweets that contained misinformation. Among them, 266 tweets included adequate metadata to reconstruct the information dissemination networks. Not all metadata were available because of data loss, including user accounts banned by Twitter, content removed by Twitter, or the user actively retracted the original post for various reasons. The comparison group ofreal information contained a total of 458 tweets that occurred within similar dates of posting of misinformation tweets and had similar number of retweets of misinformation. To avoid potential selection bias, we did not make a 1-to-1 match of real Zika tweets.

Temporal Variability in Information Dissemination Dynamics

There was substantial temporal variability in the retweeting dynamics between misinformation and real-information groups (Figure 1). It took a significantly shorter time for misinformation to receive 50% of all retweets (T50 = 334 min for misinformation; T50 = 448 min for real information; P <.001 according to the 2-sided t test). The difference was minimal to receive 75% of all retweets (T75 = 916 min for misinformation; T75 = 898 min for real information; P = .93). Interestingly, it then always took a significantly longer time for misinformation to receive 90% of retweets (T90 = 2580 min vs T90 = 1795 min; P = .03), 95% of retweets (T95 = 4739 min vs T95 = 2824 min; P = .001), and all retweets (T100 = 34 869 min vs T100 = 22 340m; P< .001). Misinformation attracted at least half of all retweets within a relatively short period of time to make it more viral. Afterward, misinformation might be deliberately retweeted to keep their visibility over a longer time span. Based on these observations, we chose the time until the last retweet to construct the network, as it provided the most complete view of retweeting activity.

Network Metrics of Real vs Misinformation Groups

We reconstructed retweeting networks for each tweet in real and misinformation groups. Examples of dynamic network structures are provided in Figure 2 for both misinformation and real information.

The distributions of important network metrics of both groups are presented in Table 1. For demonstration purpose, we scaled all network metrics between 0 and 1 with feature scaling. Actual numeric summary statistics are shown in Table 1. None ofthese distributions approximated normal distribution, showing high skewness and kurtosis as well as possible multimodality. This indicated large withingroup variability of network structures. All network metrics' distributions differed significantly (P <.05) between real and misinformation groups, according to the Kolmogorov-Smirnov test. Therefore, real and misinformation networks presented a lot of heterogeneities, both within and between groups.

The DEN was significantly higher in the misinformation group as retweeters were more likely to engage in retweeting misinformation if their friends (whom they followed) tweeted or retweeted so. Note that this network was the original follower-followee network from which information dissemination network was inferred. The difference and relationship between these 2 networks are detailed in Appendix B. The reason that we used the original network only for density is discussed in Appendix C.

The DIA was also significantly higher in the misinformation group. In general, the smaller the diameter, the fewer layers the information passed through the network to reach the outermost retweeter. Misinformation attracted more grass-roots users one after another, as opposed to more hierarchical, cascade-like dissemination in the realinformation group.

The VIR, which focused on average path length, was also significantly higher in the misinformation group, indicating that vertices were generally farther apart in the network. This finding reinforced our previous finding that misinformation involved more direct user-to-user, or small cluster-to-cluster information dissemination than hierarchical dissemination through layers in the realinformation group.

The NIF and REA were similar metrics in which REA focused on unique retweeters. The misinformation group had both significantly smaller REA and NIF. In addition, about 30% of misinformation tweets had a same vertex retweeted at least twice, which was substantially higher than in the realinformation group (< 10%). This could be an intentional propagation strategy to disseminate (mis)information on social media. However, the risk ofsuch strategy was that Twitter might detect it and take actions. Therefore, having multiple user names to retweet the same content together would be a more effective way for information dissemination than having the same user name to retweet the same content multiple times.

For the WIE, the misinformation group had significantly smaller values on average. This indicated that misinformationretweeting networks could have more starlike local clusters, which reduced the WIE. This was also consistent with our previous finding that the misinformation network had more local clusters and a larger MOD value. However, this finding seemed to contradict the previous finding that, on average, DIA was actually larger in the misinformation group. The actual distribution of WIE in the misinformation group was the key to solve this dilemma (Table 1). For the misinformation group, the WIE distribution had more than 1 prominent peak (i.e., multimodal). While some Zika misinformation networks had overall smaller WIEs, a few networks had very large WIEs. From an actual (mis)information propagation perspective, this implied that propagators exploited 2 seemingly contrasting strategies: first, using a star-like network with a very small WIE (much less frequently observed in the real-information group); second, using chain-like dissemination network with a large WIE. In addition, there were hybrids of these strategies to disseminate misinformation farther out. For example, propagators of misinformation might create an initial burst of retweets, shown as local stars in the network, which attracted more grass-roots users to help pick up the trend and retweet one after another. However, we did not observe such a sophisticated arrangement in the realinformation group.

At the local network level, we saw higher modularity more frequently in the misinformation group, indicating that users who retweeted misinformation tended to form smaller, local clusters to disseminate the information. Therefore, Zika misinformation was more difficult to tackle with traditional mitigation strategies. Multiple smaller clusters reduced the risk of removal of some clusters, as other clusters served as alternative routes for information dissemination. By comparison, the real-information group had relatively smaller MOD. MOD in the misinformation group was more heavily skewed to the left, compared with that in the real-information group (Table 1).

At the individual vertex level, distribution of OUT in the misinformation group also had a strong multimodal pattern, indicating that many misinformation tweets involved a user with an extremely large outbound degree (centrality score >200; Table 1) who might serve as potential online influencer or propagator. On the other hand, distribution of OUT in the real-information group was similar to a normal distribution. OUT of the misinformation group was more heavily right skewed in comparison with the realinformation group. The vast majority ofusers in the misinformation group were not influential in relaying information.

For BET, top BET users in the realinformation group had a significantly smaller BET score than that in the misinformation group (127 vs 1003). Therefore, these top BET users in the misinformation group were more important than their counterparts in the real-information group to maintain network stability, as higher BET score indicated a more critical role in information pass-through. While top OUT users could be identified relatively easily by their superficial activity of attracting many retweets, the top BET user, on the other hand, was much more difficult to detect unless constructing the network and performing centrality calculation for all vertices. Nevertheless, from a misinformation mitigation perspective, targeting top BET users could be a more effective way to stall or even completely shut off misinformation propagation than focusing on top OUT users.

To summarize, the misinformation group had distinct distributions of all of these network metrics from the real-information group, indicating significantly different dissemination network structures. Data mining of information dissemination networks could help health professionals and the general public better understand the dissemination process ofhealth misinformation. In addition, these quantitative metrics could be utilized by health informaticians to develop more accurate infosurveillance and misinformation detection systems.

DISCUSSION

We developed an analytical framework to investigate health misinformation dissemination on social media. We provided an operational definition of health misinformation and constructed an algorithm to explicitly track how health (mis)information is disseminated on social media through retweeting networks.

We need to point out that our current knowledge about health topics evolves through time as more and more clinical, epidemiological, and other evidence becomes available-hence, the idea of "evidencebased." The terms "real information" and "misinformation" should be used with caution because our current understanding might be falsified in the future. Timing of the discussion should be considered especially during an emerging health crisis such as the Zika epidemic. For example, we found that The Economist, a generally reliable source of information, tweeted in December 2016 that Zika is harmless to adults (the post was deleted) when there had already been clear evidence to show the causal relationship between Zika virus infection and Guillain- Barré syndrome in adults. Had the tweet appeared in early 2016 when the causal relationship was not yet established, it would not have been deemed as misinformation. As a consequence, an important follow-up of this study is to increase the health literacy in the society such that people learn how to check the validity ofhealth information and why it is misinformation, and frequently update their knowledge about the health issues, instead of merely being told whether a piece of information is real or not.

We will further investigate user activity and attributes to identify bots and examine their effectiveness in dissemination of real and misinformation on social media. The example of a real-information dissemination network (Figure 2) is suspected to be facilitated by bots. In addition, we checked user verification status and only a small fraction were verified users. The real-information group had a higher user-verification rate (2%) than did the misinformation group (1.2%). This observation agrees with other studies showing a strong presence of established news agencies and health organization on Twitter during the Zika outbreak in 2016.

Other work is currently under way to investigate users' activity through time and how this temporal dynamic reveals misinformation infiltration. In this study, we constructed a network G of a given tweet at the end of all retweeting activities. As we showed large temporal heterogeneity both within and between groups (Figure 1), our algorithm is able to construct a dynamic network Gt at given time t. If we detect a sudden rise in retweeting dynamics at time t, we can then construct a specific network by time t to explicitly identify which user is causing the burst of retweets, quantify the user's centrality scores, and work at the individual vertex level to further address the health misinformation epidemic on social media.

Public Health Implications

This study provided solid evidence on health misinformation dissemination patterns on Twitter, one of the most utilized social media platforms. Our analytical framework is universally developed and can explore other public health issues on social media. For example, we have studied genetically modified organism misinformation spreading on Sina Weibo, the largest Chinese social media platform. Other emerging and controversial health topics, including the current COVID19 pandemic, are also being investigated with this framework.

Another key public health implication of this study is to extract important features of health misinformation, which are not directly identifiable from its content alone. We showed the importance to treat misinformation (pathogen), users (hosts), and social media (environment) as an interconnected entity-the Infodemiology Triad. Misinformation, like real pathogens, is not leaving no trace behind. This study substantially increased our understanding of misinformation dissemination dynamics. Furthermore, the rich data set can be used in conjunction with other features of misinformation (e.g., content, linguistic, and account-based) to build a comprehensive health-misinformation detector. In subsequent work, we will use state-of-the-art machine-learning methods to build such a classifier for public health use.

Conclusions

We investigated health-related real and misinformation disseminated on social media during a health emergency from a dynamic network perspective. We discovered that the 2 groups had distinct network structures, indicating their different dissemination patterns. Our work has shed light on developing more accurate health misinformation detectors. ÂfPU

CONTRIBUTORS

Q. Xu, Y. Ge, S. Krishnan, and S. Chen formulated the study idea. A. Bagarvathi collected the data. L. Safarnejad andS. Chenperformed analyses and developed the article. Y. Ge and S. Chen supervised the project. All authors contributed substantially in this project.

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CONFLICTS OF INTEREST

The authors have no conflict of interest in this study.

HUMAN PARTICIPANT PROTECTION

This study used secondary online social media data in the public domain for analysis. No actual human participants were involved.

Sidebar

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Adapting and Extending a Typology to Identify Vaccine Misinformation on Twitter

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ABSTRACT (ENGLISH)

Objectives. To adapt and extend an existing typology of vaccine misinformation to classify the major topics of discussion across the total vaccine discourse on Twitter. Methods. Using 1.8 million vaccine-relevant tweets compiled from 2014 to 2017, we adapted an existing typology to Twitter data, first in a manual content analysis and then using latent Dirichlet allocation (LDA) topic modeling to extract 100 topics from the data set. Results. Manual annotation identified 22% of the data set as antivaccine, of which safety concerns and conspiracies were the most common themes. Seventeen percent of content was identified as provaccine, with roughly equal proportions of vaccine promotion, criticizing antivaccine beliefs, and vaccine safety and effectiveness. Of the 100 LDA topics, 48 contained provaccine sentiment and 28 contained antivaccine sentiment, with 9 containing both. Conclusions. Our updated typology successfully combines manual annotation with machine-learning methods to estimate the distribution of vaccine arguments, with greater detail on the most distinctive topics of discussion. With this information, communication efforts can be developed to better promote vaccines and avoid amplifying antivaccine rhetoric on Twitter. (Am J Public Health. 2020;110:S331-S339. https://doi.org/10.2105/AJPH.2020.305940)

FULL TEXT

Headnote

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Methods. Using 1.8 million vaccine-relevant tweets compiled from 2014 to 2017, we adapted an existing typology to Twitter data, first in a manual content analysis and then using latent Dirichlet allocation (LDA) topic modeling to extract 100 topics from the data set.

Results. Manual annotation identified 22% of the data set as antivaccine, of which safety concerns and conspiracies were the most common themes. Seventeen percent of content was identified as provaccine, with roughly equal proportions of vaccine promotion, criticizing antivaccine beliefs, and vaccine safety and effectiveness. Of the 100 LDA topics, 48 contained provaccine sentiment and 28 contained antivaccine sentiment, with 9 containing both.

Conclusions. Our updated typology successfully combines manual annotation with machine-learning methods to estimate the distribution of vaccine arguments, with greater detail on the most distinctive topics of discussion. With this information, communication efforts can be developed to better promote vaccines and avoid amplifying antivaccine rhetoric on Twitter. (Am J Public Health. 2020;110:S331-S339. https://doi.org/10.2105/AJPH.2020.305940)

At present, one of the greatest risks to human health comes from the deluge of misleading, conflicting, and manipulated information currently available online.1 This includes health misinformation, defined as any "health-related claim of fact that is currently false due to a lack of scientific evidence. "2(p2417) Vaccination is a topic particularly susceptible to online misinformation, even as the majority of people in the United States endorse the safety and efficacy of vaccines.2,3 The reduction of infectious diseases through immunization ranks among the greatest health accomplishments of the 20th century, yet as the 21st century progresses, vaccine misinformation threatens to undermine these successes.4 The rise in vaccine hesitancy-the delay and refusal of vaccines despite the availability of vaccination services-may be fueled, in part, by online claims that vaccines are ineffective, unnecessary, and dangerous.5 While opposition to vaccines is not new, these arguments have been reborn via new technologies that enable the spread offalse claims with unprecedented ease, speed, and reach.2,6

Combating vaccine misinformation requires an understanding ofthe prevalence and types ofarguments being made and the ability to track how these arguments change over time. One of the earliest inventories of online vaccine misinformation comes from Kata's 2010 content analysis of antivaccine Web sites.7 In this work, 8 Web sites were labeled for 6 "content attributes": alternative medicine; civil liberties; conspiracies and search for truth; morality, religion, and ideology claims; safety and effectiveness concerns; and misinformation. All Web sites shared content from more than 1 area: 100% promoted safety concerns and conspiracy content, 88% also promoted civil liberties and alternative medicine content, and 50% also promoted morality claims.7 Misinformation and antivaccine arguments were nearly synonymous, with 88% of Web sites relying on outdated sources, misrepresenting facts, selfreferencing "experts," or presenting unsupported falsehoods.7

Since 2010, both the Internet and the nature of vaccine misinformation have changed profoundly. The static Web sites Kata analyzed have been supplanted by interactive social media platforms as the primary channels for antivaccine information dissemination.8 Unlike Web sites, which feature a single perspective, social media platforms were designed to encourage "dialogue" and feature a plurality of perspectives.9 Social media also introduces new challenges, as opportunistic actors including automated bots and state-sponsored trolls flood channels with information designed to manipulate, provoke, or scam genuine users.10

Recognizing these changes, scholarly efforts to characterize vaccine misinformation on social media have taken many forms. These include content analyses of vaccine posts on platforms including Twitter,11 Facebook,12 Instagram,13 Pinterest,14 and YouTube.15 Although research questions varied-often tied to specific vaccines (e.g., human papillomavirus, influenza), temporal events (e.g., outbreaks, policy changes), or claims (e.g., debunked claim that vaccines cause autism)-the presence of misleading antivaccine content is near universal. The universality of Kata's broad categories endures, with many of these studies highlighting antivaccine content, questioning vaccine safety concerns, and promoting conspiracy theories.

More recently, computational advances have made big data and machine-learning methods popular. A common approach has been to use automated classification schemes to label posts by vaccine sentiment, either broad categorical analyses (e.g., sorting content into positive, negative, and neutral) or into topical categorization schemes (e.g., sorting content by topics such as safety, efficacy, and cost).16 18 Other applications have included mapping semantic networks,19 detecting network and community structures,20 using topic modeling to infer areas of discussion,21 23 classifying images,24 and using machine-learning classifiers to infer geographic and demographic information.25 Topic modeling has been particularly successful in surveillance of content shared by social media users and can be deployed in a variety of contexts, from monitoring key topics in human papillomavirus vaccine discussions on Reddit to identifying topical links between content posted by Russian Twitter troll accounts.22,23 A new study used latent Dirichlet allocation (LDA) topic modeling to track 10 key influenza vaccine-related Twitter topics over time and measure how they correlated with vaccine attitudes.26 The strength of automated approaches is in the ability to quickly analyze millions of messages; however, the results tend to be tied to specific data sets and often lack the broad applicability and simplicity of Kata's framework.

While these studies have expanded scholarly knowledge, big questions remain: What is the prevalence of both pro- and antivaccine content on social media platforms? What topics dominate the general vaccine discourse? And what topics are spreading misleading vaccine information? To answer these questions, we introduce a new typology, building upon Kata's 2010 work, but updating it for Twitter and introducing automated approaches to replicate our findings at scale. We chose Twitter as one of the key platforms sharing vaccine misinformation, but also as the most accessible for research.27 Twitter may not be reflective of the attitudes held by the general public, but as a communication channel it plays a powerful role in amplifying vaccine messages and can foster online communities with shared interests. The resulting typology categorizes major themes and amplification strategies in the discourse of both vaccine opponents and vaccine proponents on Twitter. We believe this is a necessary first step toward developing a comprehensive survey of online vaccine discourse and foundational to developing successful efforts to fight misinformation.

METHODS

Our analysis followed 3 stages: first we conducted a manual content analysis on a subsample ofvaccine-relevant tweets; then we utilized LDA, a type of probabilistic topic modeling, to infer the major topics of discussion in the total vaccine discourse; and, finally, we conducted a second manual content analysis of representative tweets from each of the 100 topics generated in stage 2.

Data

Our data set contained 1.8 million vaccine-relevant tweets collected between 2014 and 2017 through the Twitter public streaming keyword application programming interface. Tweets were English language, contained vaccine keywords (substrings "vax" or "vacc"), and had been filtered by using a machine-learning classifier trained to exclude tweets not relevant to vaccination (e.g., metaphors).28

Content Analysis

Our first aim was to adapt Kata's typology to Twitter data by conducting a content analysis of 10000 randomly selected vaccine-relevant tweets (Figure 1). We designed our approach to comply with an emerging set of best practices to ensure rigor and accuracy.29 Tweets had been manually annotated for vaccine sentiment as part of an earlier project.30 Two independent annotators (A. M., K. P.) then coded each nonneutral tweet into 1 or more thematic categories. On a random sample of 100 antivaccine tweets, annotators agreed 88.75% of the time on primary codes (Scott's p = 0.85; 95% confidence interval [CI] = 0.78, 0.93). On a random sample of 100 provaccine tweets, annotators agreed only 48% of the time for primary codes (Scott's p = 0.38; 95% CI = 0.26, 0.49), suggesting a much harder task. To address low reliability, a third team member (A.J.) reconciled discrepancies for both data sets and assigned final codes for each tweet.

The antivaccine codebook (see the box on p. S334) included adapted versions of5 of Kata's 6 original content categories.7 The final attribute, misinformation, was widespread across all categories and was not coded separately. We did not identify a provaccine equivalent to Kata's typology during our literature search and chose to develop our own. The annotation team created a set ofdeductive codes to mirror Kata's categories, using examples from the data set to justify each new code. For instance, "safety and efficacy" was determined to be the provaccine counterpart to antivaccine concerns about vaccine safety. In this way, we developed codes for pro-science, provaccine policy, criticizing antivaccine beliefs, and safety and effectiveness. Morality-based provaccine content (e.g., vaccinate to protect others) did not emerge as distinct theme. More common were tweets promoting vaccines without an underlying argument, prompting our fifth theme, "vaccine promotion."

Latent Dirichlet Allocation Topic Modeling

To infer distinctive topics of conversation across the entire sample of vaccine-relevant tweets, we used LDA, a widely used type of probabilistic topic model designed to identify underlying topics in a text data set by identifying groups of words that often co-occur (for more details on probabilistic topic models see Blei31).32 LDA is increasingly common in health informatics research as a method to assess large text-based data sets (see also Walter et al.23 and Chan et al.26). LDA assumes that each document (in this case, a tweet) contains an underlying mixture of topics and that each topic can be captured by an underlying mixture of words. We trained LDA with 100 topics on a subset of 1 million tweets, then inferred the topics on the remaining 800 000 tweets by using the trained model. In training the model, we preselect the number of topics we expect to find and then optimize the model for the most likely arrangement of words in each topic and topics in each document. We used the implementation of LDA from the MALLET topic modeling toolkit and used the default parameter settings unless otherwise noted.33 Every tweet receives scores reflecting probabilities for all underlying topics; the highest scoring topic is then taken as the primary topic for that tweet. For each topic, we aggregated tweets with the highest topic probabilities (87%- 95%). After excluding topics that returned fewer than 100 tweets or non-English content, the new data set contained 26 542 tweets, with an average of 285 tweets per topic (Figure 1).

Integrating the Typology

To understand how LDA topics fit within the updated typology, we conducted a second content analysis, randomly selecting up to 20 of the most relevant tweets from each LDA topic (Figure 1). LDA outputs provide keywords for each topic, but these can sometimes include co-occurring words that may not be truly conceptually related; therefore, it is important to assess highly representative full-length tweets (for topic keywords see Appendix A, available as a supplement to the online version of this article at http://www.ajph.org). Three annotators (A.J., A. M., K. P.) independently labeled each tweet for vaccine sentiment and theme. Across 100 randomly selected tweets, we observed 79% agreement on vaccine sentiment (Fleiss's k = 0.69; 95% CI = 0.59, 0.78) and 82% agreement on content labels for nonneutral tweets (Fleiss's k = 0.78; 95% CI = 0.66, 0.89). Topics were then arranged by sentiment and divided into categories: majority pro- or antivaccine (>70%nonneutral), neutral and pro- or antivaccine (20%-70% nonneutral), majority neutral (<20% nonneutral), or both (> 20% both provaccine and antivaccine; Table 1).7,9 In addition, we used this space to incorporate labels for Twitter-specific information including hashtags, @mentions, and retweet campaigns.

RESULTS

First we present results from the content analysis, then we present results integrating LDA and manual coding.

Prevalence of Vaccine Themes

Of the 10 000 messages annotated in subsample 1, 22% (n = 2241) were antivaccine, 17% (n = 1744) were provaccine, and the remaining 61% (n = 6015) were neutral or not relevant (Table 2). Among antivaccine tweets, safety concerns was the single most common theme (59%; n = 1320) followed by conspiracies (41%; n = 930), civil liberties (11%; n = 248), morality claims (5%; n = 105), and alternative medicines (2%; n = 50). Most tweets (68%; n = 1666) were labeled with a single topic. Co-occurrence was most common between safety concerns and conspiracies (n = 411).

For provaccine tweets, vaccine promotion (37%; n = 648) was the most common theme, followed by criticizing antivaccine beliefs (31%; n = 538) and safety and effectiveness (30%; n = 523). Fewer messages were pro-vaccine policy (5%; n = 92) and pro-science (5%; n = 85). Most tweets (89%; n = 1550) had a single label. The most common cooccurrence was between criticizing antivaccine beliefs and vaccine safety and effectiveness (n= 182).

Characterizing Latent Dirichiet Allocation Topics

Of the 100 LDA topics, 28 topics included significant antivaccine content, 48 included provaccine content, and 33 were neutral or not relevant (Table 1). Within each of these categories, we recognized a spectrum: 10 topics were majority antivaccine, 9 combined antivaccine and neutral content, 9 included both provaccine and antivaccine content, 20 combined provaccine and neutral content, and 18 were majority provaccine.

Although the proportions of nonneutral tweets and nonneutral topics were significantly different (X2 = 23.50; P <.001) the distribution of themes was roughly equivalent (Table 2). For provaccine topics, the same 3 topics-safety and efficacy, vaccine promotion, criticizing antivaccine beliefs -were the most represented, with slightly greater representation of provaccine policy among topics (P = .03; Fisher's test). For antivaccine topics, we observed no significant differences between the distributions of themes (X2 = 5.54; P = .24).

Topics that were primarily antivaccine consisted entirely of conspiracy and safety concerns (5 topics each, 50%). Conspiracy claims tended to focus on governmental and pharmaceutical fraud, while safety concerns included claims of vaccine-induced idiopathic illnesses and vaccines as poison. Among these 10 topics, we found the highest concentration of retweet activity in the data set, with 3 topics dominated by nearly verbatim retweets (possibly indicating bot-like activity). Other amplification strategies included use of antivaccine hashtags and @messages to celebrities and public officials for attention. Topics that combined antivaccine and neutral content (n = 9) included conspiracies (4 topics, 44%) and safety concerns (3 topics, 33%), but also civil liberties (2 topics, 22%). In these topics, neutral news content appeared alongside antivaccine claims and sometimes political content.

Majority provaccine topics (n = 18) included all 5 themes. Vaccine promotion efforts included a mix of event promotion, philanthropy efforts, and vaccine recommendations. Safety and efficacy topics emphasized the risks of not vaccinating, benefits of vaccines, or simply proclaimed #vaccineswork. Antivaccine-critical topics shamed antivaccine parents as crazy, stupid, and neglectful parents-sometimes relying on satire or parody. Pro-science topics included celebrations of vaccines as a major public health accomplishment but also included defending science against "fake news." Like antivaccine-critical topics, some of these claims relied on humor. Provaccine policy topics included discussion of vaccine mandates. Topics that combined provaccine and neutral content (n = 20) also included all 5 themes but included topics that were more controversial or polarizing like political discussions and influenza vaccine topics.

The 9 topics that combined significant provaccine and antivaccine sentiment highlighted areas of overlap in the discourse. This included debated topics in which users repeated and refuted arguments, such as differing interpretations of epidemiological evidence or the legality of mandates. It also included arguments with parallel structure; antivaccine arguments that claim vaccine science is "bad science" appeared alongside provaccine arguments describing vaccine opposition as pseudoscience. These conversations included more neutral hashtags (e.g., #immunity, #vaccine) and reliance on @messages to directly contact other users.

DISCUSSION

The sheer volume ofvaccine information on Twitter presents major challenges for researchers trying to systematically address misleading information. With this analysis, we introduce an innovative approach to estimate the prevalence of vaccine themes and classify major topics, providing a comprehensive assessment ofthe vaccine discourse on Twitter. We found a slightly greater proportion of antivaccine messages than provaccine messages (22% to 17%), with many more messages neutral on vaccines-findings in line with previous work.17 However, topic modeling demonstrated that distinctive topics ofconversation tend to be nonneutral, with a greater diversity of topics containing provaccine content from all 5 thematic areas, while topics containing antivaccine content concentrated on safety concerns and conspiracy theories. Neutral tweets represented most of the data set, but topic modeling demonstrated how they can serve as the foundation for both provaccine and antivaccine arguments, with a roughly one third of all topics mixing both neutral and polarized content.

Although very different in tone and sentiment, provaccine and antivaccine messages were more structurally similar than we anticipated. Because LDA analysis depends on word choice and language structure to identify coherent topics, that 9 topics included significant proportions of both provaccine and antivaccine content suggests use of similar language and rhetorical strategies. This does not necessarily mean that vaccine opponents and proponents were directly engaged; indeed, previous work has highlighted echo-chamber effects that limit exposure between outside viewpoints at work in vaccine communities on Twitter.34 However, the 2 communities may be indirectly influencing each other's arguments, as evidenced by similar use of semantic strategies.

The Twitter features that allow for the spread of antivaccine content have likely also reshaped how provaccine content spreads. The prevalence of straightforward vaccine promotion content suggests that Twitter is a useful platform to easily share recommendations, remind patients to get vaccinated, and provide links to events. The increased visibility of the antivaccine movement has also likely shaped the ways Twitter users use the platform to defend vaccines. This is most clear in use of the platform to debunk antivaccine conspiracies, vent anger, or otherwise shame, blame, or complain about antivaccine parents. However, many debunking efforts tended to focus on a narrow set of outdated antivaccine claims suggesting that those most critical of antivaccine arguments are responding to an abstract idea of the antivaccine population and not engaging with antivaccine topics directly on Twitter. Defending vaccines also manifested in more subtle ways, like the #vaccineswork hashtag, where users felt the need to tweet in support of vaccines, making visible a sentiment that until recently many viewed as standard. This response is mirrored in the broader "defense of science" debates happening on Twitter as users see antivaccine arguments as part of a broader antiscience trend.

In addition to characterizing topics, we were able to observe how different arguments aligned with misinformation and amplification strategies. While antivaccine arguments are using many of the same strategies Kata detailed in 2010, including presenting unsupported falsehoods and misrepresenting scientific evidence, we saw some newer strategies that are tailored to Twitter. With strict character limits, tweets do not allow for contextualization, making it much easier to mislead by using sensational falsehoods or manipulations of real data. Some antivaccine claims are presented as facts, mimicking the language of mainstream news or science. In these instances, source credibility may be more important for users to gauge validity. Although both vaccine opponents and proponents have successfully utilized hashtags, we found @messaging and retweet campaigns were more common in antivaccine topics. Political language also appeared in both pro- and antivaccine content.

We identified a Twitter-specific amplification strategy that relied on massive retweet campaigns, suggesting evidence of concentrated effort by 1 or a group of actors. These campaigns may be driven by genuine users but could also indicate networks of automated accounts. Unlike previous studies that have characterized users as likely bots,30 focusing on messaging led us to look for evidence of bot-like behavior, of which these massive retweet campaigns were the most egregious.10 Topics consisting largely of retweets were among the most clearly misleading or political, including claims that shaken baby syndrome was a cover-up for vaccine injury and stories of an alternative medicine doctor mysteriously found dead after "exposing the truth" about vaccines. This suggests that amplification and automation have been successfully used to artificially inflate the appearance ofantivaccine and political topics.

Limitations

This research is not without limitations. LDA methods have their own drawbacks: researchers must preselect the number of topics to be inferred, , setting too many or too few topics can produce different results, and the resulting topics can be too specific or too broad depending on selected parameters.35 For these reasons, LDA is best at providing broad overviews of content, not nuanced analysis of specific topics. More broadly, by focusing our analyses on text only, we cannot ascertain the identity of the user, network features, the source of the linked content, or the impact of embedded images, which undoubtedly influence how information is perceived.

In the manual analysis, intercoder reliability for provaccine annotations was quite low; we believe this reflects the high level of similarity between our chosen categories. Vaccine opponents typically level specific claims against vaccines, but vaccine proponents tend to use very general language in support of vaccines, making it difficult to select a specific provaccine code. Future research is needed to refine this coding strategy. The challenges from the first round of annotation were largely absent during the second round of annotation, suggesting that annotators improved over time or that the nonrandom distribution of tweets from topic models aided in comprehension.

Public Health Implications

This updated typology was designed to distill relevant information from across the entire vaccine discourse on

Twitter quickly and accurately. Mapping the proportion of tweets was necessary first step, but we believe understanding how these themes play out in online conversation can better inform communication efforts on how users engage with vaccine topics on Twitter. At this stage, our findings remain quite general but lend themselves to several specific recommendations, particularly for provaccine messaging. While vaccine proponents are already using the platform to debunk specific antivaccine claims, these are often not the same claims promoted in antivaccine topics. Rather than address rumors directly and risk amplifying them further, it may be more beneficial for vaccine advocates to continue to emphasize the safety and efficacy of vaccines in general terms. Similarly, engaging with a bot-driven narrative only further amplifies the message. It is also important to communicate to the Twitter users eager to defend vaccines that the humor used to criticize antivaccine tweets and anti-science tweets may inadvertently mislead and furtherprovoke.36 This updated typology serves as a proof of concept. Future research efforts should explore specific communication strategies and extend similar approaches to map vaccine discourse and associated misinformation on additional platforms. Â1PU

CONTRIBUTORS

A. M.Jamison designed the content analysis portion ofthe study, lead the manual annotation team, and wrote the article. D. A. Broniatowski designed the computational portion of the study and provided critical revision of the article. M. C. Smith performed the computational analysis. K. S. Parikh and A. Malik served as annotators for the content analysis and assisted with codebook development. M. Dredze aided in data collection and provided critical revision ofthe article. S. C. Quinn provided health communication context and provided critical revision of the article.

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M. Dredze holds equity in Sickweather Inc and has received consulting fees from Bloomberg LP and Good Analytics Inc. These organizations did not have any role in the study design, data collection and analysis, decision to publish, or preparation of the article.

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HUMAN PARTICIPANT PROTECTION

The data used in this article are from a publicly available online source, the uses ofwhich are deemed institutional review board-exempt by the University of Maryland institutional review board (1363471-1).

Sidebar

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DETAILS

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Correction as a Solution for Health Misinformation on Social Media

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ABSTRACT (ENGLISH)

Scholars (including in this issue of AJPH) have debated which interventions limit the spread of health misinformation on social media, including promoting high-quality information, removing misinformation from platforms, and inoculating people against misinformation by bolstering news, information, and health literacy. Unfortunately, these preventative solutions cannot eliminate health misinformation, necessitating strategies that respond to misinformation to limit its pernicious influence on public attitudes and behaviors. Corrections-the presentation of information designed to rebut an inaccurate claim or a misperception -are an important treatment for misinformation. Despite the relative stickiness of misinformation, corrections are typically effective in reducing beliefs in health misinformation, although they are less so as issues become more polarized or beliefs become embedded in an individual's self-concept.

FULL TEXT

Scholars (including in this issue of AJPH) have debated which interventions limit the spread of health misinformation on social media, including promoting high-quality information, removing misinformation from platforms, and inoculating people against misinformation by bolstering news, information, and health literacy. Unfortunately, these preventative solutions cannot eliminate health misinformation, necessitating strategies that respond to misinformation to limit its pernicious influence on public attitudes and behaviors.

Corrections-the presentation ofinformation designed to rebut an inaccurate claim or a misperception -are an important treatment for misinformation. Despite the relative stickiness of misinformation, corrections are typically effective in reducing beliefs in health misinformation, although they are less so as issues become more polarized or beliefs become embedded in an individual's self-concept.1,2

CORRECTION ON SOCIAL MEDIA

On social media, in contrast to individually directed private communication, there are two targets for any corrective message: (1) the person sharing the misinformation, and (2) the community of individuals seeing the misinformation or the correction. These two targets may have different levels of resistance to correction. Someone posting misinformation is likely quite committed to that position, and cognitive dissonance makes it difficult for that poster to alter his or her beliefs after publicly sharing them. However, even people sharing misinformation can be corrected, especially when correction comes from a close tie.3

The second target of a correction on social media is the audience-those who witness a correction on social media but are not directly targeted or engaged in the interaction. This can occur, for example, when individuals see someone who is sharing misinformation being corrected by another user or an expert organization; it could also extend to corrective messages offered in response to commonly held misperceptions without targeting a misinformation post directly. Those watching from afar are likely less affected by cognitive dissonance, as their identity is not directly under threat, and thus more amenable to correction. We refer to this phenomenon as "observational correction."4,5 Research has consistently documented the ability of observational correction to reduce health misperceptions, including correction from a variety of sources- algorithms within the platform, expert organizations, and other social media users-on different platforms and on a wide range of health topics.4-6

BEST PRACTICES

Research has identified a number of best practices for engaging in observational correction on social media. First, citing highly credible factual information with links to expert sources is important, especially for users offering corrections.1,6 Expert sources themselves are more effective in correcting misinformation than users are, and engaging in such corrections on social media does not appear to negatively affect their credibility.5 Sharing corrections that counter personal or political interest can enhance trust and thus effectiveness, so considering trusted sources among a target audience is essential.

Second, offering a coherent alternative explanation for the misinformation boosts the power of corrections.1,2 Corrections can state what is false and provide an explanation for why it is false (which may include the origins of the misinformation) to have stronger impacts. For example, you could debunk the myth that cutting sugar from your diet will cure cancer by explaining that sugar and diet are linked to cancer risk, but not to its treatment.

Third, multiple corrections reinforce the message, leading to reduced misperceptions.1,5 Repetition is a classic communication strategy and may be necessary when users correct.5

Finally, misinformation should be corrected early, before misperceptions are entrenched.4 Once misperceptions are ingrained and associated with one's identity, motivated reasoning to protect those beliefs becomes more likely, leading people to dismiss corrective information. Although early corrections may prevent misperceptions from being created, they should avoid drawing attention to uncommon misperceptions and must be transparent about the amount of expert consensus and evidence that exists on a topic.7

We offer one example of best practices for observational correction in the context of COVID-19 in Figure 1, wherein Tito's Vodka rapidly responds to an individual claiming she or he used their vodka to make hand sanitizer. The Tito's Vodka correction includes an unusual source debunking against their self-interest, citing a credible expert in the health domain, explaining why the myth is inaccurate, and repeating the accurate information.

REMAINING QUESTIONS FOR RESEARCH

There is substantial evidence that correcting health misinformation on social media is a fruitful strategy for reducing misperceptions among both those sharing misinformation and the community seeing the interaction. However, more research is needed to determine the efficacy of this strategy and to understand its limits.

First, we must consider the related questions of who engages in correction and how to encourage more people to respond to misinformation. Observational correction depends on a critical mass of trusted, willing, and informed correctors, but in general people are reluctant to confront others on social media and may not be equipped with the skills and information necessary to do so. Research should investigate how to develop appropriate social norms or interventions to encourage corrections on social media. Ideally, corrections would come from across the population, representing different demographics, backgrounds, and attributes; this may require targeted interventions to encourage groups who are currently less likely to engage in corrections. Likewise, relevant experts, professionals, and organizations could be incentivized to engage in corrections.

Second, calculated judgments about which misinformation should be prioritized in correction efforts are needed. If the myth being addressed is sufficiently rare or the account comparatively obscure, efforts to debunk the misinformation may heighten awareness of the myth unnecessarily.1 The potential of the misinformation to cause harm, the vulnerability and size of the audience for the post, and the level of evidence and expert consensus on the issue7 should be part of this calculation, but more research is needed into exactly where correction can do the most good.

Third, false corrections-that is, people claiming to correct when they are actually providing misinformation-merit attention. Not everyone correcting misinformation on social media is doing so accurately or in good faith. Right now, we have little understanding of the effects of false corrections. We also need to know more about how people respond when a correction generates debate about the truth.

Fourth, greater coordination between scholars and social media platforms could make correction more effective. This could include platforms working to highlight the visibility of comments that provide debunking materials; for example, prioritizing comments that link to credible health organizations or trustworthy news media sources. Beyond working with researchers to test interventions, platforms might also make appropriately anonymized data available to researchers, allowing greater investigation into the frequency, scope, and type of misinformation and correction occurring on social media.

Finally, many elements of observational correction may vary by platform or by circumstance. Among these are the tone of the correction, whether the correction comes before or after the misinformation, whether it relies on logic- or fact-based appeals, what sorts of visuals it uses, and what types ofpopularity or credibility cues are available. Each of these is likely to affect how the corrective information is perceived and whether it is accepted by the audience of users witnessing it.

Health misinformation on social media will not be resolved with any single intervention, but encouraging users, experts, and platforms to correct misinformation as they see it on social media may be part of the solution.

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CONFLICTS OF INTEREST

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Sidebar

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Document 7 of 61

Who Is Susceptible to Online Health Misinformation?

Scherer, Laura D, PhD; Pennycook, Gordon, PhD

ProQuest document link

ABSTRACT (ENGLISH)

Although everyone has the potential to be misled by false information, online misinformation is not an equal opportunity aggressor. Some of us are more likely to believe misinformation than are others and serve as vectors by sharing it on social media. To effectively combat misinformation on social media, it is crucial to understand the underlying factors that lead certain people to believe and share false and misleading content online. A growing body of research has tackled this issue by investigating who is susceptible to online misinformation and under what circumstances. This literature can help shape future research and interventions to address health misinformation. We provide a brief overview of what we know about who is susceptible and what we still have to learn.

FULL TEXT

Although everyone has the potential to be misled by false information, online misinformation is not an equal opportunity aggressor. Some of us are more likely to believe misinformation than are others and serve as vectors by sharing it on social media. To effectively combat misinformation on social media, it is crucial to understand the underlying factors that lead certain people to believe and share false and misleading content online. A growing body of research has tackled this issue by investigating who is susceptible to online misinformation and under what circumstances. This literature can help shape future research and interventions to address health misinformation. We provide a brief overview of what we know about who is susceptible and what we still have to learn.

THEORETICAL PERSPECTIVES

One dominant perspective, which is sometimes referred to as the deficit hypothesis, is that people who believe misinformation do not have sufficient knowledge or literacy to discriminate between true and false information. Although health researchers often focus on health literacy, other types of literacy deficits are relevant, such as digital literacy, media literacy, and science literacy. Brashier and Schacter recently argued that the reason older adults share fake news on social media more frequently than do younger adults is not because of cognitive declines but because older adults have lower digital literacy than do younger adults. Older adults may be less savvy at identifying reliable online news sources, advertised (vs editorial) content, and manipulated photographs.1 Accordingly, some interventions have sought to address misinformation susceptibility by improving digital literacy (and related skills). For example, Guess et al. recently reported that a brief digital media literacy intervention improved detection of fake news headlines in both the United States and India.2

Another perspective is that people tend to be susceptible to misinformation that is consistent with their preexisting beliefs or worldview.3 Considerable research has shown that people tend to preferentially believe information that is consistent with their other preexisting beliefs.3 However, recent research has found that people may not be as influenced by their preexisting attitudes as previously thought. Specifically, in one study, individuals who had a more reflective cognitive style, as measured by the Cognitive Reflection Test, were better able to discern between true and false news content than were people who were more intuitive.4 Importantly, this occurred regardless of whether the news headlines were consistent or inconsistent with the participants' political ideology. Individuals' tendency to engage in greater reflective thought is also associated with their ability to detect COVID-19 misinformation.5 Moreover, other work has found that those who are worse at discerning between true and false information tend to overclaim their own knowledge and to be receptive to "pseudoprofound" statements (i.e., they rate random sentences filled with buzzwords but devoid of intended meaning as being profound).6 Evaluating these findings altogether, experts have speculated that receptivity to misinformation is related to being more "reflexively openminded."6 That is, people who are susceptible to misinformation fail to even consider that the content is inaccurate, regardless of their underlying political ideology or preexisting beliefs.

Accordingly, a recent study showed that a simple accuracy nudge that primes people to think about whether headlines are true is sufficient to increase the quality of COVID-19-related news content that people indicate they would share on social media.5 A Twitter field experiment employing a similar intervention has also reported promising results.7 These findings support the idea that people fall for misinformation because they fail to think about the accuracy of content that they come across on social media, not because they are exercising politically motivated reasoning or are simply confused about what is and is not true.

To summarize, there are three currently dominant (albeit not entirely mutually exclusive) theoretical perspectives addressing why certain people are susceptible to online misinformation: (1) being confused about what is true versus false, suggesting that knowledge or various literacies are a primary factor; (2) having strong preexisting beliefs or ideological motivations that lead to motivated reasoning and therefore a desire to believe and share misinformation; and (3) neglecting to sufficiently reflect about the truth or accuracy of news content that is encountered on social media.

QUESTIONS FOR FUTURE RESEARCH

There are, of course, other individual characteristics that may be particularly relevant to accepting health-related misinformation that are not as neatly characterized under these perspectives. An important element is trust in health experts and health science. Trust is multifaceted: people can possess varying levels of (dis)trust in doctors, medical science, scientists, and health care systems. Each type of distrust may make an individual more susceptible to health misinformation. More research is needed on different facets of trust and their implications for believing misinformation. Other individual characteristics that have not yet been adequately studied in relation to misinformation susceptibility include traits such as the need for autonomy and one's orientation toward medicine. For example, a medical-maximizing orientation (i.e., the tendency to want active, aggressive approaches to health care) was recently found to be robustly associated with susceptibility to COVID-19 misinformation, a finding that warrants further explanation and exploration.5

A key unanswered question is whether susceptibility to misinformation is a generalized trait or is context dependent. The people who believe misinformation about politics may be the same people who believe misinformation about health5-however, there may be important differences between people who believe one or the other type of misinformation, and this issue has not been systematically investigated. For that matter, health misinformation spans many different health topics, and it is unclear whether people who believe misinformation about a particular health topic, such as vaccines, also tend to believe misinformation about other health topics (e.g., misinformation about cancer treatments, COVID-19). No research has explicitly addressed this question, but an answer to it could provide insight into the extent to which findings in one content area can inform other areas. Such knowledge would help to streamline the development and testing of interventions. For example, if we knew that similar people believe misinformation about health and politics and science, then we could more confidently extend interventions from one domain to others.

ADDRESSING SUSCEPTIBILITY

Although content moderation on social media platforms is clearly needed, we also need scalable interventions that can efficiently reach and effectively influence the people who are susceptible to believing and sharing health misinformation. These might be interventions to improve digital literacy or misinformation awareness in online environments. We envision a targeted public health campaign, and the first thing that any campaign needs is an excellent understanding of its audience: who they are, what motivates their beliefs and behaviors, and what is likely to persuade them. To understand our audience and deliver effective messages, we need to identify the characteristics ofpeople who are particularly susceptible to misinformation. Identifying who is susceptible to misinformation will also help us understand why they are susceptible. Understanding misinformation susceptibility in this way could help us make great strides in addressing it through targeted public health interventions. ÂfPU

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The authors contributed equally to this editorial.

CONFLICTS OF INTEREST

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Document 8 of 61

Facebook Pages, the "Disneyland" Measles Outbreak, and Promotion of Vaccine Refusal as a

Civil Right, 2009–2019

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ABSTRACT (ENGLISH)

Objectives. To understand changes in how Facebook pages frame vaccine opposition. Methods. We categorized 204 Facebook pages expressing vaccine opposition, extracting public posts through November 20, 2019. We analyzed posts from October 2009 through October 2019 to examine if pages' content was coalescing. Results. Activity in pages promoting vaccine choice as a civil liberty increased in January 2015, April 2016, and January 2019 (t[76]= 11.33 [P< .001]; t[46] = 7.88 [P< .001];and t[41] = 17.27 [P<.001], respectively). The 2019 increase was strongest in pages mentioning US states (t[41] = 19.06; P< .001). Discussion about vaccine safety decreased (r_s[119] = -0.61; P< .001) while discussion about civil liberties increased (r_s[119] = 0.33; Py< .001]). Page categories increasingly resembled one another (civil liberties: r_s[119] = -0.50 [P<.001]; alternative medicine: r_s[84] = -0.77 [P<.001];conspiracy theories: r_s[119] = -0.46 [P< .001]; morality: r_s[106] = -0.65 [P< .001];safety and efficacy: r_s[119] = -0.46 [P< .001]). Conclusions. The "Disneyland" measles outbreak drew vaccine opposition into the political mainstream, followed by promotional campaigns conducted in pages framing vaccine refusal as a civil right. Political mobilization in state-focused pages followed in 2019. Public Health Implications. Policymakers should expect increasing attempts to alter state legislation associated with vaccine exemptions, potentially accompanied by fiercer lobbying from specific celebrities. (Am J Public Health. 2020;110:S312-S318. https://doi. org/10.2105/AJPH.2020.305869)

FULL TEXT

Headnote

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Methods. We categorized 204 Facebook pages expressing vaccine opposition, extracting public posts through November 20, 2019. We analyzed posts from October 2009 through October 2019 to examine if pages' content was coalescing.

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Conclusions. The "Disneyland" measles outbreak drew vaccine opposition into the political mainstream, followed by promotional campaigns conducted in pages framing vaccine refusal as a civil right. Political mobilization in state-focused pages followed in 2019.

Public Health Implications. Policymakers should expect increasing attempts to alter state legislation associated with vaccine exemptions, potentially accompanied by fiercer lobbying from specific celebrities. (Am J Public Health. 2020;110:S312-S318. https://doi. org/10.2105/AJPH.2020.305869)

Facebook connects billions of people globally,1 enabling individuals to share information on pages organized around common interests. Facebook can therefore be used to spread health-related information2 and misinformation3-5 quickly and widely, affecting public discourse6,7 and potentially driving real-world behaviors. These community dynamics could also allow malicious actors to mobilize vulnerable communities for their own purposes.8 For example, Facebook has been linked to recent outbreaks of violence around the world.9

The dynamics of health misinformation on Facebook pose a threat to vaccination programs. Social media exposure is theorized to amplify vaccine skepticism,10 exposing billions of users to misinformation about vaccines, increasing hesitancy and delay,11-13 eroding trust in health care providers and public health experts,12,14 and reducing vaccination rates, with repeated exposures potentially exacerbating this hesitancy.15

In addition to amplifying misinformation, the group structure of social media platforms may concentrate it,7 polarizing communities.6 Tightly knit communities that collectively refuse to vaccinate lack herd immunity-meaning that a small number of disease exposures can lead to deadly outbreaks -and damage herd immunity for the broader population. In 2019, the US Centers for Disease Control and Prevention reported outbreaks of measles in several US states and worldwide, all of which struck communities with low vaccination rates (https://www. cdc.gov/measles/cases-outbreaks.html). Finally, some have raised concerns that the COVID-19 "infodemic" could trigger vaccine refusal.16 Public health communicators must therefore attend to rationales for vaccine refusal and how this misinformation might affect real-world behaviors.

Rationales for vaccine refusal vary widely and often contradict one another.17 One emphasizes vaccine harms, health risks, or safety concerns associated with vaccination. Another frames vaccination as a civil liberties issue, asserting parental rights to determine medical care. Others embrace conspiracy theories (emphasizing scientific, governmental, and pharmaceutical malfeasance) or alternatives to Western medicine such as naturopathic cures or dietary supplements. Historically, these different rationales have been associated with different social groups.18 On the surface, social media seem to reflect this community structure, with specific Facebook pages corresponding to these audiences.

On the other hand, recent outbreaks and legislative proposals around the world19 suggest that vaccine opposition may be coalescing around a common narrative, emphasizing civil rights and freedom from elitist government overreach. Because coalescence could facilitate organized political action around vaccine opposition, we sought to test this hypothesis, examining how the discourse of vaccine opponents on social media has changed over time. Here, we report the results of a retrospective observational study characterizing the content of 204 public Facebook pages, emphasizing different vaccine opponent narratives. Using a set of 284 266 posts from October 2009 through October 2019, we quantified changes in the popularity of these narratives. Finally, we examined the proportion of messages associated with different communities, testing the hypothesis that pages expressing a specific group affiliation nevertheless post vaccine refusal content from a wide range of different perspectives.

METHODS

We conducted 3 analyses. First, we categorized Facebook pages opposing vaccination and measured the volume of posts in each category. Second, we described the topics of discourse within each page type over time and tested the hypothesis that pages in each category preferentially shared posts reflecting an underlying group identity. Third, we measured whether content across page types was coalescing over time.

Data Collection

Using a method initially developed for identifying online community structure,20 we identified a cluster of Facebook pages expressing vaccine opposition. We first identified a seed set of pages promoting content opposing vaccination, then added additional pages if they "liked" these seed pages and vice versa. This expanded list was then cross-checked to eliminate false identifications, and we iterated this process by using snowball sampling20-22 until no more pages were added. We identified 303 Facebook pages pertaining to vaccines, sampled on March 25, 2019. Using data from CrowdTangle,23 a public insights tool owned and operated by Facebook, we downloaded all public posts for these pages on November 21, 2019. After removing 22 (7%) non-English pages, 214 (71%) of the remaining pages, involving 1 414 081 "fans" as of March 25, 2019, expressed vaccine opposition. We successfully downloaded all 288 175 posts from 204 of these pages (95%; we were unable to download posts for some pages, and 1 page, with 3 511 posts, was excluded because of a coding error), with a total of1 397 086 (99%) fans.

Analysis

Which online communities are most active? Using information contained in pages' title and "about" sections, we categorized pages into 5 high-level non-mutually exclusive content categories derived from Kata's24 typology of vaccine-opposing content: (1) safety and efficacy, (2) alternative medicine, (3) civil liberties, (4) conspiracy theories, and (5) morality. We did not use the sixth category, misinformation, because misinformation appeared across all pages. Two independent annotators (A. M. J. and E. S.) agreed in 76.7% of instances (Cohen's k = 0.66; 95% confidence interval [CI] = 0.58, 0.74, indicating "substantial" agreement).25 Discrepancies were reconciled discursively and final codes reflect consensus. We also identified pages containing the name of a US state (e.g., "Michigan for Vaccine Choice"). We then enumerated fans and monthly post volume for each page category.

Raw post counts (Appendix A, Figure A, available as a supplement to the online version of this article at http://www.ajph.org) suggest qualitative changes in activity surrounding (1) January 2015: the "Disneyland" measles outbreak26; (2) April 2016: the release of Vaxxed, a film directed by a discredited former physician; and (3) January 2019: a US measles epidemic. We used the t test to examine changes in post frequency in different page categories before and after these events (see Appendix A, Figures B and C, for additional evidence for these specific events).

What content is most likely to be posted in these pages? We combined the message text and, if applicable, link text, and link description into a single document for each post after removing all URLs. Using the MALLET software package (AK McCallum, Amherst, MA) with Bayesian hyperparameter optimization,27 we inferred 100 topics for these documents using a Latent Dirichlet Allocation28 model fit to all 288 175 posts through November 20, 2019. Two authors (D. A. B. and A. M. J.) independently matched each of the resulting topics to 1 of 6 content or 2 design ("emotive appeals" or "content aspects") attributes listed in Kata's typology24 after manually inspecting the top 10 keywords and 50 posts for each latent Dirichlet allocation topic (Cohen's k = 0.67; 95% CI = 0.58, 0.77). We merged the conspiracyoriented attributes "profit," "collusion," "protection," and "coverup" attributes because ofoverlapping content; both annotators independently reported inability to distinguish among these attributes. In addition, we added new attributes reflecting novel content: within "alternative medicine," dieting and lifestyle; within "civil liberties," politics, political rallies, and events; and a "miscellaneous" category with design attributes specific to social media platforms (e.g., hashtags). Disagreements between annotators were reconciled discursively and final codes reflect consensus.

Next, we averaged the document-specific probability distributions for all documents in each month to generate monthly distributions over topics for 284 266 (99%) posts from October 2009 through October 2019. (We excluded data from before October 2009 [33 posts; 0.01%] because they had fewer than 20 posts per month, making probability distribution calculations unreliable. In addition, we excluded November 2019 [3876 posts; 1%] because we only had partial data for that month.) We generated similar average monthly distributions for each page category. We examined how these category-specific distributions increased or decreased in popularity29 using Spearman's rank correlations to account for floor and ceiling effects. Finally, we segmented the data into the same 4 time periods as described previously.

Are rationales for vaccine opposition coalescing around common topics? For each page type, we calculated the average monthly proportions of category-consistent topics compared with post proportions in all other pages (e.g., civil liberties topic proportions in civil liberties pages compared with civil liberties topics in all other pages). We tested the hypothesis that pages had higher proportions of category-consistent content. Next, we examined how these proportions changed over time. Finally, we calculated the Kullback-Leibler divergence-a standard metric of probability distribution similarity-between the category-specific monthly topic distribution for each Facebook page category and the average distribution for all posts in October 2019, the last full month in our sample. We examined whether the Kullback-Leibler divergence for each page category decreased over time, which would indicate that the distribution ofposts within that page category was becoming more similar to the reference.

RESULTS

Out of204 Facebook pages in our sample, 90 (44%) were categorized as "civil liberties," 90 (44%) as "safety and efficacy," 61 (30%) as "conspiracy theories," 16 (8%) as "alternative medicine," and 7 (3%) as "morality" (43 pages [21%] had 2 annotations; see Appendix A, Table A). A total of 53 (26%) pages contained the name of a US state in their title. After applying a logarithmic transform to correct for skewed data, we did not detect statistically significant differences in the number of fans (F[6197] =0.14; P = .99) orposts (F[6197] = 0.36; P = .90) per page by page type (Appendix A, Figures D and E).

Measles Outbreaks, Movies, and Legislative Mandates

Figure 1 shows several statistically significant nonlinear increases in post volume in the time period between October 2009 and October 2019. Compared with previous months, overall monthly post volume increased during the period between January 2015 (the "Disneyland" measles outbreak) and March 2016 (r[76] = 12.16; P< .001). A second increase occurred in the period between April 2016 (the release of Vaxxed) and December 2018 (t[46] = 3.63; P< .001). This second increase seems to have occurred in pages promoting "civil liberties" (t[46] = 9.46; P< .001) but not associated with any specific states. By contrast, post volumes in other pages decreased slightly (t[46] = -2.93; P = .005). Finally, compared with the period between April 2016 and December 2018, a statistically significant increase occurred in January 2019 (the 2019 US measles epidemic; t[41] = 13.47; P< .001). These changes cannot be attributed to linear increases in the overall Facebook user base (Appendix A, Figure F).

This increase seems to be primarily associated with activity in civil liberties pages, but also pages mentioning a US state in their title. Because there was statistically significant overlap between these categories (38 [72%] of the 53 state pages were categorized as "civil liberties"; x2[1] = 22.09; P< .001), we examined them separately. Civil liberties pages mentioning states (t[41] = 17.31; P< .001), civil liberties pages not mentioning states (t[41] = 12.85; P< .001), and pages mentioning states but not civil liberties (t[41] = 21.45; P <.001) all experienced statistically significant increases in post volumes. Pages mentioning states contained a total of 67 036 (24%) posts, with 33 498 (50%) posts in pages mentioning just 6 states: Michigan, Oregon, Georgia, New Hampshire, Delaware, and Vermont (raw counts in Appendix A, Table B). Pages mentioning neither states nor civil liberties did not experience a statistically significant change in post volumes (t[41] = -1.67; P = .10).

Political Mobilization and Celebrity Spokesmen

Appendix B (available as a supplement to the online version of this article at http:// www.ajph.org) shows the proportion of all topics in our data set, aggregated into attributes and typology categories (see Appendix A, Table B, for topic descriptions). Results show that posts in our sample were roughly equally likely to be about conspiracy theories (21%), civil liberties (20%), and safety and efficacy (19%). Figure 2 shows that the monthly share ofposts pertaining to safety and efficacy decreased overall (rs[119] = -0.61; P< .001), driven by a decrease in posts about immunity to specific diseases (e.g., indicating that vaccines are ineffective, cause diseases, or otherwise weaken the immune system; rs[119] = -0.71; P< .001). This decrease coincided with the "Disneyland" measles outbreak (t[76] = -4.51; P< .001) and the launch of Vaxxed (t[46] = 2.94; P = .005). By contrast, the share ofposts pertaining to civil liberties has grown overall (rs[119] = 0.33; P< .001), with discrete increases associated with both the 2015 (t[76] = 5.41; P< .001) and 2019 (t[41] = 6.38; P< .001) measles outbreaks but a decrease in between (t[46] = -3.20; P = .003). These changes are largely attributable to posts opposing vaccine mandates ("totalitarianism"; rs[119] =0.45; P< .001), which follow the same pattern: increases in 2015 (t[76] = 5.75; P< .001) and 2019 (t[41] = 5.91; P< .001), with a decrease in between (t[46] = -2.54; P = .01). Furthermore, we saw discrete increases in posts advocating political mobilization ("politics") in both 2015 (t[76] = 3.78; P< .001) and 2019 (t[41] = 5.23; P< .001), and with a statistically significant decrease in between (t[73] = 3.52; P< .001).

The share of posts reflecting "content aspects" also increased statistically significantly (rs[116] = 0.29; P = .001), driven primarily by posts about Vaxxed (rs[119] = 0.79; P< .001), with statistically significant increases corresponding to the lead-up (t[76] = 6.17; P< .001) and launch (t[46] = 5.79; P< .001) of Vaxxed, but with a statistically significant decrease afterward (t[41] = -4.01; P< .001). Concurrently, posts referring to the movie's producer have steadily increased (rs[119] = 0.82; P< .001), as have those referring to a political activist and attorney with whom he frequently collaborates (rs[119] =0.73; P< .001). By contrast, posts referring to a candidate for public office in New York City who opposes vaccines (rs[119] = -0.40; P <.001) and the founder of a nonprofit who advocates for "parents of vaccine-injured children" (rs[119] = -0.67; P< .001) have both decreased over time.

Coalescence of Rationales Across Pages

As expected, pages categorized as promoting civil liberties (t[119] = 12.67; P< .001) and conspiracies (t[119] = 6.67; P <.001) posted statistically significantly more content reflecting their corresponding topic categories than did other pages. By contrast, we did not detect statistically significant differences between pages categorized as about safety and efficacy (t[119] = -0.50; P = .62) and morality (t[106] = -1.90; P = .06) and their corresponding categories. Pages pertaining to alternative medicine had statistically significantly less alternative medicine content than did other pages (ř[84] = -8.90; P< .001).

All page types displayed an overall decreasing trend in the Kullback-Leibler divergence between each month's topic probability distribution and the average distribution for October 2019 (civil liberties: rs[119] = -0.50 [P< .001]; alternative medicine: rs[84] = -0.77 [P< .001]; conspiracy theories: rs[119] = -0.46 [P< .001]; morality: rs[106] = -0.65 [P< .001]; safety and efficacy: rs[119] = -0.46 [P< .001]). Thus, each Facebook page category is hosting increasingly similar content. For example, pages pertaining to safety concerns contained equal proportions of posts about safety concerns as those that did not pertain to safety concerns (Figure 3). Even pages pertaining to conspiracy theories, which seem to have experienced a relative increase starting in 2017, are converging.

DISCUSSION

Our results demonstrate how the vaccine opponent discourse has increased in volume and evolved over time, with 3 distinct phases:

1. vaccine opposition becomes mainstream,
2. popular media spokesmen target civil liberties pages, and
3. civil liberties pages promote state-level political mobilization.

Phase 1

The "Disneyland" measles outbreak brought national attention to mainstream vaccine opposition. Before this date, measles outbreaks in the United States had garnered comparatively little media attention. This outbreak sparked a national debate and the enactment of legislation to curb personal belief exemptions in California. During this period, the volume of posts on all vaccine opponent pages increased, and civil liberties discourse, in particular, became widespread.

Phase 2

The launch of Vaxxed coincided with an increase in posts to non-state-specific civil liberties pages. However, the proportion of civil liberties topics discussed decreased whereas the proportion of posts about the movie increased. This suggests that these pages may have been used as vehicles to disseminate content advertising the movie, possibly having established a linkage between the civil liberties discourse and the personalities driving this movie's agenda. This interpretation is supported by a decrease in civil liberties content in civil liberties pages, such that these pages more directly mirrored the content of other pages (Figure 3). This coincided with an increase in references to the movie's producer and collaborator during the same time period (Figure 2d, in particular, shows a large spike in January 2017). Fans of civil liberties pages may have been explicitly targeted as audiences for this movie.

Phase 3

The year 2019 gave rise to a sharp increase in posts to pages mobilizing Facebook fans for political purposes. This effect is especially pronounced in US state pages, which have seen increases in civil liberties discourse, but also vaccine safety concerns and alternative medicine. Michigan, Oregon, Georgia, New England, and Delaware seem to have been especially targeted. Notably, several of these regions were sites of measles outbreaks in 2019, a focus of legislative debate regarding vaccines, or both. For example, Georgia's House Bill 615 would "authorize certain minors to receive vaccinations without parental consent" (http://www.legis.ga.gov/ Legislation/ en-US/display/20192020/HB/ 615). Finally, among nonstate pages, only civil liberties pages experienced a similar increase whereas other topics declined in volume.

These findings were replicated in the topic analysis, which showed that both 2015 and 2019 saw a sharp increase in the civil liberties discourse, attributed largely to increased discussions about political mobilization and totalitarianism. By contrast, discussion of safety and efficacy has decreased, suggesting that vaccine opponents increasingly oppose vaccination as a matter of political principle rather than because of any particular concern about harms.

Emergence of a Common Vaccine Opponent Narrative

All categories of vaccine pages appear to increasingly reflect the same proportion of topics regardless of the stated purpose of the page. Furthermore, a large and increasing proportion of these messages reflect civil liberties and especially totalitarianism and political mobilization. This raises questions regarding to what extent there may be coordinated action driving content to these pages, with common ideological, political, or commercial commitments.

Limitations

A labeling error by 1 annotator led us to inadvertently exclude 1 page (1% of posts)- that claimed to promote "understanding of" or "truth about" vaccines, but actually opposed vaccines-from our sample. Beyond this 1 error, we utilized trained annotators with subject matter expertise to achieve reliable results.

In general, Facebook pages reflect "the official profiles for entities, such as celebrities, brands or businesses"30 constituting a limited snapshot of Facebook's dynamic network structure. By contrast, Facebook groups are designed for people to "share their common interests and express their opinion."30 Pages often point to eponymous groups, suggesting similar content; however, future work should conduct a more extensive comparison. Furthermore, private groups are inaccessible to ethical researchers whereas all pages are public. Although some content may have been removed before data collection, these removals appear limited-only 10 pages did not return any posts-compared with the millions of fans and hundreds of thousands of posts in our sample.

Public Health Implications

Health communicators frequently focus their efforts on debunking misinformation and promoting the health benefits of vaccination to the public. By contrast, vaccine opponents increasingly use the language of civil liberties-such as "vaccine choice"-to frame their efforts.

There is scientific consensus regarding the safety and efficacy of vaccination. Nevertheless, a civil liberties frame implies a legitimate debate about vaccination. This frame is known to increase hesitancy and delay-and, therefore, the likelihood of outbreaks-even among those who believe that vaccines are safe and effective.8 Furthermore, this frame puts the impetus for making what would otherwise be a routine procedure on vulnerable parents. Finally, framing vaccination as an individual choice shifts attention away from the social rationales for vaccination, including that herd immunity is a key factor in protecting the most vulnerable patients-the immunocompromised and the elderly.31

A freedom-of-choice frame has previously been adopted by vaccine opponents in other countries19 and by the tobacco industry when seeking to advance its business interests: this frame had been used to oppose government regulation by deflecting blame from corporate responsibility onto individual consumers.9 Vaccine opponents may similarly be using this frame to deflect attention from internal contradictions and significant internal disagreements regarding specific safety concerns or conspiracy theories. For example, some vaccine opponents claim that vaccines cause the diseases that they actually prevent, whereas others claim that vaccines are unnecessary because associated illnesses were already declining. Given the shifting rationales for vaccine refusal, a "civil liberties" framing fundamentally recontextualizes vaccination, making it into a value-laden political issue, rather than a debate over scientific or medical facts.

To the extent that public health communications emphasize verbatim facts over the gist, or bottom-line meaning,32 34 of vaccination, vaccine opponents and proponents may be talking past one another, with proponents unable to convince opponents about the value of vaccination and conflating vaccine opposition with ignorance-a linkage that strengthens the claim that public health and medical officials are elitist. Thus, this framing presents health communicators with a danger and an opportunity. The danger is that public health practitioners, often with limited human and fiscal resources, cannot devote the sheer attention necessary to maintain a constant social media presence. Furthermore, they may wish to avoid the appearance of communications that could be judged to be partisan or political. By contrast, by empowering members of the public to make their own choices about vaccination, public health communicators must be equally empowered-but only if provided with adequate resources-to communicate the appropriate and compelling social context for vaccination decisions.

Our results suggest that vaccine opponents are becoming increasingly organized with considerable political clout.

Public health agencies and advocates must therefore build strong relationships with state policymakers so that they may take an active stance when proposed laws or exemptions would further threaten the public's health. Finally, legislation is shaped by public opinion. Thus, continued protection ofthe public health will require sustained research into effective messages for communicating fact-based rationales for vaccination that are nevertheless targeted and tailored. These messages must be responsive to the contextual factors, specific values, and gists motivating vaccine refusal.

CONTRIBUTORS

D. A. Broniatowski designed the study, collected and analyzed data, conducted the statistical analyses, and wrote the first draft of the article. A. M. Jamison assisted with study design, critically revised the article, and conducted the qualitative analysis. N. F. Johnson, N. Velasquez, R. Leahy, and N. Johnson Restrepo collected and labeled data and critically revised the article, M. Dredze critically revised the article. S. C. Quinn critically revised the article and assisted with study design.

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CONFLICTS OF INTEREST

D. A. Broniatowski has received an honorarium of$500 from the United Nations Shot@Life Foundation-a nonprofit organization that promotes global childhood immunization. M. Dredze holds equity in Sickweather and has received consulting fees from Bloomberg LP and Good Analytics N. F. Johnson, N. Velasquez, R. Leahy, and N. Johnson Restrepo occasionally act as consultants to outside companies, but they do not and have not acted in this capacity with any company related to the content of this article, nor more generally in public health or on the topic ofvaccines. None ofthe organizations or companies listed here had any role in the study design, data collection and analysis, decision to publish, or preparation of the article.

HUMAN PARTICIPANT PROTECTION

The data used in this article are from publicly available online sources, the uses ofwhich are deemed exempt by the George Washington University institutional review board (180804).

Sidebar

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DETAILS

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Document 9 of 61

Using a Global Pandemic as a Teachable Moment to Promote Vaccine Literacy and Build Resilience to Misinformation

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ABSTRACT (ENGLISH)

Vaccination against infectious disease has been recognized as one of the "Ten Greatest Public Health Achievements" of the 20th century, given the substantial impact immunizations have had globally across a range of diseases, including polio, influenza, pneumonia, measles, mumps, rubella, viral hepatitis, pertussis, and oncogenic human papillomarvirus.1 Populationlevel vaccination programs have resulted in significant declines of new cases of disease, decreased morbidity and mortality, lower health care costs, and improved productivity.1 However, despite the proven clinical and cost effectiveness of vaccination, vaccines have not yet achieved their full potential, as rates of immunization among children and adults remain suboptimal, leading to a resurgence ofsome infectious diseases (e.g., measles).

FULL TEXT

Vaccination against infectious disease has been recognized as one of the "Ten Greatest Public Health Achievements" of the 20th century, given the substantial impact immunizations have had globally across a range of diseases, including polio, influenza, pneumonia, measles, mumps, rubella, viral hepatitis, pertussis, and oncogenic human papillomarvirus.1 Populationlevel vaccination programs have resulted in significant declines of new cases of disease, decreased morbidity and mortality, lower health care costs, and improved productivity.1 However, despite the proven clinical and cost effectiveness of vaccination, vaccines have not yet achieved their full potential, as rates of immunization among children and adults remain suboptimal, leading to a resurgence ofsome infectious diseases (e.g., measles).

Bringing increased attention to vaccination now is especially important as the world continues to combat COVID-19, a novel infectious disease that is easily transmissible and has an uncertain disease course, disproportionately affects elderly and ethnic/ racial minority populations, provides fertile ground for misinformation, and has become politicized. As an uncertain population anticipates the development of a COVID-19 vaccine to help return society to some semblance of normalcy, priming the public for vaccine acceptance is an urgent public health priority. With daily lives interrupted and vaccine discussions dominating news headlines, government hearings, and social media discourse, this urgency should be used as a teachable moment to promote vaccine literacy, address hesitancy, and build resilience to misinformation specific to a COVID-19 vaccine and about vaccination more generally. These efforts require us to reengage the public, community leaders, health care providers, public health practitioners, policymakers, and health agencies in addressing the challenges associated with bolstering vaccine-related knowledge, attitudes, and behaviors.

The fact that lack of access to vaccines is a critical driver oflow immunization rates in many communities is undeniable; however, when individuals do have access, lack of vaccine confidence becomes a primary barrier to uptake. In fact, recent polls suggest that many Americans do not plan to get a COVID-19 vaccine when one becomes available. Therefore, we specifically focus on strategies and research ideas for addressing vaccine literacy and hesitancy. Given the speed at which a vaccine for COVID-19 is being produced, adequate information about vaccine development and implementation as well as safety and efficacy may be challenging for individuals to gather and process. Proactive and coordinated communication efforts (e.g., public awareness campaigns) emphasizing the phases of vaccine development, Food and Drug Administration oversight, and adverse event reporting systems could increase confidence in vaccine safety and effectiveness.2

In addition to increasing knowledge about vaccines, efforts to promote vaccine literacy should support the public's ability to critically evaluate health information, strengthen numeracy skills, and instill an appreciation of the complexity of scientific research.3 Strategies for cultivating vaccine literacy could include tailored patient- and parent- provider communication during clinical encounters, targeted media campaigns, peer-to-peer vaccine education, school-based health and science courses, and community-delivered educational programs (e.g., churches, social services, cooperative extension programs).4

Although increasing the public's knowledge about vaccines will be vital, perhaps the greatest challenge facing vaccine literacy efforts is the proliferation of vaccine misinformation online. For years, public health experts and vaccine advocates have tried to reverse the damage caused by reports of an unfounded link between autism and childhood vaccines, only to have these efforts undermined by the massive amount of vaccine misinformation circulating online. Misinformation has become an especially acute problem in the context of COVID-19 because there are still many unanswered questions about the disease, making it easy for rumors to take root in the absence of scientific certainty.

Alarmingly, antivaccination groups are taking advantage of this situation to actively mislead the public and engage in divisive discourse on social media, even before the development of a COVID-19 vaccine. As evidenced by recent media reports, these activists are using social media to propagate rhetoric related to personal freedoms, to try to preempt possible COVID-19 vaccine mandates, to amplify fear and distrust of vaccines, to discredit those involved in vaccine development (e.g., pharmaceutical companies, philanthropists, government scientists), and to encourage parents to skip routine vaccination appointments during the pandemic. These online disand misinformation efforts are especially worrisome, as research has shown that fewer children have been getting routine vaccines since COVID-19 was declared a national emergency.5

Notably, exposure to misinformation cannot simply be undone through fact checking, correcting, or debunking efforts: a large body of research has shown that retractions are rarely successful at eliminating reliance on misinformation, a phenomenon known as the "continued influence" effect.6 Mitigating the effects of exposure to vaccine misinformation requires the development and testing of novel strategies beyond traditional vaccine education efforts. These strategies could include inducing skepticism about disinformation agents modeled after previous efforts to discredit the tobacco industry and developing tools to help the public identify credible information sources (e.g., creating a symbol to indicate that a Web site or social media account is credible and has been vetted). Other innovative ideas include combatting online conspiracy theories by partnering with former members of conspiracist communities to offer insights on the group's beliefs and disseminate evidence-based health information to current members. Mobilizing the provaccine majority to counter online misinformation may also be considered a testable strategy to assuage exposure to misinformation. Social media platforms could also proactively monitor, flag, and remove content or accounts that promote harmful health information and reconfigure platform features that amplify misinformation.

Although strengthening knowledge of vaccines, addressing misinformation, and reinforcing literacy skills are all necessary, they are not sufficient to fully address vaccine hesitancy and uptake. Cognitive, emotional, social, cultural, and contextual factors also shape overall vaccine attitudes and behaviors.2,7 Examples of these factors include political ideology, religious beliefs, online information silos dominated by singular viewpoints, medical mistrust, stances on government involvement in individual health decisions, and disease risk perceptions. Vaccine literacy efforts must therefore acknowledge that hesitancy is not always driven by a lack of knowledge and address these drivers by creating and delivering messages that align with individuals' values, acknowledge their concerns, and emphasize the health and economic benefits of vaccination for individuals, their families, and their communities. Potentially effective strategies include reinforcing healthpromoting social norms, engaging social media and key opinion leaders and influencers to advocate vaccines, and ensuring the provision of strong and consistent vaccine recommendations from health care providers. However, we recognize that many of these proposed intervention strategies have limitations (e.g., limited efficacy among individuals with entrenched beliefs, insufficient reach); therefore, communication efforts should be combined with policy-based approaches- such as school and workplace immunization requirements- that establish vaccination as the default option for individuals and families and disincentivize individuals from refusing vaccinations.

As we collectively face the public health consequences of the COVID-19 pandemic, we need to proactively and thoughtfully develop, test, and implement timely communication interventions to increase vaccine confidence. It is challenging enough to promote uptake of vaccination under normal circumstances, but it is particularly vital in anticipation of a future COVID-19 vaccine and the contentious discourse and pervasive misinformation that currently surrounds this topic. Going backward in the progress made against vaccine-preventable diseases is not an option; routine vaccination ofchildren and adults cannot be compromised or delayed. We should seize the attention being given to the COVID-19 pandemic and ubiquitous discussions of a vaccine as an opportunity to explore new intervention strategies to reinforce our commitment to a vaccine-literate and vaccineprotected public. >4jPI-l

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R. C. Vanderpool conceptualized the editorial and wrote the first draft. A. Gaysynsky and W-Y.S. Chou contributed additional concepts and participated in further writing and revision.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

Sidebar

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Note. The opinions expressed by the authors are their own, and this material should not be interpreted as representing the official viewpoint of the US Department of Health and Human Services, the National Institutes ofHealth, or the National Cancer Institute.

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DETAILS

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Document 10 of 61

HPV Vaccine Searches on Pinterest: Before and After Pinterest's Actions to Moderate Content

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ProQuest document link

ABSTRACT (ENGLISH)

Objectives.To compare how human papillomavirus (HPV) vaccination was portrayed on Pinterest before and after the platform acted to moderate vaccine-related search results to understand (1) what the information environment looked like previously and (2) whether Pinterest's policy decisions improved this environment in terms of sources and content. Methods. In this quantitative content analysis, we compared 2 samples of 500 HPV vaccine-focused Pinterest posts ("pins") collected before and after Pinterest's actions to provide more reliable vaccine-related information. Pins were based on search results and were analyzed using the Health Belief Model. Results. The majority of preaction search results leaned toward vaccine skepticism, specifically focused on perceived vaccine barriers. Few pins were published by public health-related Pinterest accounts. Postaction search results showed a significant shift to HPV vaccination benefits, and the number of pins by government or medical accounts increased. However, the proportion of pins in search results containing HPV content of any type was significantly lower. Conclusions. Pinterest's efforts to moderate vaccination discussions were largely successful. However, the ban also appeared to limit HPV vaccination search results overall, which may contribute to confusion or an information vacuum. (Am J Public Health. 2020;110:S305-S311. https://doi.org/10.2105/AJPH.2020.305827)

FULL TEXT

Headnote

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Methods. In this quantitative content analysis, we compared 2 samples of 500 HPV vaccine-focused Pinterest posts ("pins") collected before and after Pinterest's actions to provide more reliable vaccine-related information. Pins were based on search results and were analyzed using the Health Belief Model.

Results. The majority of preaction search results leaned toward vaccine skepticism, specifically focused on perceived vaccine barriers. Few pins were published by public health-related Pinterest accounts. Postaction search results showed a significant shift to HPV vaccination benefits, and the number of pins by government or medical accounts increased. However, the proportion of pins in search results containing HPV content of any type was significantly lower.

Conclusions. Pinterest's efforts to moderate vaccination discussions were largely successful. However, the ban also appeared to limit HPV vaccination search results overall, which may contribute to confusion or an information vacuum. (Am J Public Health. 2020;110:S305-S311. https://doi.org/10.2105/AJPH.2020.305827)

Human papillomaviruses (HPVs) repre- i sent the most common sexually trans- j mitted diseases. They are the primary cause of , warts and cancers of the genital areas, as well as several other cancers.1,2 Since 2006, a vaccine against most HPV infections that can lead to cancer has been introduced in more than 80 countries.3 Recent estimates indicate that 70% to 90% of HPV-related cancers may be prevented through universal HPV vaccination.4 Despite the potential benefits of HPV vaccination, there are several challenges that hinder vaccine uptake.3 Many individuals have negative attitudes toward the vaccine5 or are concerned about vaccine safety.6 Others believe it is for females only or that being in a monogamous relationship prevents individuals from getting HPV.7,8

While individuals likely learn about the HPV vaccine from a variety of sources, searching for health information online is increasingly common. Although the specific influence of social media on medical decision-making remains understudied, research supports an association between online health information searches and medical decision changes.9 Visiting antivaccination Web sites for 5 to 10 minutes can increase perceptions of vaccination risks and decrease intentions to vaccinate.10 In addition, HPV vaccine uptake may be lower in states where vaccine misinformation and conspiracies made up higher proportions of Twitter exposure,11 suggesting that negative representations of vaccines may influence vaccine acceptance. Recent studies have demonstrated that Pinterest is home to a large volume of health information,12-14 including significant amounts of antivaccine content.12,15 These studies prompted Pinterest to take action in 2019 to improve the available information about vaccines on its platform.16 In this study, we examined the content of pins resulting from searches for HPV vaccine information on Pinterest and how their efforts to mitigate vaccine-related misinformation have affected the information environment.

HEALTH MISINFORMATION ON SOCIAL MEDIA

Despite widespread scientific agreement about the value ofvaccines,17 misinformation about vaccines is common. Campaigns that question the safety and efficacy ofvaccination often outweigh official narratives on Twitter.18,19 Likewise, analyses of videos about the HPV vaccine on YouTube20 and portrayals of vaccination on Pinterest12 both found that antivaccination posts elicited more engagement, echoing research suggesting that mothers who oppose childhood vaccination communicate more about the issue on social media.21 These antivaccination posts often pair logical and seemingly factual language with fewer anxiety-related words than provaccination posts, heightening their appeal.22 While concerns about health misinformation on social media are widespread,22,23 vaccine misinformation deserves special attention, given its potential for compromising herd immunity and putting vulnerable populations not eligible to receive vaccinations at risk.

Human Papillomavirus Vaccine on Pinterest

In2018,29%ofadults in the United States reported using Pinterest, with usage particularly high among women (41%) and adults aged 18 to 49 years (34%).24 In addition, 80% of mothers and 38% of fathers in the United States use the platform.25 As mothers continue to be the primary care coordinators for children26 and make most health care decisions for their families,27 Pinterest's demographics make it particularly well suited for examining HPV vaccination messages.

In response to calls for social media platforms to take proactive approaches to manage misinformation, Pinterest instituted a series of policy changes. In early 2019, Pinterest first disabled searches for pins that contained certain vaccine-related information, regardless of the results' reputability.28 In late summer of 2019, Pinterest announced that it would only show information about vaccines from public health organizations.16 As a consequence, the search results for HPV vaccine content have deviated from the broader body ofposts on this topic, making it critical to adopt a "search as research" approach to understand the information that the public receives when they seek HPV vaccinerelated information in Pinterest.29

To date, to our knowledge, no other studies have examined the content that Pinterest displays when people search for the HPV vaccine or evaluated Pinterest's effort to reduce vaccine misinformation in that content. Therefore, this study offers 2 advancements to our understanding of health information on Pinterest. By comparing how HPV vaccination was portrayed in search results before the platform took action to moderate vaccine-related content (the "preaction" time period) versus after these actions (the "postaction" time period) this study shows (1) what the information environment looked like previously and (2) whether Pinterest's policy decisions improved the search environment in terms of the sources and the content of pins.

Health Belief Model

The Health BeliefModel (HBM) provides a useful theoretical framework for analyzing media messages about vaccination.30,31 The HBM posits that motivation for adopting healthy behaviors is determined by perceptions of susceptibility, severity, benefits, barriers, self-efficacy, and cues to action. In the context of HPV vaccination, perceived susceptibility refers to beliefs about the likelihood of contracting HPV vaccine-preventable diseases. Perceived severity is the assessment of the seriousness of contracting HPV vaccine-preventable diseases. Perceived benefits are assessments ofthe effectiveness of the HPV vaccine and associated positive consequences of avoiding HPV-related diseases. Perceived barriers about the HPV vaccine include safety concerns and any perceptions that inhibit someone from getting the vaccine (e.g., fear of needles, cost). Perceived self-efficacy is individuals' assessments of their ability to get the HPV vaccine. Lastly, cues to action are defined as external triggers prompting people to get the vaccine for themselves or their children.31 Broadly, we consider "pro-HPV vaccine" pins those that highlight the susceptibility and severity of contracting HPV-related diseases, promote the benefits of the HPV vaccine and selfefficacy, and offer cues to action to get the vaccine. Conversely, those highlighting barriers-including visuals likely to elicit fear (e.g., include a large needle, fearful expression, perceived vaccine adverse effects)-are considered to be "anti-HPV vaccine" content.

A large body of research demonstrates the utility of the HBM in predicting vaccination and other preventive behaviors such as health screenings,32,33 making it an appropriate framework for examining whether Pinterest's policy changes had the effect of improving vaccine-related content in alignment with the best available medical evidence. Given that Pinterest took actions designed specifically to boost the prominence of high-quality official sources of vaccine information, we hypothesized the following:

1. A greater proportion of official sources regarding HPV vaccine-related posts will appear in the postaction period as compared with the preaction period.
2. The postaction period will have (1) a greater proportion ofHBM constructs that support HPV vaccination and (2) a smaller proportion of HBM constructs that oppose HPV vaccination (compared with the preaction period).

Notably, Pinterest removed engagement indicators in the postaction period. However, we hypothesized the following:

3.In the preaction period, posts with (1) HBM constructs that oppose HPV vaccination will receive more engagement, and (2) HBM constructs that support HPV vaccination will receive less engagement than posts without these constructs.

METHODS

We conducted a quantitative content analysis of2 samples of500 HPV vaccine- related Pinterest posts. The first sample was collected October 2, 2018, before Pinterest's actions to moderate vaccine-related search results; the second was collected December 2, 2019, following Pinterest's actions to moderate vaccine-related search results. For both searches, we cleared the limited browsing history of the computer used (a brand-new computer that had not been used except to install basic programs for future use), used procedures to access Pinterest without being logged in to the platform, and used the same computer and procedure for both searches to ensure that algorithms for an existing account or user would not influence the search.

We collected both samples via a form of manual systematic random sampling, in which every third pin from the search results was selected, and this process was carried out for each time period until 250 posts were reached for each of 2 search terms, "HPV vaccine" and "HPV vaccination," for a total of 500 posts per time period. Consistent with the "search as research" approach, the sample is representative of the search results yielded by Pinterest, although not ofthe overall body of posts that people have created on the platform.

We manually coded all posts (n = 1000) for engagement (i.e., the total number of saves and comments each were counted and included), account characteristics (e.g., individual, commercial, health-related, and government), and whether the post linked to an external Web site (yes or no; if yes, the type of Web site). We also recorded visual characteristics (e.g., primarily image, primarily text, mix of image and text, infographic, drawing, or video), and the presence of fear visuals (e.g., large needle, mask, orthreat sign, such as a skull and crossbones). Furthermore, we coded pins for the presence of HBM constructs (e.g., perceived benefits of and barriers to the HPV vaccine, perceived severity ofand susceptibility to HPV, as well as perceived self-efficacy and cues to action). Examples for the HBM constructs present in search results are included in Appendix Figures A through F (available as supplements to the online version ofthis article at http://www.ajph.org).

Intercoder Reliability

After a period of training, 3 coders (J. P. D. G., H. M. M., and Y. Q.) independently coded 20% of posts (n = 200). After pretesting and subsequent coding protocol changes, intercoder reliability using Krippendorffs a ranged from 0.70 to 1.00, with an average of 0.77, meeting the standard for reliability. One coder coded 600 additional posts, and each ofthe remaining coders coded 150 more.

Statistical Analyses

We carried out descriptive analyses for all variables. We assessed differences between time periods with the %2 test. We used the Mann-Whitney U test to check for differences in Pinterest engagement between posts with (vs without) a range of dichotomous variables. We conducted all analyses with SPSS version 26 (IBM, Somers, NY).

RESULTS

The purpose of this study was to analyze HPV vaccine-related search results on Pinterest, comparing results before and after Pinterest's 2019 actions on vaccine-related searches. All of the preaction pins mentioned HPV or the HPV vaccine in some way, but only 40.6% of the postaction sample did, despite our explicitly using the search terms "HPV vaccine" or "HPV vaccination." Some pins in the postaction sample (n = 500) focused on a non-HPV vaccine (e.g., influenza; measles, mumps, and rubella [MMR]; 18.6%), while others mentioned vaccines in general (29.2%) or made no mention of vaccines (11.6%). Within the postaction sample, 74.0% of pins from the "HPV vaccination" search (n = 250) mentioned the HPV vaccine or the virus itself, compared with only 7.2% of the "HPV vaccine" pins (n = 250).

In the preaction period, most visuals (64.4%) primarily consisted ofan image. The remaining pins were 9.4% primarily textbased, 16.4% a mix of image and text, and 3.6% an infographic. In the postaction period, the proportion of visuals consisting primarily of an image was lower (36.0%), while the proportions of primarily text-based (15.6%), a mix of image and text (29.2%), and infographic (10.0%) pins were higher. The %2 test showed that all of these differences were significant (Table 1).

Regarding information sources, most pins (79.2%) in the preaction period originated with individuals, while only 3.2% were published by official medical entities (e.g., hospitals), and no pins originated with government entities (e.g., public health departments, the Centers for Disease Control and Prevention; Table 1). By contrast, in the postaction period, only a quarter of pins (25.8%) originated with individuals, with 46.2% published by official medical entities and 7.6% by government entities. The %2 test revealed that all of these differences were significant (Table 1), supporting our first hypothesis.

Next, we examined the HBM constructs present in HPV-vaccine related search results. In the preaction sample, the most frequently mentioned HBM construct was perceived barriers (65.6%), with perceived benefits a distant second (13.0%; Table 1). Barriers included adverse effects of the HPV vaccine (55.0%), fear visuals (32.2%), and conspiracy theories (13.8%; Table 1).

Among pins in the postaction sample that focused on HPV or the HPV vaccine, the HBM constructs present were categorically different (supporting our second hypothesis). Perceived benefits were mentioned most frequently (40.2%), followed by perceived severity of HPV infection and its consequences and perceived susceptibility to HPV infection (22.1%; Table 1). By contrast, perceived barriers to vaccination were present in only 11.3% of posts, vaccine adverse reactions in 1.6%, conspiracy theories in 1.2%, and fear appeals in 14.2% of posts. A large needle remained the most common fear visual. The %2 test again showed that all of these differences were significant (Table 1) and broadly provided support for our second hypothesis, as provaccine content increased and antivaccine content decreased in postaction pins.

Finally, we assessed the relationship between message features and engagement in the preaction period. As shown in Table 2, pins mentioning barriers to getting the HPV vaccine were significantly more likely to produce Pinterest engagement than pins that did not mention barriers. Mentioning benefits ofthe HPV vaccine, self-efficacy, and cues to action were each associated with lower median save frequencies (Table 2), supporting our third hypothesis.

DISCUSSION

While Pinterest still tends to be seen as a place to find and share recipes and decorating ideas, several studies demonstrate not only that vaccine posts are present but also that these posts tend to be dominated by vaccine skeptics.10,12 The results of the preaction time period of this study confirm these trends: 65.4% of pins mention specific barriers to getting the HPV vaccine, such as perceived adverse effects of the vaccine and conspiracy theories. Not only do HPV vaccine-skeptic posts dominate this part of the sample, but when they appeared, they also were often associated with higher levels of engagement in the form of saves (Pinterest's main engagement metric). Apart from perceived barriers, HBM constructs were almost entirely absent from the preaction sample. When we considered the high percentage oflisted barriers to getting the HPV vaccine, together with very little mention of the severity of and susceptibility to HPV, it was clear that vaccine skepticism was prevalent in these search results, and more strategic efforts to promote the HPV vaccine in this space were needed.

Another finding of interest for the preaction sample was that the majority of the pinners in the search results were individuals, while only 3% of all pins were confirmed to originate with official medical accounts (e.g., hospitals, medically focused nonprofits), and there was no presence of any pins published by government accounts such as the Centers for Disease Control and Prevention. This is concerning, as it appeared to suggest that the public health experts' voice-often likely to provide trustworthy and reliable health information-was again largely absent on this platform, which was a concern shared by earlier health-focused Pinterest studies.12-15

Pinterest engaged in several strategic efforts over the course of 2019-first disabling searches for certain vaccine-focused terms, and then repopulating these searches with posts originating with reliable public health entities. The postaction sample in this study yielded several encouraging results: more of the posts originated with either public health- or health-related entities, and of the HBM constructs, perceived benefits of the HPV vaccine, as well as severity of and susceptibility to HPV infection, were mentioned in 23.5% and 22.1%, respectively, of the postaction sample (as compared with 3.6% and 5.0% of the preaction sample).

However, a few serious concerns also surfaced. First, in the postaction sample, 60% of all pins did not address the HPV vaccine or the virus in any way, instead focusing on other, often younger childhood vaccines about which information may not be relevant for people searching for HPV vaccine information. We performed additional searches on December 21, 2019, to probe these results. At the time this article was written, keyword searches for "HPV vaccine," "flu vaccine," "MMR vaccine," and "vaccine" yielded identical results (i.e., the same mix of messages focused on diverse vaccine-related issues such as the MMR vaccine, influenza vaccine, HPV vaccine, herd immunity, history ofvaccines, and general advice on how to make vaccines an easier experience for young children (Appendix Figures G-J, available as supplements to the online version of this article at http://www.ajph.org). Although we are not privy to Pinterest's search algorithm, we suspect that the results for the search for keyword "vaccine" were replicated and provided for the search for any type of"vaccine"-related search, whether that be "flu vaccine," "HPV vaccine," or "MMR vaccine."

In addition, 12.2% of the postaction sample did not discuss vaccines of any kind in their posts. Interestingly, the distribution of HPV- versus non-HPV-related pins appeared to be clearly skewed in 1 direction: pins from the "HPV vaccine" keyword search only yielded 7.2% of HPV vaccine- and virusrelated posts, while pins from the "HPV vaccination" keyword search yielded 74% of HPV vaccine- and virus-related posts. As postaction results were identical for "HPV vaccine" and non-HPV vaccine searches, the low rate of HPV content from the "HPV vaccine" search may be an artifact of how Pinterest has implemented its strategy for reducing misinformation around vaccines more broadly. Of further interest is that a search for keyword "HPV vaccine" produced a warning from Pinterest, but "HPV vaccination" did not (Figure 1). Finally, even when a pin mentioned the HPV vaccine or virus, visuals were often of questionable quality and utility, frequently because the quality of the image was lacking (Appendix Figure K, available as a supplement to the online version of this article at http://www. ajph.org) or because the pin was not designed for Web use (Appendix Figure L) or it was not conveying any kind of clear message or information (Appendix Figure M).

Limitations and Future Directions

There is no current application programming interface available for Pinterest data collection by keyword, so the sampling method, while approximating randomization as closely as possible, couldbe improved.12,14,34 Second, while network analysis on Pinterest is in its infancy, future studies should consider using both current (posts that are saved from another user, similar to Twitter's "retweeted" posts) and original (posts created by the pinner as original Pinterest content) pinner data to better understand which messages spread fastest and how they spread. Third, a qualitative analysis should be considered to extend this research, as should message-testing studies that focus on correcting misinformation and spreading accurate information on Pinterest. Finally, we did not seek to capture the overall body of Pinterest posts about HPV vaccination, but rather focused on Pinterest as a source of information via its search mechanism. Future work should consider what individual people post to Pinterest and iftheir behaviors have changed in light of Pinterest revising its algorithms to reduce antivaccine content in search results.

Public Health Implications

Overall, Pinterest's efforts to mitigate HPV vaccination misinformation in its search results were partially successful. The information landscape before Pinterest's systematic effort was largely anti-HPV vaccination, with individuals sharing information that highlighted barriers, promoted conspiracy theories, and focused on rare or inaccurate negative side effects of the vaccine rather than the severity of and susceptibility to HPV. Although these trends were not eradicated with Pinterest's efforts, the postaction information available skewed more positively, focusing on the benefits of vaccination and the dangers of HPV infections. The postaction pins originated more often with reputable accounts, without removing individuals' ability to communicate by creating their own pins.

However, the way in which the content restrictions were implemented also appeared to limit HPV vaccination content. Many of the pins that emerged when we searched for "HPV vaccine" were not related to vaccination at all or focused on other, younger childhood vaccinations. This could lead to another type of misinformation if audiences fail to realize when a pin is referring to a different vaccine type, or an information vacuum. Although Pinterest took an important first step with its 2019 actions, it can and should improve the curational aspect of vaccine-related searches on its platform.

Health communication and public health professionals as well as advocacy organizations should also do more to fill the information gap related to HPV vaccination on social media. More health professionals should consider expanding their social media activities to include Pinterest, particularly considering Pinterest's largely female user base and the dominant role of women in making health care decisions for their families.27 Second, while more messages in the postaction sample discussed benefits of vaccination and dangers of HPV infection, content could further encourage self-efficacy for or actions to get the vaccine, as self-efficacy is important in achieving behavior change to overcoming perceived health threats.35 Finally, more strategic partnerships between social media platforms like Pinterest and health communication professionals would help create a space where valuable-and accurate-health information flourishes.

Conclusions

To our knowledge, this research is the first to evaluate Pinterest's actions to moderate content to combat the spread of vaccine-related misinformation. Although Pinterest's efforts represent initial progress toward thwarting messages with potentially harmful information, improved approaches are necessary moving forward. Social media platforms should do more than block harmful content and redirect search results. From a public health perspective, it is imperative that Pinterest users seeking vaccine information receive search results that are not only medically accurate but also relevant to the specific vaccine ofinterest. To achieve more meaningful moderation and promote the dissemination ofaccurate information on Pinterest, a 2-pronged approach is needed: improved strategies for filtering in relevant and vaccine type-specific pins, as well as generating a greater volume ofhigh-quality, reliable content to fill the void left by blocking misleading pins. Public health content creators should provide more well-designed, informative, and effective Pinterest messages and visuals.

CONTRIBUTORS

J.P.D. Guidry contributed to conceptualization, data curation, investigation, methodology, formal analysis, preparation of the original draft, and article review and editing. E. K. Vraga contributed to methodology, review and editing of the article, and formal analysis. L. I. Laestadius contributed to preparation ofthe original draft. C. A. Miller and K. E. Carlyle contributed to methodology and review and editing of the article. A. Occa, X. Nan, and B. F. Fuemmeler contributed to review and editing ofthe article. H.M. Ming and Y. Qin contributed to the investigation.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

Institutional reviewboard approval was not neededfor this study because all Pinterest posts were publicly available.

Sidebar

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Document 11 of 61

Tackling Online Misinformation: A Critical Component of Effective Public Health Response in the 21st Century

Zucker, Howard A, MD, JD

ProQuest document link

FULL TEXT

As commissioner of health for New York State, I am charged with overseeing the state's response to health crises: Ebola, Zika, measles, and, currently, the COVID-19 pandemic. In each case, I have experienced firsthand how the development and spread of misinformation can make responding to public health crises even more challenging. It has become increasingly evident that our job now is fighting not only the spread ofdisease but also the spread of misinformation about the disease. Although the control of misinformation is most urgent when tackling outbreaks of infectious diseases such as COVID-19, it is also important in many other domains of health, including chronic disease. For example, last year, the Food and Drug Administration released a statement warning consumers not to drink a solution that turns into bleach when "activated" following product directions, because it was being promoted on social media as a treatment for conditions ranging from autism to cancer (https:// bit.ly/3hetir2).

The spread of false and malicious information is not new. However, it has recently become an especially challenging problem for several reasons. First, the sheer speed and scale at which (mis)information spreads is alarming. Whereas it used to take hours, if not days, for information to reach the public, it now takes minutes, if not seconds. And with Americans increasingly getting their news from social media (https://pewrsr.ch/3aGeFdA), the potential reach of false information is enormous and unprecedented. Second, misinformation is especially dangerous today because of declining trust in institutions, including government, medical systems, and the press, which has created a vacuum in which science is pushed to the margins and misinformation more easily takes hold.

The viral spread of misinformation on social media is of significant concern to public health practitioners; once inaccurate information starts circulating, it is incredibly difficult to contain or mitigate its effects. Misinformation spreads because it tends to be driven by emotions, especially fear, and it is very difficult to combat emotions using facts, which is the traditional approach public health employs in response to misinformation. Equally concerning is the fact that even after individuals learn that a piece of information is false, they still tend to believe it, at least to some extent, because of the difficulty of removing information once it has been encoded in memory. This perseverance of false information means it is exceedingly difficult to reverse the harm of misinformation exposure. Using medical terms, one might say misinformation is widely prevalent, incredibly infectious, and highly resistant to currently available treatment.

Although misinformation has received significant attention in the political sphere since the 2016 US presidential election, the public health stakes are equally high, if not higher. Health misinformation threatens to negate much of the progress we have made in the past century to improve population health. In spring 2019, I gave a TEDx presentation focused on this national concern (available at https://www.youtube.com/watch?v=ak-aV6bkedE). Those of us working on the frontlines ofpublic health urgently need research that will help us better surveil, understand, prevent, and mitigate the viral spread of health misinformation online. I congratulate AJPH for responding with this special issue of research examining social media misinformation across an array of health topics. >4jPU

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Document 12 of 61

Twitter Communication During an Outbreak of Hepatitis A in San Diego, 2016–2018

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ABSTRACT (ENGLISH)

Objectives. To examine how and what information is communicated via social media during an infectious disease outbreak. Methods. In the context of the 2016 through 2018 hepatitis A outbreak in San Diego County, California, we used a grounded theory-based thematic analysis that employed qualitative and quantitative approaches to uncover themes in a sample of public tweets (n = 744) from Twitter, a primary platform used by key stakeholders to communicate to the public during the outbreak. Results. Tweets contained both general and hepatitis A-specific information related to the outbreak, restatements of policy and comments critical of government responses to the outbreak, information with the potential to shape risk perceptions, and expressions of concern regarding individuals experiencing homelessness and their role in spreading hepatitis A. We also identified misinformation and common channels of content driving themes that emerged in our sample. Conclusions. Public health professionals may identify real-time public risk perceptions and concerns via social media during an outbreak and target responses that fulfill the informational needs of those who seek direction and reassurance during times of uncertainty. (Am J Public Health. 2020; 110:S348-S355. https://doi.org/10.2105/AJPH.2020.305900)

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Conclusions. Public health professionals may identify real-time public risk perceptions and concerns via social media during an outbreak and target responses that fulfill the informational needs of those who seek direction and reassurance during times of uncertainty. (Am J Public Health. 2020; 110:S348-S355. https://doi.org/10.2105/AJPH.2020.305900)

The hepatitis A virus (HAV) is a fecal- orally transmitted virus[1] spread primarily through close personal contact with an HAVinfected person and occasionally through consumption of contaminated food and water. Although its incidence has decreased dramatically since the introduction of the hepatitis A vaccine,[1] for reasons that are unclear, since late summer 2016 HAV has had an increased presence across the United States. In particular, a large outbreak of hepatitis A in San Diego, California, was officially declared a local public health emergency by the San Diego County public health officer on September 1,2017. The outbreak was notable in both its severity and its rapid spread, with almost 600 cases, 20 deaths, and 400 hospitalizations in San Diego County through early 2018. In addition, since the outbreak, numerous other states reported cases ofhepatitis A, some ofwhich may be linked to the initial outbreak in San Diego.[2] An audit by the state later noted that San Diego County's response to the HAV was greatly delayed.[3]

During situations with a sudden increase in caseload or transmission, a coordinated public health strategy can facilitate communication about risks and appropriate behavioral responses.4 Creating and implementing a coordinated public health strategy requires effective communication deployed in a rapid manner.5 Social media offers a way to provide the public with emergency alerts and real-time updates regarding emergencies.6 Effective communication also requires that public health professionals deftly handle the rising problem of health-related misinformation on social media.7 As questions about how to monitor and assess misinformation during an infectious disease outbreak have emerged among public health professionals, an increased understanding of the context in which health-related misinformation spreads via social media may serve as a starting point for addressing these questions.

At the same time that misinformation on social media has begun to emerge as a possible threat to public health, the United States has experienced several significant infectious outbreaks, including the current COVID-19 pandemic. However, despite the increasing interest in exploring the use of social media message platforms for early disease prediction8 and message content during environmental emergencies,9 research on content and communication during an outbreak spurred by a vaccine-preventable communicable disease outbreak remains limited.10 It is also unclear whether and how real-time patterns of health information diffused via Twitter during an outbreak of a vaccine-preventable infectious disease may differ from other outbreaks or how communication varies if the outbreak originated in a stigmatized population.

We examined both how and what was communicated (and miscommunicated) via social media during the 2016 through 2018 hepatitis A outbreak in San Diego. One example of a misinformation effect on public health is the antivaccine misinformation in social media posts describing childhood immunizations as a cause of autism and the subsequent reductions in herd immunity.11 We address the following research questions (RQs):

RQ1: How did Twitter users communicate about the hepatitis A outbreak?

RQ2: What were the source types (type of individual or organization) and characteristics of Twitter users contributing to the conversation about the hepatitis A outbreak?

RQ3: What themes about the hepatitis A outbreak on Twitter were more likely to be shared and by which source types?

RQ4: Was there misalignment between messaging about the hepatitis A outbreak on Twitter from authorities and members of the public?

RQ5: Was misinformation shared on Twitter during the hepatitis A outbreak?

RQ6: In what ways did users seek or share content about HAV on Twitter?

METHODS

We used the hepatitis A outbreak in San Diego (November 2016 to October 2018) and a grounded theory-based thematic analysis to motivate our research. We first examined qualitative data to identify themes of tweets shared during the outbreak. This approach was guided by principles of grounded theory methods.12 Our primary data were publicly available messages posted to Twitter by official response agencies (e.g., the public health department) and other numerous stakeholders during October 2017 through December 2017-the height of the outbreak.

Data Collection

We used the visualizing information space in ontological networks framework13 to examine the interrelationships between online messages, space, and time. The framework consists of an approach our team developed for visualizing and analyzing Web pages and social media content from a spatiotemporal perspective. We focused exclusively on data collected from Twitter because of the realtime and dynamic nature ofthis platform. We took advantage of the spatial filtering methods provided by the Twitter search application programming interface.

We collected 4401 tweets limited to San Diego County between October and December 2017, coinciding with Governor Jerry Brown's declaration of a statewide emergency and the downward epidemiological curve of new cases.14 We used user profile information with place name dictionaries (gazetteers; Appendix A, available as a supplement to the online version of this article at http://www.ajph.org) to determine that all tweets originated in San Diego County. Of these tweets, we randomly selected 1000 tweets for analysis. After identifying the number of unique users, we randomly de-duplicated users so they each had only 1 tweet. We decided to randomly select 1 tweet per user to ensure that we did not violate assumptions of independence in observations for our tests of association. We further constrained the sample by removing tweets that (1) were about flu only, (2) were about vaccines for animals, (3) discussed other forms of hepatitis, or (4) were written in a language other than English. This resulted in a final analytical sample of 744 tweets, which represented 17% of all tweets collected; the sample was composed of tweets from unique users, meaning each user appeared in our sample only once.

Data Analytics

We used retrieved tweets and metadata to tabulate information such as the impressions and engagements of each tweet and to establish the frequencies of hashtag use. We also searched metadata fields (e.g., Twitter @handle, display name, number of followers) for relevant search terms. Two researchers (R. E. H. and T. A.) manually coded the message content of the original tweets from the entire data set to identify relevant themes. Using grounded theory, we performed a thematic analysis to identify themes oftweets in our sample. We additionally coded each targeted account with an included tweet in the sample according to its network size (number of followers) and number of accounts followed by the account.

We first analyzed and coded tweets using the constant comparative method.15 Using this approach, we focused on patterns of conceptual and exemplar convergence and divergence in the data. The identification of themes occurred through revisits and recodes of tweets to ensure that themes were substantiated by the data. When reasonable, we reconsidered and revised coding categories in cases that departed from identified themes.16 Over the course of revising thematic categories, we developed a coding scheme for 2 coders (who were not privy to the research questions driving the study) to use to quantitatively examine tweets in our sample. Coders also quantified the number of times a theme was observed (RQ1) and calculated intercoder reliability between both coders for the frequency of themes identified in our sample. Using coding guidelines from previous research,17 coders also coded tweets for source type (RQ2), which we then used to link to themes (RQ3). Building on patterns of misinformation and misalignment between public health messaging and individuals and organizations who were not public health authorities, we developed coding categories for content inconsistent with known public health messaging about hepatitis A vaccinations and contamination or sanitation issues (RQ4) and misinformation (RQ5).

We developed coding procedures for misinformation related to vaccines with guidance from others.18 For example, if a tweet promoted a vaccine-related conspiracy theory (e.g., vaccine policymakers are influenced by profit motives) or trivialized vaccine-preventable diseases (e.g., vaccines are worse than the measles), we coded it as containing misinformation. If a tweet contained any misinformation (related or unrelated to the hepatitis A outbreak), we coded it as having misinformation. To qualify as having no misinformation, a tweet could contain only accurate content. Last, given the unique properties of social media, we developed coding categories to capture the frequency with which users engaged in seeking and sharing information (i.e., in the form of news, statistics, known facts) and opinions (RQ6). Our codebook (Appendix B, available as a supplement to the online version of this article at http://www.ajph.org) contains more information about coding approaches. We examined contingency tables using C2 analysis and magnitude of effect with the j (ф) coefficient.

Coders were trained on a training set of tweets and double-coded 20% of the total number of tweets. In instances of coding disagreements, coders discussed discrepancies until resolved. Good intercoder reliability (at least 0.80) was achieved after 3 rounds of double-coding, after which remaining tweets were single-coded. We used Gwet's agreement coefficient,19 as it may address limitations observed in the use of other more commonly used coder reliability statistics, including Cohen's k and Scott's P, which are more sensitive to prevalence.20,21

We conducted the statistical analyses using Microsoft Excel (Microsoft Corp., Redmond, WA) and SAS version 9.4 (SAS Institute, Cary, NC).

RESULTS

We report the findings of tweets in our sample (n = 744) that were used for our thematic analysis. The median number of followers for these users was 480.5, and the median number of users they were following was 453.5.

Research Question 1

RQ1 was, How did Twitter users communicate about the hepatitis A outbreak? To answer this question, we identified major themes in our sample of Twitter users (any publicly viewable accounts that could be organizations, excluding accounts of a single person) or individuals (excluding accounts of an organization or cause). Among the 744 messages, we found that a subset related to policy issues (n = 281) and questions regarding general medical information (n = 177). These were followed by themes related to risk perceptions ofhepatitis A (n = 111), concerns regarding individuals experiencing homelessness and their role in spreading hepatitis A (n = 151), specific hepatitis A medical concerns (n = 90), and other (n = 137; Table 1). We did not code themes as mutually exclusive, and intercoder reliability was strong, with an average Gwet's agreement coefficient of 0.87, ranging from 0.80 to 0.96.

Research Question 2

RQ2 was, What were the source types and characteristics of Twitter users contributing to the conversation about the hepatitis A outbreak? Table 2 presents results showing the source types in our sample. The majority of tweets in our sample were shared by individuals (77.2%), and the most common categories for individuals included users who mentioned being a parent (9.1%) and a journalist (11.0%). Aportion of tweets shared by individuals expressed firsthand experience of the hepatitis A outbreak (15.7%) and pointed to the spirituality (8.2%) and political persuasion (25.8%) of the user. The most common types of organizations contributing to the conversation about the hepatitis A outbreak were businesses (65.8%), news organizations (37.7%), and nonhealth advocacy groups (18.2%). We noticed, however, that only a small portion of tweets (1%) was shared by government organizations.

Research Question 3

RQ3 was, What themes about the hepatitis A outbreak on Twitter were more likely to be shared and by which source types? Organizations were more likely to tweet themes related to government and policy ($\phi = 0.09$), particularly news affiliates ($\phi = 0.24$) and content with general medical information, when compared with individuals ($\phi = 0.10$; Table 3). By contrast, individuals were more likely than organizations to share tweets with themes centering on the population experiencing homelessness ($\phi = 0.09$). Individuals with political affiliations were most likely to tweet about policy ($\phi = 0.15$) and homelessness ($\phi = 0.18$). Journalists were most likely to discuss risk perceptions ($\phi = 0.14$).

Research Question 4

RQ4 was, Was there misalignment between messaging about the hepatitis A outbreak on Twitter from authorities and members of the public? We explored the frequency with which tweets in our sample contained any content that was inconsistent with known messaging from the Health Department of San Diego County with regard to hepatitis A vaccination and sanitation or contamination concerns (Table 4). Most tweets contained content that was not relevant to messaging on issues related to hepatitis A vaccination (92.2%; n = 686) and sanitation or contamination (87.1%; n = 648). For tweets that were relevant, the majority discussing HAV vaccination (89.7%; n = 52) were consistent with messaging from the health department. However, we observed a different pattern for relevant tweets discussing HAV sanitation or contamination concerns, with the proportion discussing issues in a manner inconsistent with messaging from the health department (49.0%; n = 47) evenly split with the proportion of tweets aligned with the health department (51%; n = 49).

Research Question 5

RQ5 was, Was misinformation shared on Twitter during the hepatitis A outbreak? Table 4 also shows the results of our examination of misinformation. We detected the presence ofmisinformation shared on Twitter during the outbreak. However, we discovered that only a small proportion of tweets (7.4%) contained any misinformation. Most tweets did not expressly align or misalign with county messaging on selected themes.

Research Question 6

RQ6 was, In what ways did users seek or share content about HAV on Twitter? Our last research question sought to examine different and nonmutually exclusive ways that users engaged with HAV content on Twitter (Table 4). Specifically, we looked at content contained in each tweet that indicated users' engagement as characterized by seeking or sharing information (in the form of news, statistics, or known facts) or opinions. Overall, we found that a higher proportion of information (60.1%) and opinion (45.6%) sharing than information or opinion seeking (5.8%)

occurred among users in our sample.

DISCUSSION

In this descriptive study, we note the similarities of previous research18 to the themes (RQ1) we uncovered surrounding warnings to the public through updates on the progression of the outbreak. We also note that emergent themes related to risk perceptions of the outbreak (e.g., susceptibility and severity related to infection) and perceptions regarding (in)effectiveness of policy and government responses (e.g., response efficacy of recommendations to the public) aligns with concepts of risk-response theorizing.22 Our study also showed that tweets shared by government sources (RQ2) were rare, suggesting a lack of dialogue between government agencies and the public during the outbreak.

Although previous research emphasizes the public's engagement with information from government authorities during times of crisis, scholars have also noted that often crisis communication on Twitter takes the form of a 1-way flow of information rather than an interactive dialogue between government authorities and members of the public.23 This lack of dialogue may have further added to public perceptions of insufficient action on the part of the government during the initial stages of the outbreak and critiques that the county's response was unsatisfactory. In future outbreak scenarios, using the interactive properties of Twitter may help public health authorities more effectively use this communication channel to promote dialogue with affected communities.

Perhaps unsurprisingly, organizations were more likely to tweet themes sharing broad informational content (RQ3), whereas individuals were more likely to share information on risks and advocacy issues (e.g., homelessness). This difference in focus may suggest that a shift away from top-down communication by organizations in our study toward meaningful and engaging dialogue with the public24 did not take place during this outbreak. Without this dialogue, organizations may struggle to address the concerns and informational needs of public audiences, which may create an unintended informational vacuum in which the public seeks desired information elsewhere.25

We also detected some misalignment between messaging about the hepatitis A outbreak on Twitter from authorities and members of the public (RQ4). Although most tweets discussing hepatitis A vaccination were consistent with messaging from the health department, small fractions of tweets with messages that are inconsistent with official public health messaging may be concerning, as even seemingly small pieces of misinformation can be propagated. For example, as Baker discusses, Andrew Wakefield's published article on a vaccine-autism connection gained traction in part through the Internet26 despite later retraction, and in the recent global COVID-19 pandemic, we have observed the power that even 1 piece of dangerous misinformation uttered once by a political leader despite an immediate response by health experts to correct the situation.27

For tweets falling under themes providing general medical information and HAVspecific information, we found references to misinformation regarding vaccine safety, all of this in light of an ongoing outbreak of a vaccine-preventable disease. Although only a small proportion of tweets in our study contained misinformation (RQ5) at the individual level, in the aggregate even a small amount of misinformation can pose potential issues for public health at the population level if it leads to vaccine noncompliance among enough individuals and subsequent reductions in herd immunity. However, more research is needed to establish thresholds of misinformation and when they reach problematic proportions requiring intervention.

Additionally, the context of an outbreak of an infectious disease such as hepatitis A suggests that the level, nature, and spread of misinformation is likely to vary depending on public health concerns. This particular hepatitis A outbreak largely affected a marginalized and socially distant population; however, outbreaks affecting populations such as children may evoke a greater level of concern that generates content and levels of misinformation differing from what we observed. Future research may examine content and proliferation ofmisinformation, as well as outbreaks affecting different populations, to confirm this hypothesis.

Our results also indicate that Twitter users' activities are likely to be dominated by more information- and opinion-sharing efforts than information- and opinion-seeking ones (RQ6). As individuals are likely to engage in information seeking regarding health issues about which they desire more knowledge,28 it is possible that our coding of tweets captured mostly content from users who had already sought information about the outbreak before posting tweets.

Future research may seek to examine how users seek information on Twitter, as it is an important source of public health information, including content about vaccinations.29 Last, findings from our study show evidence of some aspects following a distancing, blame, stigma pattern.30 Some tweets conveyed information that the hepatitis A outbreak was largely confined to individuals experiencing homelessness, and although not true ofall tweets in our sample discussing the individuals experiencing homelessness in San Diego, a portion of tweets referred to this population in derogatory ways in the context of the hepatitis A outbreak.

Limitations

This study contains some limitations. Our sample was not representative of the entire population of tweets about the hepatitis A outbreak during the specified time frame of our study; we examined content only about HAV from Twitter, and we could not draw inferences related to content flow on Twitter or elsewhere or of the offline effects of these tweets. We also could not draw inferences about the potential impact ofmessages offline or attributes of messages that would increase their online reach (e.g., liking, retweeting, mentions), an area ripe for future research. However, we can get a sense of the range of diverse topics, level of public awareness, and early stirrings of misinformation on the issue of HAV. Such findings can help health authorities keep abreast of the information environment during a time-sensitive event and offer a method for detecting unfulfilled informational needs that can serve as a starting point for formative research guiding the design ofeffective messaging. Last, although the hepatitis A outbreak originated in the population experiencing homelessness, our data do not suggest which Twitter users in our sample may be homeless or whether they were obtaining information from Twitter. However, emerging evidence suggests that the use of these platforms among individuals experiencing homelessness may be especially common among youths.31

Public Health Implications

Results of this study may help inform policies or practices that increase services to the population experiencing homelessness and may help reduce the spread of hepatitis A by reconsidering the best way to reach the population most affected by this outbreak. Although our data included sources that were health authorities as well as sources that were individuals acting as advocates and organizations that work with the homeless community, it was not clear whether these sources were attempting to use Twitter to reach individuals experiencing homelessness directly in this context. This may be a missed opportunity, given that a portion of tweets coded under "specific HAV medical concerns" would be of great value if they were read by individuals experiencing homelessness.

By connecting themes and information sources, we saw that the fast-paced spread of a vaccine-preventable disease brought antivaccination argumentation to the forefront. Public health professionals may consider engaging with social media to address the public's risk perceptions and concerns as they arise in real time during an outbreak and tailoring responses that fulfill the informational needs of those who seek direction and reassurance during times of uncertainty. In addition, given the proportion of sources representing journalists and users articulating political viewpoints, it will be vital to ensure that sources in positions of power outside public health exercise care in the content they share about an epidemic and avoid spreading misinformation for commercial or political gain.

Last, public health agencies can use the results of this study to understand whom their messages are reaching, the concerns of these individuals regarding an outbreak, and their reaction to official public health recommendations. Because the containment of infectious disease outbreaks may depend on human behavior (e.g., getting vaccinated, handwashing), such factors can provide insight for how to best engage such individuals with necessary targeted public health messaging if compliance with public health recommendations begins to weaken among certain population groups.

Conclusions

Previous research has found that exposure to misinformation influences vaccine knowledge32 as well as perceptions of vaccine risk compared with perceived susceptibility to diseases that can be prevented by vaccines.33 Our findings illustrate the ongoing need to develop and refine approaches for advancing health-related misinformation surveillance. Such methods can help illuminate the nature and extent of health-related misinformation on social media and provide guidance on how and when public professionals may need to intervene and enact corrective action, issues particularly relevant during the current COVID-19 pandemic.

CONTRIBUTORS

E. Oren and L. Martinez conceptualized, updated, and developed the study design; drafted the article; and supported the creation of the study forms and tools. R. E. Hensley, P.Jain, T. Ahmed, andI. Purnajo contributedto data management and analysis. R. E. Hensley, P. Jain, A. Nara, and M-H. Tsou contributed to updating and developing the study design. P. Jain and T. Ahmed created study forms and tools. All authors contributed to writing the article and approved the final article.

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No protocol approval was necessary because no human participants were involved in this study.

Sidebar

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Document 13 of 61

Where We Go From Here: Health Misinformation on Social Media

Chou, Wen-Ying Sylvia, PhD, MPH; Gaysynsky, Anna, MPH; Cappella, Joseph N, PhD

ProQuest document link

ABSTRACT (ENGLISH)

Falsehoods have been shown to spread faster and farther than accurate information,1 and research suggests that misinformation can have negative effects in the real world, such as amplifying controversy about vaccines2 and propagating unproven cancer treatments.3 Health misinformation on social media, therefore, urgently requires greater action from those working in public health research and practice. ASSESS CONSEQUENCES OF MISINFORMATION Little evidence is available regarding the extent to which misinformation exposure online affects health-related behaviors, attitudes, knowledge, and outcomes at the individual or population level, or how exposure to misinformation intersects with existing health disparities.

FULL TEXT

Falsehoods have been shown to spread faster and farther than accurate information,1 and research suggests that misinformation can have negative effects in the real world, such as amplifying controversy about vaccines2 and propagating unproven cancer treatments.3 Health misinformation on social media, therefore, urgently requires greater action from those working in public health research and practice. We define "health misinformation" as any health-related claim of fact that is false based on current scientific consensus. Many other types of information pose a challenge for health communication, including contradictory or conflicting findings, changing evidence, and information that involves a high degree of uncertainty; however, these issues are outside the scope of this editorial, which focuses on information that is patently false.

Responding to misinformation is challenging for many reasons. For example, psychological factors, including emotions and cognitive biases, may render straightforward efforts to counter misinformation by providing accurate information ineffective. This may be why interventions, such as recommending articles with corrective information, have shown mixed efficacy.4 Another issue concerns the difficulty of identifying and reaching those who are exposed to misinformation. The diversity and volume of social media facilitate the creation and maintenance of information silos by making it easy for users to selfcurate their feeds and find similar content through automated algorithms. These features reduce the likelihood that individuals who are part of a group in which misinformation is circulating will be exposed to content that contradicts the prevailing view of their network.

As accumulating evidence indicates, in domains as varied as childhood vaccines and COVID-19, widespread health misinformation can have potentially devastating consequences, and responses need to be timely, strategic, and evidence based. We outline five understudied research areas that need to be addressed to improve policy and practice in response to health misinformation (Figure 1).

ENHANCE SURVEILLANCE

Much of the research conducted to date has relied on cross-sectional content analysis of social media data,5 and although these types of studies are important, the field needs to move toward a more comprehensive understanding ofthe social media misinformation environment. For example, many studies have focused on Twitter, but other popular platforms, such as WeChat, Tumblr, Reddit, and Pinterest, remain understudied. Additionally, research is needed to better understand nontextual content, including images, memes, and videos found on platforms such as Instagram, TikTok, and YouTube, taking advantage of computer-assisted visual analysis.

Surveillance efforts also need to account for the complex processes affecting diffusion by systematically exploring the spatial, temporal, network, and crossplatform dynamics of misinformation spread. This knowledge would help us identify critical platform, content, and network characteristics that enable or impede the dissemination of misinformation.

UNDERSTAND PSYCHOLOGICAL DRIVERS

We also need to draw on theoretical frameworks from political science, psychology, communication, and other social sciences to examine the role of emotion, cognition, and identity in relation to misinformation and use this knowledge to inform interventions. For example, the human tendency toward confirmation bias may render debunking efforts ineffective, as corrective information may be viewed as inconsistent with a preferred narrative and therefore ignored or denied. In situations in which a strong confirmation bias exists, interventions based on value affirmation might be more effective.

Similarly, although the impact of emotion on misinformation processing has been studied in the context ofpolitics,6 less is known about the role emotions play when it comes to health misinformation-even though health topics can generate strong emotions, including fear and anxiety. A deeper understanding of the psycho-socio-emotional drivers of misinformation acceptance and sharing, and how they differ across various domains (e.g., political vs health information), will be crucial for designing successful interventions.

ASSESS CONSEQUENCES OF MISINFORMATION

Little evidence is available regarding the extent to which misinformation exposure online affects health-related behaviors, attitudes, knowledge, and outcomes at the individual or population level, or how exposure to misinformation intersects with existing health disparities.

Moreover, misinformation may have additional consequences that-although difficult to observe-are equally insidious. For example, misinformation could create the impression that no consensus exists on a topic or that official sources of information are not credible, which could generate feelings ofapathy, confusion, and mistrust. This could then lead individuals to disengage from health information seeking, avoid health care, or make decisions that are detrimental to their health. Although there are challenges to linking online activity with offline behavior, theoretically informed empirical research is needed to elucidate the full extent of the real-world consequences of misinformation exposure.

FOCUS ON THE MOST VULNERABLE

Research indicates that most people are susceptible to misinformation in some contexts and that typical sociodemographic predictors of health disparities may not govern vulnerability to misinformation. For instance, highly educated individuals may be equally vulnerable to misinformation when it comes to topics that are central to their identity.7 Identifying factors that may increase susceptibility to misinformation (e.g., conspiracy mindset, lack of access to evidence-based health information) would enable better targeting of resources and better tailoring of strategies.

Once we identify who is most vulnerable, methods for strategically intervening with these groups will be needed. For example, interventions could use sources of information that are deemed credible by a particular vulnerable community to increase the likelihood of message acceptance. Research is also needed to understand whether interventions should target the most influential individuals in these vulnerable groups or focus on those who might be less integrated into the group and still amenable to change.

DEVELOP AND TEST EFFECTIVE RESPONSES

An approach centered on simply providing evidence-based health messages or broadly debunking misinformation will likely be insufficient. Interdisciplinary research is needed to develop additional strategies and identify the optimal timing, manner, and forum for responding to misinformation. Although a reactive response will be effective in one situation, a proactive response (such as inoculation) may be vital in a different context. It is also possible that the best response is no response at all, for example, if acknowledging the falsehood in a correction would only "give it oxygen" and further its spread.

Additionally, targeted approaches for reaching misinformed individuals with corrective information are needed. Public health practitioners and health care providers could attempt to identify and penetrate online information silos where misinformation is rampant to offer evidence-based information, direct users to credible sources, or provide countermessaging.

Finally, system-level preventive efforts are also needed, such as legislation requiring social media platforms to remove potentially harmful misinformation or incentives to increase their adoption ofpractices that make it more difficult for users to find and share misinformation. Increasing the public's health, science, and media literacy to decrease vulnerability to misinformation is another important prevention strategy. Such efforts could raise awareness of the techniques (e.g., cherry-picking data) used by agents of misinformation and increase the public's understanding of the inherent uncertainty and complexity of health and science information to induce a healthy skepticism toward claims that are overly simplistic or sensational.

USING RESEARCH TO INFORM POLICY AND PRACTICE

The research priorities we have outlined should inform and improve policy and practice aimed at addressing health misinformation on social media, such as content moderation standards used by platforms and rumor mitigation efforts undertaken by public health agencies. As these policies and interventions are implemented, further research will be needed to evaluate their impact. >4jPI-l

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CONFLICTS OF INTEREST

The authors have no conflicts ofinterest to disclose.

Sidebar

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DETAILS

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Document 14 of 61

Limited Role of Bots in Spreading Vaccine-Critical Information Among Active Twitter Users in the United States: 2017–2019

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ABSTRACT (ENGLISH)

Objectives. To examine the role that bots play in spreading vaccine information on Twitter by measuring exposure and engagement among active users from the United States. Methods. We sampled 53 188 US Twitter users and examined who they follow and retweet across 21 million vaccine-related tweets (January 12, 2017-December 3, 2019). Our analyses compared bots to human-operated accounts and vaccine-critical tweets to other vaccine-related tweets. Results. The median number of potential exposures to vaccine-related tweets per user was 757 (interquartile range [IQR] = 168-4435), of which 27 (IQR = 6-169) were vaccine critical, and 0 (IQR = 0-12) originated from bots. We found that 36.7% of users retweeted vaccine-related content, 4.5% retweeted vaccine-critical content, and 2.1% retweeted vaccine content from bots. Compared with other users, the 5.8% for whom vaccine-critical tweets made up most exposures more often retweeted vaccine content (62.9%; odds ratio [OR] = 2.9; 95% confidence interval [CI] = 2.7, 3.1), vaccine-critical content (35.0%;OR= 19.0; 95% CI = 17.3, 20.9), and bots (8.8%;OR = 5.4;95% CI = 4.7, 6.3). Conclusions. A small proportion of vaccine-critical information that reaches active US Twitter users comes from bots. (Am J Public Health. 2020;110:S319-S325. https://doi. org/10.2105/AJPH.2020.305902)

FULL TEXT

Headnote

Objectives. To examine the role that bots play in spreading vaccine information on Twitter by measuring exposure and engagement among active users from the United States.

Methods. We sampled 53 188 US Twitter users and examined who they follow and retweet across 21 million vaccine-related tweets (January 12, 2017-December 3, 2019). Our analyses compared bots to human-operated accounts and vaccine-critical tweets to other vaccine-related tweets.

Results. The median number of potential exposures to vaccine-related tweets per user was 757 (interquartile range [IQR] = 168-4435), of which 27 (IQR = 6-169) were vaccine critical, and 0 (IQR = 0-12) originated from bots. We found that 36.7% of users retweeted vaccine-related content, 4.5% retweeted vaccine-critical content, and 2.1% retweeted vaccine content from bots. Compared with other users, the 5.8% for whom vaccine-critical tweets made up most exposures more often retweeted vaccine content (62.9%; odds ratio [OR] = 2.9; 95% confidence interval [CI] = 2.7, 3.1), vaccine-critical content (35.0%;OR= 19.0; 95% CI = 17.3, 20.9), and bots (8.8%;OR = 5.4;95% CI = 4.7, 6.3).

Conclusions. A small proportion of vaccine-critical information that reaches active US Twitter users comes from bots. (Am J Public Health. 2020;110:S319-S325. https://doi. org/10.2105/AJPH.2020.305902)

Vaccine misinformation-false information not supported by evidence-is believed to be common on social media,1 but much less is known about whether it is commonly encountered and who encounters it. Not all vaccine-critical content posted on social media is misinformation, but misinformation is common in vaccine-critical content.2 Misinformation can undermine confidence in vaccination and encourage hesitancy and refusal,3 which then may influence the number and severity of infectious disease outbreaks.4,5 The potential for misinformation to spread via social media platforms is a pressing question for governments and global agencies.

Information epidemics and the potential impact of poor-quality health information online have been discussed for more than 20 years.6 To understand the effect of misinformation on health behaviors and outcomes, we need to go beyond characterizing misinformation and measuring how quickly it spreads7,8 to measure the composition of what people are exposed to and engage with online. Information exposure is related to the concept of exposure in individual psychology studies on misinformation, and measures of information engagement are related to the concepts of salience of misinformation and how people choose to express their vaccine attitudes online.9 Because of its openness, Twitter is a convenient platform for estimating information exposure and engagement, but it has limitations. Potential exposure can be measured by observing social network structure, and engagement can be partially measured by observing how users pass on misinformation as retweets.

The Twitter information ecosystem is a complex mix of human and nonhuman actors posting or engaging with information for a range of purposes. Software agents (bots) that post on social media are an important type of nonhuman actor. Although there is evidence of their involvement in vaccination discourse and more broadly in public health on social media platforms,10-12 estimates of the size of their presence and their potential impact vary considerably. On Twitter, bots are accounts that are operated automatically to post, retweet, or reply and may vary in sophistication from simply reposting links to certain (often malicious) Web pages to more sophisticated masquerading of humans aiming to alter the discourse of a topic. A 2017 study estimated that between 9% and 15% of Twitter accounts are bots.13

A study that characterized vaccine-related tweets posted by trolls and bots on Twitter suggested that trolls and bots affect vaccine discourse10 but did not measure whether people ever saw or engaged with those tweets. Related research examining the potential effect of bots and fake news in politics suggested that bots play a minor role in potential influence, with humans more often responsible for spreading misinformation than bots.8,14

Despite the number of studies characterizing vaccine-related content on social media, none have provided reliable estimates ofhow often human social media users see or engage with bots on the topic. We sought to measure exposure to and engagement with vaccine information among active Twitter users in the United States and examine the role that bots might play in spreading vaccine-critical information on the platform.

METHODS

We collected all tweets matching a set of vaccine-related keywords and posted by any Twitter account between January 12, 2017, and December 3, 2019. We labeled tweets as vaccine critical or otherwise by training a machine-learning classifier, and we identified bots among the accounts posting vaccine-related tweets. Although tweets expressing a negative opinion of vaccination are not necessarily misinformation, much of the vaccine-critical content available online is either inaccurate or makes claims unsupported by evidence.2

In parallel, we monitored a sample of active, human-operated Twitter accounts from the United States (users) to track potential exposure and engagement with vaccine-related content. Information exposure is challenging to measure at scale, so we used information about the accounts the users follow as a proxy. Similarly, engagement is multifaceted and could be defined by views, interactions, replies, retweets, quoting, or other actions, and we measured retweets under the assumption that they most closely relate to active engagement.

Study Population

First, we sampled a set of Twitter users from the United States, requiring that these users be well established and active. We sampled accounts ofpeople who had recently posted any tweet and used a heuristic based on previous studies examining users over time to target active and established users via checks on the number of followers, rate of posting, and proportion of retweets (Appendix, section 2 [available as a supplement to the online version of this article at http://www.ajph.org]). A gazetteer, Nominatim (Appendix, section 3), then parsed accounts we judged to be active and well-established human users to infer a home location, and we included those that were in the United States in the analysis.

Vaccine-Related Tweets and Accounts Posting Them

We captured vaccine-related tweets posted by any public Twitter account via continuous keyword filtered requests to Twitter servers. Keywords included all reasonable synonyms and variants for words related to vaccines, vaccination, and immunization (Appendix, section 1). We have previously experimented with coverage ofthis approach and are confident that it covers all public tweets and retweets that match these keywords relative to the current best practice for Twitter surveillance in public health applications.15

We identified bots using Botometer,16 an established and validated method for identifying Twitter accounts likely to be bots (Appendix, section 4.1). Because of daily limits on the service, we collected these intermittently after accounts first posted a vaccine-related tweet during the study period. Bot scores vary between 0 and 1, where scores closer to 1 indicate a higher likelihood that a user is a bot. The typical approach used to identify bots among a population of Twitter accounts is to use a simple threshold, where any account with a score of 0.5 or higher is labeled as a bot.8,13,17

We used a supervised machine-learning method to identify vaccine-critical tweets. We created training data with help from Amazon Mechanical Turk workers, who were asked to label tweets based on whether they were vaccine critical. We sampled 10 000 vaccine-related tweets from 10 000 distinct accounts from the complete set of vaccine-related tweets, and we used labels from multiple workers to train a classifier (Appendix, section 4.2). We then applied the best-performing classifier to all vaccinerelated tweets to label them as vaccine critical or otherwise.

Analysis of Exposure and Engagement

We measured exposure based on the Twitter accounts that users followed. We collected lists of such accounts once per user after we first sampled each user. We counted any vaccine-related tweet or retweet posted by an account that a user was following as a potential exposure. We counted any vaccine-related tweet posted during the study period as a potential exposure if the user followed the account at the time the information was collected.

We measured engagement by identifying vaccine-related tweets that were retweeted by users. We looked for the users' identifiers in the set of 21 million vaccine-related tweets and retweets (Appendix, section 1).

In our primary analysis, we focused on descriptive characterizations of the frequency and distribution ofexposures and engagements for bots relative to human-operated accounts and for vaccine-critical relative to other vaccine-related tweets. Because we did not attempt to infer the demographics of the randomly sampled users, we were unable to measure or adjust for demographic differences.

We conducted a post hoc analysis of the set of users for whom potential exposures to vaccine-critical tweets were at least half of the total number of potential exposures to vaccine-related tweets. For this subgroup of users, we compared engagement with bots and vaccine-critical tweets against their counterpart users for whom vaccine-critical tweets made up less than half of their exposures. Differences are reported as unadjusted odds ratios (ORs) with 95% confidence intervals (CIs).

RESULTS

The study included 53 188 Twitter users in the United States, who we sampled independently from whether they were exposed to or shared vaccine-related content (Figure 1). These users were distributed across the United States; the most common user locations were California (12.3%), New York (9.2%), and Texas (9.1%; Appendix, section 3). Ofthe 5 124 906 scored accounts tweeting or retweeting about vaccines during the study period, 2 121 315 accounts were followed by 1 or more of the 53 188 users.

Potential Exposure to Bots and Vaccine-Critical Tweets

In terms of the frequency of potential exposures, we found that users were potentially exposed toa median of 757 (interquartile range [IQR] = 168-4435) vaccine-related tweets, a median of 27 vaccine-critical tweets (IQR = 6-169), and a median of 0 vaccine-related tweets from bots (IQR = 0-12). The results indicate that for most users, exposure to vaccine-critical content was relatively infrequent and that exposure to bots was extremely infrequent (Figure 2).

Exposure to bots was rare and unevenly distributed across users (Figure 2); 42.0% of users may have been exposed at least once to a vaccine-related tweet originally posted by a bot, because either they followed a bot account that posted a vaccine-related tweet or an account they followed retweeted a vaccine-related tweet posted by a bot account. However, posts from bots made up a small percentage of vaccine-related exposures; the median percentage of exposures originating from bots was 0.0% (IQR = 0.0%-0.5%). Bot accounts were responsible for at least half of the potential exposures to vaccine-related tweets for less than 0.06% of users.

Exposure to vaccine-critical tweets was also relatively rare and unevenly distributed across users (Figure 2). As a proportion of exposures, vaccine-critical tweets made up a median of 3.2% (IQR = 1.4%-9.2%) of all vaccine-related exposures. Vaccine-critical tweets made up at least halfofvaccine-related exposures for 5.8% of users. The results indicate that although most users may have seen a vaccine-critical tweet, only 1 in 20 users were more often exposed to vaccine-critical content than other vaccine-related content.

Engagement With Bot Accounts and Vaccine-Critical Content

When counting the retweets of any vaccine-related tweets and the posting ofany original vaccine-related tweets together, we found that the median number oftimes a user posted or retweeted about vaccines was 0 (IQR = 0-2) and that 36.7% of users posted or retweeted vaccine-related content at least once during the period. Few users actively engaged with vaccine-related tweets; 1.9% of users engaged with vaccine-related tweets at least once per month on average.

Retweeting bots was uncommon. Just 2.1% of users retweeted a bot at least once during the study period, compared with 27.1% of users who retweeted vaccine-related tweets from human-operated accounts at least once (Figure 3).

Retweeting vaccine-critical content was relatively uncommon. Just 4.5% of users retweeted a vaccine-critical tweet at least once, compared with 26.2% of users who retweeted other vaccine-related tweets at least once (Figure 3).

Engagement with bots and vaccine-critical tweets was unevenly distributed across users (Figure 3). For 2.6% of users, vaccine-critical tweets made up at least half of their vaccinerelated retweets during the study period. Bots made up at least half of the set of vaccine-related retweets for just 0.4% of users.

Users Disproportionately Exposed to Vaccine-Critical Tweets

We further analyzed the 5.8% of users for whom at least half of their potential exposures to vaccine-related content were vaccine-critical tweets. The median potential exposure count among the 3086 users was 30 709 (IQR= 8795-65 091) compared with 750 (IQR = 195-3698) for other users, indicating that users in this subgroup were more often exposed to any type of vaccine-related tweets than their counterparts. The median percentage of exposures to bots among the 3086 users was 6.2% (IQR = 2.2%-9.1%) compared with 0.0% (IQR = 0.0%-0.4%) among other users, indicating that bots made up a greater proportion of what these users may have seen.

Users from this subgroup were more likely to engage with vaccine-related posts in general, suggesting that they were more engaged with vaccines and vaccinations as a topic. In this subgroup, 62.9% (1940 of3086) retweeted vaccine-related content at least once in the study period compared with 36.9% (17 553 of 47 513) of other users (OR = 2.9; 95% CI = 2.7, 3.1). The median number of posts or retweets among the subpopulation was 2 (IQR = 0-6), compared with 0 (IQR = 0-2) from other users.

Users from this subgroup were also more likely to retweet bots and vaccine-critical content than were other users. The percentage of users from this subgroup who retweeted bots at least once was 8.8% (271 of 3081) compared with 1.7% (825 of47 513) of other users (OR = 5.4; 95% CI = 4.7, 6.3). The percentage of users from this subgroup who retweeted vaccine-critical tweets at least once was 35.0% (1081 of 3086) compared with 2.8% (1310 of 47 513) of other users (OR = 19.0; 95% CI = 17.3, 20.9).

These results show that 5.8% of Twitter users in the United States are embedded in communities where exposure to vaccinecritical content is common. These users differ from other Twitter users in the United States in that they tend to engage with the topic more often and are more likely to share vaccine-critical content. Although they are also more likely to share content from bots than other users, bots still accounted for a small proportion ofwhat they read or shared.

DISCUSSION

Twitter users in the United States were frequently exposed to information about vaccines between January 12, 2017, and December 3, 2019. More than a third ofusers also engaged in discussion about the topic by posting or retweeting vaccine information, but this engagement was relatively infrequent for most users. Engagement with any vaccine-related tweets, vaccine-critical tweets, and bots was higher in the 5.8% of users who were embedded in communities where vaccine-critical content was common. The overwhelming majority of the vaccine-related content seen by typical users in the United States is generated by human-operated accounts, not bots. The results show that bots play little to no role in shaping vaccine discourse among Twitter users in the United States.

Comparison With Existing Literature

Consistent with other literature in the area, we found that a small proportion of Twitter users were embedded in communities where vaccine-critical content was shared more than other vaccine content. Compared with other users, these users were more likely to have posted or retweeted about vaccines, and more of the vaccinerelated tweets they posted were vaccine critical. These results indicate that engagement with vaccine-critical information is concentrated in certain communities. This is consistent with the findings of studies examining community structure and information exposure in human papillomavirus vaccines on Twitter,18 20 studies of news media coverage of vaccinations,21 and studies on exposure to and engagement with political fake news.14 Although this study is not directly comparable with studies that characterize vaccine-related posts from bots and trolls,10 our results suggest that conclusions drawn about the importance ofbots in shaping the discourse on social media may be overstated. We found that Twitter users in the United States rarely share vaccine-related content posted by bots. A 2017 study examined follower relationships between human users and bots on Twitter, estimating that between 9% and 15% of accounts are bots, that human users mostly form connections with other human users, and that there is little reciprocity (humans following bot accounts that follow them).13 Although we measured engagement in a more direct way, our results are generally consistent with these findings. Another study examining the spread of low-credibility content suggests that human users retweet articles posted by bots almost as much as they retweet other humans, although it appears that what drives amplification is the volume of retweets the content has regardless of the provenance of those retweets.17 This highlights the importance of estimating exposure and engagement in populations of information consumers rather than speculating about impact by counting posts.

Limitations

The tool we used to detect bot accounts may be imperfect, and some users may have been misclassified. However, we used a standard threshold common to previous studies that show the tool rarely misclassifies accounts.13,16,17 Some bots may have been deleted or suspended after posting about vaccines and before we could capture their bot score. Of the 5.28 million accounts posting about vaccines, we did not score 0.1 million accounts (2.4%) because they became unavailable in the period between identifying the account and checking its score. It is possible that a greater proportion of those accounts were bots compared with the accounts that were included in the analysis. Given the number, this difference could not have affected the conclusions.

We did not investigate the full complexity of the information landscape on Twitter. For example, we cannot draw any conclusions about trolls-human-operated Twitter accounts that use a range of approaches to gain followers and may post misinformation. New studies would benefit from measuring the potential effect of trolls via exposure and engagement with trolls in a robust sample of human users.

Our method for detecting vaccine-critical tweets had a high accuracy but was imperfect, which means that we likely misclassified a small proportion of posts. However, because the classifier was designed to maximize recall over precision (Appendix), we were more likely to overestimate than underestimate the number of vaccine-critical tweets. Measures of potential exposure are approximations based on the structure of the follower network and do not capture changes to the algorithms that Twitter uses to deliver posts to users; therefore, including advertising and recent changes that present tweets from accounts that users do not follow may make potential exposure estimates less reliable. Estimates of potential exposure may have also been affected by an inability to continually update information about who users follow on Twitter. It was only feasible to collect information about who the users followed after they were identified, and users are likely to have followed or unfollowed other users during the study period. However, users are still much more likely to be exposed to tweets ofthe accounts they follow, so the measure of potential exposure is likely to be a reasonable proxy for information consumption.

Public Health Implications

Our results have implications for public health practice and can be used to inform approaches for addressing vaccine misinformation.7,22 Two proposed approaches are (1) tools to help social media platforms identify misinformation (a precursor to removing, hiding, or algorithmically reducing exposure), and (2) interventions designed to empower users to critically appraise the information they see.7 Critical appraisal skills necessary to distinguish between credible information and misinformation vary,23 and tools that could be used to support the critical consumption of vaccine-related information might offer insights into the techniques and topics used in antivaccine arguments.24,25 Our results suggest that allocating resources to eliminating bots may be less effective than providing tools to improve media literacy and developing personalized communications interventions targeted at communities where vaccine-critical content is most common.26 Strategies that focus on limiting the impact of influential accounts spreading misinformation are warranted-an approach aligned with how public health organizations make decisions about how and when to engage with vaccine-critical content.27

Our analysis also has implications for research practice and reporting. Beyond counting and characterizing the content posted on social media platforms, it is important to consider that not all posts have the same effect. Posts vary in terms of reach and engagement, and phenomena such as echo chambers mean that certain content is shared and consumed mostly in specific communities of often like-minded people. Measuring and separating out the mechanisms ofhomophily, contagion, and external drivers of network dynamics require studies that involve social media users as participants.

How those messages influence vaccination uptake requires them to be considered in the broader context of how vaccination decisions are made. Although experimental studies of the direct impact of vaccination messages online show a capacity to change beliefs and intentions temporarily,30 studies that involve people who choose not to vaccinate their children indicate that core beliefs about health and parenting experiences in the health care system are central.31,32 Given that lack of vaccination tends to be clustered, it is likely that social network structures play a role in the process.

Further studies are needed to better understand the gaps between what can be observed about people online and the decisions they make about vaccination offline. Despite some early examples across several social media platforms,33-35 social media research rarely connects measures of information expression or exposure from social media data to individual attitudes and behaviors measured by surveys or using medical records. We recommend further studies that can reconcile the link between online and offline behavior to improve the translation of social media research.

Conclusions

Active Twitter users in the United States are frequently exposed to vaccine-related content, but most users never or infrequently engage. For nearly all users, bots are responsible for a small proportion of the vaccine-related content users see, and engagement with bots is negligible. Exposure to and engagement with vaccine-critical content tend to be most heavily concentrated in a relatively small subgroup ofusers who are more engaged with the topic overall. Researchers studying health information consumption should consider measuring exposure and sharing in representative populations to better understand the potential effect of what is being posted. Rather than focusing efforts on bots, social media platforms, policymakers, and public health agencies should continue to focus on the known factors influencing vaccinationrelated behaviors. /4JPI-I

CONTRIBUTORS

A. G. Dunn, J. Leask, E. Coiera, A. Dey, and K. D. Mandl conceptualized and designed the study. A. G. Dunn, D. Surian, J. Dalmazzo, and D. Rezazadegan collected, processed, and analyzed the data. A. G. Dunn, M. Steffens, and A. Dyda interpreted the data. All authors drafted the article, provided critical revisions, and finalized the article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

Human ethics approval for the research was granted by Macquarie University (52019614312780).

Sidebar

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Document 15 of 61

A Prologue to the Special Issue:Health Misinformation on Social Media

Chou, Wen-Ying Sylvia, PhD, MPH; Gaysynsky, Anna, MPH

ProQuest document link

FULL TEXT

This National Cancer Institute-sponsored special issue of the AJPH reflects the growing consensus among national health agencies, public health researchers, and practitioners that online health misinformation, particularly on social media (SM) platforms, presents a critical challenge for public health. The spread ofmisinformation threatens to erode much of the progress that has been made on many fronts, including vaccination, tobacco use, and control of infectious diseases.

This special issue came about in recognition of several key trends that have emerged over the past decade, including (1) Americans are increasingly getting their news and health information from SM; (2) the public's trust in traditional sources ofinformation (e.g., mass media, government agencies, the medical system) is at historic lows; and (3) the online discourse, from politics to health, has become increasingly divisive and partisan. These factors provide a fertile environment where health misinformation can take root and spread, and the potential real-world consequences are alarming. For example, antivaccine views promoted on SM could lead to avoidance of routine vaccinations and community spread of disease, and videos advertising ineffective or dangerous cancer treatments could lead patients to forgo recommended therapies.

Reacting to these trends, we began planning this special issue in 2019. However, shortly after the article submission deadline passed, the world experienced the defining health crisis of our generation-the COVID-19 pandemic-and we witnessed in real time how the proliferation of misinformation hindered pandemic response. Rumors, myths, and conspiracy theories regarding the origins of the disease, its severity and prevalence, vaccine development, prevention measures, and unproven treatments spread online at alarming speed.

The consequences of endorsing such misinformation can be disastrous: the belief that the pandemic is overblown can make people less willing to comply with social-distancing measures and mask requirements, mistrust in vaccine experts can impede vaccination programs' ability to achieve sufficient coverage, and the use of unproven treatments can cause serious injury or even death. The onslaught of misinformation about COVID-19 grabbed news headlines and became a key theme in both public and private discourse during the pandemic, engendering a wider recognition ofthe urgent need to better understand, and more effectively respond to, health misinformation. The contributions in this special issue are, therefore, especially timely.

Our initial call for proposals attracted more than 140 submissions, demonstrating the field's readiness to tackle the challenge of health misinformation. After two rounds of competitive reviews, we selected the articles for publication based on rigor, public health relevance, and diversity of topics and methods. The issue therefore covers a wide array of health topics, including vaccines (Dunn et al., p. S319; Bonnevie et al., p. S326; Jamison et al., p. S331; Broniatowski et al., p. S312; Guidry et al., p. S305), cancer prevention and treatment (Wilner and Holton, p. S300; Zenone et al., p. S294), and infectious disease outbreaks (hepatitis A in Oren et al., p. S348; Zika in Safarnejad et al., p. S340).

The issue also features research across a diverse set of SM platforms. Although most articles examined Twitter (Dunn et al.; Bonnevie et al.; Jamison et al.; Oren et al.; Safarnejad et al.) and Facebook (Broniatowski et al.), a few focused on understudied platforms such as Pinterest (Guidry et al.; Wilner and Holton) and GoFundMe (Zenone et al.).

The articles in this issue also showcase a wide range ofresearch methods, including machine learning and natural language processing (Bonnevie et al.; Dunn et al.; Jamison et al.; Broniatowski et al.), content analysis (Guidry et al.; Wilner and Holton; Oren et al.; Zenone et al.), and network analysis (Safarnejad et al.). These contributions provide an informative set of rigorous and replicable approaches to understanding and responding to misinformation.

More important than the diversity of topics and methods are the practical lessons these studies offer the field of public health. Analyses ofSM content can yield useful findings, for example, in tackling vaccine misinformation. Dunn et al. show that vaccine misinformation on Twitter is not primarily driven by bot activity- suggesting that focusing on specific communities where vaccine misinformation is circulating might be more effective than targeting bot accounts. Bonnevie et al. show that the types of misinformation that vaccine opponents spread are quite limited and that the sources of misinformation are not heterogeneous or distributed; therefore, identifying and countering a small set of arguments and highly influential accounts could be an efficient way to address vaccine misinformation.

The methodology developed by Jamison et al. could be used to help identify prominent themes in SM vaccine discourse and develop counterarguments against misinformation. The longitudinal analysis of antivaccine Facebook pages in Broniatowski et al. points to one such theme: the "freedom of choice" framing of vaccine decisions. The increased focus on civil liberties since 2015 suggests that attempts to counter vaccine misinformation will need to address political arguments, rather than solely providing facts about vaccine safety and efficacy.

Notably, public health practitioners are not the only ones dealing with health misinformation, and the actions of other players, such as SM platforms, need to be studied. Evaluating the impact of Pinterest's 2019 vaccine content moderation policy, Guidry et al. show that although it successfully reduced human papillomavirus vaccine misinformation in search results, it also reduced the amount of human papillomavirus vaccine-related content overall, potentially creating an information vacuum. As SM sites enact new policies, public health organizations and health care providers should be ready to fill any information gaps resulting from these changes. It is not enough to simply remove misinformation; we must ensure that accurate information is widely accessible on these platforms.

Another limitation of SM companies' actions is that they tend to be reactive and focus on the particular topics receiving attention at a given moment, rather than tackling misinformation in a holistic manner. Although Pinterest took action to address vaccine misinformation, the study by Wilner and Holton shows that misinformation about breast cancer is also a significant issue on the platform. These authors found that many pins about breast cancer prevention or treatment contain misinformation, including claims about foods that allegedly prevent or treat cancer, references to unsubstantiated cancer risk factors, and statements downplaying the accuracy and safety of mammograms. However, the subtlety of the misinformation identified (e.g., most claims were exaggerated rather than patently false, inaccurate information was often conveyed through images instead of text) highlights why falsehood detection and content moderation efforts can be challenging.

Zenone et al. also confront a complex case of cancer-related misinformation in their examination of the way cannabidiol is portrayed in fundraising campaigns on GoFundMe. Most campaigns were found to misleadingly present cannabidiol as curative or life prolonging, with many relying on anecdotal evidence to support these claims. The hype and misperception surrounding cannabidiol underscores the need to investigate the realworld harms of misinformation, especially when the evidence base on a topic is not well established. Furthermore, the study demonstrates the need to expand research beyond prominent platforms, as misinformation can also proliferate on SM platforms that are not primarily considered informationdissemination channels.

The last research articles offer timely case studies on two previous disease outbreaks, with lessons for the COVID-19 pandemic. Oren et al. demonstrate the feasibility and utility of studying tweets to understand the community response to a hepatitis A outbreak. Key themes identified-including risk perception (e.g., susceptibility to and severity of infection), criticisms of the government's response, and stigma against the population perceived to be the source of the outbreak-all have echoes in the current discourse on COVID19. The authors also point to missed opportunities for health organizations to use SM to engage in dialogue with affected communities, rather than using these platforms to simply broadcast information.

Safarnejad et al. analyzed tweets related to the 2015 to 2016 Zika outbreak, finding distinctly different dissemination network structures between misinformation and accurate information. This study highlights the need to go beyond crosssectional content analysis to track how misinformation spreads. It also points to a central challenge in outbreak communication: the evolving nature of the evidence base makes it difficult to identify and counteract misinformation in real time.

As a complement to the empirical research articles, we also solicited commentaries and editorials focusing on critical gaps and priorities in health misinformation research and practice. To begin, Chou et al. (p. S273) outline five priority areas for future research:

1. enhancing misinformation surveillance,
2. understanding the psychological drivers of misinformation endorsement and sharing,
3. identifying real-world consequences of misinformation,
4. intervening with those who are most vulnerable to misinformation and its consequences, and
5. developing and testing effective responses to misinformation.

Scherer and Pennycook (p. S276), Vraga and Bode (p. S278), and Tan and Bigman (p. S281) further expand on some of these priority areas. Scherer and Pennycook present three theoretical perspectives that may explain what makes certain people more susceptible to misinformation and suggest additional factors (such as trust) to be further explored. Vraga and Bode summarize best practices for "observational correction" online-a potentially effective approach that can be scaled up by engaging the public, experts, and SM platforms. Tan and Bigman explore avenues for misinformation research in the context oftobacco control, highlighting the need to enhance misinformation surveillance of new tobacco products; assess the impact of exposure to online tobacco misinformation, especially among vulnerable populations; and develop interventions for tobacco disparity populations.

The final set of editorials offers concrete recommendations for those on the front lines of public health. Southwell et al. (p. S288) highlight the critical role of health care providers, encouraging them to proactively combat misinformation by monitoring the information environment, listening to patients, and helping patients gain a better understanding of medical evidence. Donovan (p. S286) offers recommendations for public health communicators seeking to provide timely, relevant, and local information on COVID-19 and other health issues, including monitoring rumors that are gaining traction, building stronger relationships with journalists, and using channels other than SM (e.g., text messaging) to communicate critical health information.

Vanderpool et al. (p. S284) discuss the need to leverage the attention paid to COVID-19 vaccines to tackle vaccine hesitancy more broadly, advocating efforts to enhance vaccine literacy and improve communication efforts by taking into account people's values as well as the cognitive, emotional, sociocultural, and contextual factors associated with vaccine hesitancy. Finally, Susser (p. S290), an ethicist, cautions the field against adopting the tools that have proven effective for spreading misinformation (e.g., microtargeting) to disseminate evidence-based health information, noting the need to weigh the potential effectiveness of digital influence tools against the risks they raise, such as violations of privacy, disregard for personal autonomy, perpetuation of bias, and lack of transparency and accountability.

In summary, as our knowledge of the (mis)information ecosystem grows, we will need to reexamine traditional health communication theories, standard research designs, and ongoing public health practices. It would be naive to assume that delivering accurate health information earnestly using existing tools, channels, and guidance will be effective. It is time to boldly explore innovative, adaptive, and alternative approaches to both disseminating evidence-based information and mitigating the impact of misinformation. With COVID-19 continuing to cause global suffering and disruptions, understanding and combatting health misinformation is one of the most urgent public health priorities of our time. Á¡PU

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CONFLICTS OF INTEREST

The authors have no conflicts ofinterest to disclose.

Sidebar

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Note. The opinions expressed by the authors are their own, and this material should not be interpreted as representing the official viewpoint of the US Department of Health and Human Services, the National Institutes ofHealth, or the National Cancer Institute.

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Document 16 of 61

Breast Cancer Prevention and Treatment: Misinformation on Pinterest, 2018

Wilner, Tamar, MA; Holton, Avery, PhD

ProQuest document link

ABSTRACT (ENGLISH)

Objectives. To quantify and describe the incidence of misinformation about breast cancer on the social media platform Pinterest, a leading source of women's health (e.g., breast cancer) information. Methods. We performed a hand-coded content analysis on 797 Pinterest posts ("pins") mentioning the terms "breast cancer" or "breast" and "cancer," collected in November 2018. Results. From the original sample of 797, 178 (22.3%) made a factual claim about what social media users could do to prevent or treat breast cancer. Of these, more than half-91 (51.1%)-contained misinformation. Therefore, 11.4% of the sample overall contained misinformation related to breast cancer prevention or treatment. Conclusions. Pinterest is a significant vector of misinformation about breast cancer, especially given the platform's overwhelmingly female composition and its visual means of conveying information. Public Health Implications. Health practitioners should be aware of the myths circulating about breast cancer prevention and treatment and be prepared both to dismantle misinformation and to stress reliable health guidance. Meanwhile, Pinterest may wish to widen the criteria it uses for identifying health misinformation on its platform. (Am J Public Health. 2020;110:S300-S304. https://doi.org/10.2105/AJPH.2020.305812)

FULL TEXT

Headnote

Objectives. To quantify and describe the incidence of misinformation about breast cancer on the social media platform Pinterest, a leading source of women's health (e.g., breast cancer) information.

Methods. We performed a hand-coded content analysis on 797 Pinterest posts ("pins") mentioning the terms "breast cancer" or "breast" and "cancer," collected in November 2018.

Results. From the original sample of 797, 178 (22.3%) made a factual claim about what social media users could do to prevent or treat breast cancer. Of these, more than half-91 (51.1%)-contained misinformation. Therefore, 11.4% of the sample overall contained misinformation related to breast cancer prevention or treatment.

Conclusions. Pinterest is a significant vector of misinformation about breast cancer, especially given the platform's overwhelmingly female composition and its visual means of conveying information.

Public Health Implications. Health practitioners should be aware of the myths circulating about breast cancer prevention and treatment and be prepared both to dismantle misinformation and to stress reliable health guidance. Meanwhile, Pinterest may wish to widen the criteria it uses for identifying health misinformation on its platform. (Am J Public Health. 2020;110:S300-S304. https://doi.org/10.2105/AJPH.2020.305812)

Health misinformation presents an increasingly complex problem in online and social media spaces.1 3 Misinformation can be defined as "false or inaccurate information regardless of intentional authorship."4(p282) Online misinformation about cancer is a particularly critical concern because the few extant studies suggest that such misinformation may be widespread.5 The presence of cancer-related misinformation online remains largely undocumented, however.6 Researchers have therefore called for more investigation of the frequency of inaccurate cancer information on social media.7

Breast cancer misinformation online is a particular phenomenon that warrants more analysis. Breast cancer is one of the most common cancers found in US women.8 Health misinformation about breast cancer is ofparticular concern on Pinterest. About 322 million people use Pinterest every month,9 and health and fitness content constitute its third-most-popular subject matter by followers perpin, after travel and education.10 The platform's user base is 70% female, and 42% of all US women use the site.11,12

Pinterest is also composed mostly of visuals. Each "pin," or piece of content, on Pinterest consists primarily of a graphic file. This poses a particular misinformation concern because, compared with text, visuals have greater positive effects on attention and recall.13 In addition, visuals are uniquely able to persuade.14

Among the few studies of misinformation on Pinterest, Guidry et al.15 found that of 800 vaccine-related pins, 74% were antivaccine. Guidry et al.16 found that pins about waterpipe smoking tended to portray the activity in a positive light. Tang and Park17 found that pins about nonmelanoma skin cancer tended to provide scant information about causes, prevention, and treatment.

CLASSIFYING MISINFORMATION

To understand misinformation posts about breast cancer, it is important to analyze sources, types of misinformation, phase, and the presence of conspiracy theories.

Sources

By investigating who the sources of misinformation are, we can attempt to shed light on the motivations of the actors involved, which could then help antimisinformation activists to know what countersteps might work.18

Misinformation Types

Wardle distinguishes 7 types of mis- and disinformation: satire or parody, false connection, misleading content, false context, imposter content, manipulated content, and fabricated content.18 The types are distinguished by some content characteristics but also by the motivations of the creator. We briefly employed this typology but found it to be problematic for several reasons. First, the typology is derived in large part from motivations of the content creator, which we felt we could not ascertain with certainty. Second, even based on content features alone, most of Wardle's misinformation types did not present themselves and thus did not seem relevant in this context. These include misleading content ("misleading use of information to frame an issue or individual") and imposter content ("when genuine sources are impersonated"). We pilot an alternative approach, outlined in Table B (available as a supplement to the online version of this article at http://www.ajph.org).

Phases

In addition, a study of cancer misinformation should seek to understand the "phase" under discussion: whether the information pertains to cancer prevention, cancer treatment, or both. While both forms of misinformation are potentially life-threatening, misinformation on treatment presents more short-term risks, such as people abandoning a more effective treatment for a less effective one.

Conspiracy Theories

Several studies suggest that conspiracy theories are a frequent aspect of health misinformation online.16 Conspiratorial thinking is especially resistant to correction,19 and belief in health-related conspiracies correlates negatively with desirable health behaviors.20 Conspiracy theories on cancer are widespread: a representative survey of US adults found that 37% believe the Food and Drug Administration is bowing to drug company pressure to cover up natural cancer cures.20 It is therefore important to examine the role of conspiracy thinking in breast cancer misinformation online.

PROBLEM STATEMENT

The prevalence, typology, content, and sourcing of misinformation about breast cancer on Pinterest remain understudied. In our current study, we sought to fill this gap with a content analysis of 797 systematically selected pins. We identified the frequency of misinformation within posts, the location of the misinformation within eachpost (i.e., text only, image only, both), the sources linked to by the posts, the types of misinformation used, the phase described, the content of misinformation (e.g., vitamins and minerals, food, mammograms), and the presence of conspiracy theories.

METHODS

We used the software program ParseHub (ParseHub, Toronto, ON, Canada) to search the terms "breast cancer" and "breast + cancer," on November 14, 15, and 16, 2018, fora total of6 searches. We then used ParseHub to automatically scrape links to the pins. We collected a sample of 838 pins, similar to previous research.15,16 This sample size was deemed large enough to perform the required statistical analyses (frequencies and %2s) while still being a manageable amount to code. We saved a screen capture of each pin. We found 41 of the links downloaded not to connect to extant pins, and we discarded these, leaving 797 pins for further analysis.

Codebook

We conducted coding in 2 phases, deductive and inductive. In the deductive phrase, we worked from a codebook presented as Table A (available as a supplement to the online version of this article at http://www.ajph.org). We used 1 variable within this codebook ("phase") to answer the research questions but also as a screener to determine which pins required further coding. This code captures whether each pin made a factual claim about what social media users could do to prevent or treat breast cancer. From the original sample of 797 pins, 178 (22.3%) met this criterion and were analyzed further. Excluded posts mostly consisted of inspirational messages and promotions for breast cancer-themed products. The further coding for the set of 178 posts included several codes based on Guidry et al.15 These were the type of Web site the pin linked to and conspiracy theory used in the post (if any). We considered a conspiracy theory to be a claim about breast cancer that invoked secrecy by powerful groups or individuals.

In addition, we created variables for the presence of misinformation in the image and in the text. We determined the presence of misinformation by comparing the content of the pins to reputable sources of information on breast cancer, including the Web sites of the Memorial Sloan Kettering Cancer Center (especially its guide to herbs and botanicals21), the World Cancer Research Fund (especially its guide to diet, nutrition, and physical activity22), the National Cancer Institute,23 BreastCancer.org, Susan G. Komen,24 and published academic papers. If a claim in the pin was shown to be false by evidence from 1 of these sites, we coded the text or image in question as containing misinformation. Only 1 false claim was required to code for misinformation, even if the text or image made several claims.

In the inductive content analysis phase, we employed a grounded, qualitative coding approach to discover common themes in the types and content of misinformation in the posts. The first author (T. W.) examined notes made during the deductive analysis and used this to derive a misinformation typology and a typology of topics (Table B).

Coder Training and Intercoder Reliability

Using a random number generator, 80 pins were selected for a pretest, in which both researchers coded. Acceptable Krippendorff alphas were achieved for all quantitative variables, as follows: 0.91 for phase, 0.88 for source, 0.82 forpresence ofmisinformation in the image, 0.82 for presence of misinformation in the text, and 0.80 for presence of conspiracy theory.

RESULTS

Of pins that made a factual claim about breast cancer prevention or treatment, more than half (51.1%) contained misinformation. This means that 11.4% of the sample overall contained misinformation related to breast cancer prevention or treatment. Of those, 28.6% contained misinformation in the image only, 23.1% in the text only, and 48.4% in both. Pins containing misinformation linked overwhelmingly to blogs (71.4% of the time), with much smaller proportions linking to mainstream media Web sites (7.7%), medical Web sites such as hospitals (3.3%), other health-focused Web sites (5.5%), social media sites (2.2%), and other sites (2.2%).

Type of Misinformation

Of posts containing misinformation, we classified 54.9% as exaggerated. Examples included claimed anticancer or cancer prevention effects for probiotics, flaxseed, turmeric, dandelions, pomegranates, green tea, vitamin D, insulin-like growth factor 1 (IGF-1), and a variety of other foods, medicines, and supplements.

We classified another 18.7% of misinformation as no evidence, with examples including claims that antiperspirants cause cancer (and that an "armpit detox" can counteract this supposed effect), and claims about the cancer-fighting powers of various foods and supplements. Meanwhile, we classified 16.5% of misinformation as inaccurate. Common themes here were downplaying of the accuracy and safety of mammograms, sometimes in favor of ultrasounds; false claims that bioidentical hormones do not carry the same cancer risks as synthetic hormones; and mischaracterization of tumor size and lymph node involvement during the various stages of breast cancer. We classified another 4.4% as outdated, in all cases because official guidance on when women should start getting mammograms has changed.

Finally, we classified 2.2% as contraindicated -these had to do with claims on turmeric and colloidal silver, described in more detail in the "Content of Misinformation" section-and we classified 2.2% as error by omission, because, while listing warning signs of breast cancer, they failed to mention obvious candidates including lumps and other changes to the breast.

Phase in Posts

We performed a %2 test of independence to examine the relationship between the presence ofmisinformation and the post phase (restricting the analysis only to pins that made factual claims about prevention and treatment). There was a significant relationship between these variables (C2 [2;n = 178] = 8.51; Cramer's V = 0.219; P <.05). Bonferroni pairwise comparisons showed that frequencies for posts containing misinformation were significantly different than posts without misinformation for the "both" category at P <.05. For the other 2 phase categories, there were no significant differences. Of posts containing misinformation, 34.1% related to prevention, 41.8% related to treatment, and 24.2% related to both. For posts found to contain no misinformation, 42.5% related to prevention, 49.4% related to treatment, and 8.0% related to both.

Content of Misinformation

Breaking down misinformation posts by topic, 39.6% were about foods that supposedly prevent or treat cancer, or that supposedly cause cancer. Many claims were mild and nonspecific, such as "Mediterranean Diet for Breast Cancer." Others went further-for example, proposing that 10 certain foods "Prevent Breast Cancer Completely." One post asked if readers were taking "this breast cancerpill" (which turned out to be probiotics, on which breast cancer research is at an early stage). Other pins advocated the use of turmeric, which the breast cancer foundation Susan G. Komen says should be used cautiously by people with breast cancer until more about its effects are known.25

Another 19.8% of misinformation pins were about vitamins, minerals, herbs, or supplements. Pins sometimes posed these substances as add-ons for a healthy lifestyle (as in, "This Tree Bark Can Heal Digestive Issues and May Even Fight Breast Cancer," about slippery elm), but sometimes as substitutes for other cancer treatments (as in "One simple pill stops breast prostate and thyroid cancers," about iodine). One pin touted "5 Known Cures for Cancer that the World NEEDS to know!," with the pictured "cure" being colloidal silver (Figure 1). The Memorial Sloan Kettering Cancer Center says colloidal silver cannot cure cancer, and long-term use can cause seizures and kidney damage.26

Next, 9.9% of misinformation pins were about supposed environmental causes of cancer, with antiperspirants being 1 commonly cited culprit, despite the National Cancer Institute saying that no scientific evidence links antiperspirants to breast cancer.27 Other pins blamed soaps, pots and pans, and genetically modified organisms. Meanwhile, 8.8% of misinformation pins were about mammograms, ultrasounds, or thermography. Some of these posts played up the risks and downplayed the benefits of mammography, touting thermography and ultrasounds as alternatives. Others were simply outdated, recommending that women begin annual mammograms at age 40 years, when the American Cancer Society has raised the recommended age to 45 years, with mammograms elective from 40 to 44 years.28

Some of the less-common content of the misinformation pins included the stages of breast cancer (5.5%), symptoms (3.3%), surgery (3.3%), hormone treatment (2.2%), the role of faith in treatment (2.2%), breast selfexaminations (1.1%), benign lumps (1.1%), research organizations (1.1%), and alternative medicine, not including food, vitamins, minerals, herbs, or supplements (1.1%).

Conspiracy Theories

Ofthe misinformation pins, 95.6% did not put forth any conspiracy theories. The few to do so either alleged that information on cancer is being withheld from the public or implied that research organizations are profiting from cancer.

DISCUSSION

These findings suggest that misinformation about breast cancer reaches people through vectors besides the obvious platforms of Facebook and Twitter and does so by using persuasive methods. Misinformation clearly takes advantage ofPinterest's visual nature: in our findings, most of the pins with misinformation used either the image alone, or the image in combination with text, to convey their inaccuracies. We also found that the misinformation pins were more likely than the nonmisinformation pins to relate to prevention and treatment simultaneously, meaning the misinformation could be more influential over patient decision-making.

The results demonstrate the complexity of the misinformation landscape on a single platform, with likely varying implications for health outcomes, confirming earlier observations.4 The finding that most claims were exaggerated rather than "no evidence," "inaccurate," or "contraindicated" is somewhat reassuring; however, we would caution that even treatments based on a germ oftruth can be harmful if used to replace a more established treatment.

One encouraging finding was that conspiracy theories did not appear frequently among the misinformation. This is somewhat surprising given widespread belief in cancer conspiracy theories.20 It is possible that Pinterest's efforts to crack down on health misinformation have led to such posts being taken down before other types of misinformation. Or perhaps Pinterest's users are more concerned with providing helpful tips on what users can do than they are with analyzing the motives of governments and companies. This finding, along with the others, does suggest that Pinterest moderators should be rather expansive in what sort of pins they consider evaluating for misinformation; obvious flags like conspiracy theories may not be present.

As Southwell et al. note, the effects of misinformation are highly dependent on diffusion and exposure.4 The mere presence of this misinformation on Pinterest does not guarantee that these pins were heavily viewed, and questions of misinformation's diffusion on Pinterest-whom it reaches and how its reach compares with that of factual information-warrant further research. However, we note several reasons for concern. First, studies suggest that false and misleading health stories get far more shares on social media than do verified news stories on the same topic.29 Second, hearing about breast cancer-related controversy can provoke online searching.30 As we obtained these results by searching on Pinterest for the most obvious breast cancer-related terms, the results suggest that Pinterest users who hear about breast cancer controversies may well end up seeing similar pins to what we found.

PUBLIC HEALTH IMPLICATIONS

Health providers should be aware that many of their patients use Pinterest, and patients employing Pinterest to find information on breast cancer are likely to have been exposed to misinformation. This misinformation can be particularly persuasive given that it leverages Pinterest's emphasis on visual content, and given that it often appeals to people's desire for information about both prevention and treatment. Thus, the misinformation on Pinterest appeals to both those with breast cancer and those looking to avoid the disease. In addition, many Pinterest users are women aged older than 50 years, creating a particular vulnerability12-given that most breast cancers are found in women aged 50 years or older,31 and that older people may be more susceptible to misinformation.32

Given that a majority of misinformation pins featured exaggerated claims, often about foods and supplements, practitioners should be prepared to discuss the importance of following the most evidence-based health recommendations for both breast cancer prevention and treatment. Much of this informative work may be preemptive, such as clearly and persuasively outlining the benefits of mammograms or of lowering cancer risk with exercise. At the same time, dangerous yet less-shared ideas such as the use of colloidal silver may only need to be directly addressed as patients raise them. For public health advocates, the study suggests information to stress in public health campaigns, such as the need for mammograms and the importance of curbing established breast cancer risk factors. This may begin to counteract misinformation present on Pinterest.

CONTRIBUTORS

The authors jointly designed the study and coded for reliability testing. T. Wilner carried out subsequent coding. The authors jointly wrote the article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

Human participant protection was not needed because there were no human participants involved in this study.

Sidebar

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DETAILS

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Misinformation About Commercial Tobacco Products on Social Media- Implications and Research Opportunities for Reducing Tobacco-Related Health Disparities

Tan, Andy S L, PhD, MPH, MBA, MBBS; Bigman, Cabral A, PhD

ABSTRACT (ENGLISH)

Misinformation about commercial tobacco products is not new. For decades, major tobacco companies deliberately deceived the public through marketing practices (e.g., brand names or labels such as "natural" and "organic") and public relations campaigns. The tobacco industry's deception of the public provides an important historical context for examining current forms of tobacco product misinformation through social media. The industry's campaigns sought to downplay and deny health harms and addictiveness of combustible cigarettes. These campaigns were aimed at creating doubt about scientific evidence showing how cigarette smoking harmed smokers and those exposed to secondhand smoke.

The tobacco industry's deliberate deception has led to tremendous human suffering and millions oflives lost in the United States and globally every year because of smoking and secondhand smoke exposure. Although the overall prevalence of smoking in the United States has declined over the past 50 years because of comprehensive tobacco-control policies and efforts, targeted marketing campaigns and community sponsorships among disparity populations-including African American communities, sexual and gender minorities, and populations experiencing homelessness-contribute to persistent disparities in cigarette smoking and related health consequences in these populations.

FULL TEXT

Misinformation about commercial tobacco products is not new. For decades, major tobacco companies deliberately deceived the public through marketing practices (e.g., brand names or labels such as "natural" and "organic") and public relations campaigns. The tobacco industry's deception of the public provides an important historical context for examining current forms of tobacco product misinformation through social media. The industry's campaigns sought to downplay and deny health harms and addictiveness of combustible cigarettes. These campaigns were aimed at creating doubt about scientific evidence showing how cigarette smoking harmed smokers and those exposed to secondhand smoke.

The tobacco industry's deliberate deception has led to tremendous human suffering and millions oflives lost in the United States and globally every year because of smoking and secondhand smoke exposure. Although the overall prevalence of smoking in the United States has declined over the past 50 years because of comprehensive tobacco-control policies and efforts, targeted marketing campaigns and community sponsorships among disparity populations-including African American communities, sexual and gender minorities, and populations experiencing homelessness-contribute to persistent disparities in cigarette smoking and related health consequences in these populations.

In recent years, the introduction of alternative forms of nicotine products into the marketplace (e.g., e-cigarettes, heated tobacco products, and smokeless tobacco) has led to a more complex information landscape, as the population health effects of using these products remain inconclusive- leading to intense scientific and public debate.

For example, misinformation from the online marketing of e-cigarettes by manufacturers, retailers, and social media influencers has claimed that e-cigarettes contain only water vapor and are harmless. This misinformation serves to downplay the risks and addictiveness of e-cigarette use and is in part responsible for the youth vaping epidemic of recent years. Conversely, online misinformation that e-cigarettes are just as or more harmful than smoking potentially deters current cigarette smokers who are unable to quit smoking from considering reducing harms by switching to e-cigarettes. Because cigarette smoking is increasingly concentrated among disparity populations, the impact of misperceptions about e-cigarettes' relative harms compared with smoking could lead to widening tobacco-related health disparities in these populations.1

Social media may amplify the transmission of tobacco product misinformation in addition to traditional media. Exposure to and effects of misinformation about tobacco products may be unevenly distributed across population subgroups because of structural determinants, including variations in access to trusted sources of health information, health literacy, and online social networks. Inequalities in misinformation exposure and receptivity may perpetuate and widen tobacco use disparities and related health disparities.2 Tailoring algorithms based on users' online behaviors and preferences may further increase certain users' exposure to misinformation about commercial tobacco products. However, there is limited research on exposure to misinformation about tobacco products on social media and the effects of such exposure on attitudes and use of tobacco products, particularly among disparity populations.

We discuss gaps in research to address misinformation about tobacco products on social media, especially among tobacco disparity populations. In the current information environment, most misinformation is from tobacco companies and user-generated social media posts that are not explicitly linked to tobacco companies. We further consider both explicit misinformation (information that is verifiably false based on current scientific evidence) and implicit misinformation (information that misleads the public about the harms and benefits of tobacco products).3

SOCIAL MEDIA MISINFORMATION SURVEILLANCE

Surveillance of misinformation on tobacco products on social media is needed to keep pace with the introduction of new tobacco products such as e-cigarettes and smokeless tobacco and the spread of false information about such products. For example, a content analysis of 1068 tweets from a corpus of tobacco-related tweets reported that 10% contained claims about tobacco-related health consequences, use patterns, policies, or tobacco industry actions. Of these claims, the researchers coded 18% as explicitly false, with the majority being unverified health consequences of tobacco product use and cessation methods that were not evidence based.4

It is clearly important to conduct surveillance on protobacco misinformation on social media that misleads the public into thinking tobacco products are safe or help smokers to quit successfully, contrary to current evidence. Yet, there is also a need to characterize the prevalence and content of misinformation that exaggerates the harms of e-cigarettes on social media (e.g., posts that e-cigarettes are as harmful as or more harmful than combustible tobacco products or cause cancers). Although evidence suggests that e-cigarette use is not completely harmless, switching completely to e-cigarettes is associated with reducing the risks of short-term health effects compared with continuing cigarette smoking. Social media posts focusing on the harms of e-cigarette use may be a reason for a growing public misperception that e-cigarettes are just as harmful as or even more harmful than combustible cigarettes.5

EXPOSURE TO AND EFFECTS OF MISINFORMATION

Research is also needed to assess whether exposure to and effects of misinformation about tobacco products on social media adversely affect tobacco use and tobacco-related health consequences among disparity populations. Efforts are needed to determine whether disparity populations are specifically targeted by misinformation campaigns about tobacco products in terms ofthe content, sources, and how these social media posts are disseminated. There is limited research on measuring exposure and effects of tobacco product misinformation in the general population, and none has focused on disparity populations.

A randomized experiment to examine the effects ofmisleading tobacco content in YouTube videos found that young adult participants aged 18 to 24 years who viewed misleading information about e-cigarettes and hookahs reported more positive attitudes toward these products than did those who viewed a control video unrelated to health.6 The majority of participants were non-Hispanic (88%) and White (73%).

Research to assess how misinformation influences tobacco product perceptions and use among tobacco disparity populations will help to determine the need for preventive and corrective interventions and appropriate approaches to intervene for these populations.

PREVENTIVE AND CORRECTIVE INTERVENTIONS

Recent research focused on misinformation corrective strategies, including court-ordered corrective statements, reported that there was an uneven reach of these correctives across education level and socioeconomic status.7 However, there are research gaps in evaluating interventions aimed at debunking misinformation about tobacco products on social media and preventive approaches such as inoculation messages or media literacy training for increasing awareness of and resistance to influence by misinformation. In addition, research has not focused on the effectiveness of corrective approaches among disparity populations. Research is needed to design and implement culturally appropriate and effective preventive and corrective interventions for disparity populations, if warranted based on evidence from research on the exposure and effects of misinformation among these populations. Principles of community-engaged and participatory research provide helpful frameworks to design culturally appropriate preventive and corrective interventions for diverse populations.

In sum, misinformation about tobacco products on social media is a significant factor that may influence public misperceptions and adversely affect the health of populations who are most affected by tobacco product use and widen health disparities. It is critical to apply state-of-thescience approaches from the emerging body of research on health misinformation to conduct surveillance, measure exposure and effects, and design potential interventions to prevent and mitigate the adverse effects of tobacco product misinformation among tobacco disparity populations. ÂjPU

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CONTRIBUTORS

The authors contributed equally to the editorial.

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Note. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the FDA.

CONFLICTS OF INTEREST

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Sidebar

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Document 18 of 61

Concrete Recommendations for Cutting Through Misinformation During the COVID-19 Pandemic

Donovan, Joan, PhD

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ABSTRACT (ENGLISH)

The COVID-19 pandemic presents multifaceted challenges for the US health care system. One such challenge is in delivering vital health information to the public-a task made harder by the scourge of health misinformation across the information ecosystem (Southwell et al., p. S288 in this issue of AJPH, and Southwell etal.1). I offer concrete recommendations for public health information officers and communication professionals drafting communication

campaigns for health agencies and health organizations to maximize the chance that timely health advisories reach the public. At Harvard Kennedy's Shorenstein Center, the Technology and Social Change Research Project studies how misinformation spreads and what its impact is on politics and society (bit.ly/2YcTX09bit.l). Unlike political disinformation, or fake news, health misinformation can quickly lead to changes in behaviors, which is why health communicators can't wait for tech companies to solve the problem.
For example, research on antivaccination movements shows how celebrities, activists, and discredited physicians gain influence over vaccination policies, while also promoting quackery, misinformation, and conspiracies on social media.3 Although it is difficult to know who has been affected by health misinformation, best strategies to counter it focus on addressing "silent audiences" with direct, careful, and succinct messaging.

FULL TEXT

The COVID-19 pandemic presents multifaceted challenges for the US health care system. One such challenge is in delivering vital health information to the public-a task made harder by the scourge of health misinformation across the information ecosystem (Southwell et al., p. S288 in this issue of AJPH, and Southwell etal.1). I offer concrete recommendations for public health information officers and communication professionals drafting communication campaigns for health agencies and health organizations to maximize the chance that timely health advisories reach the public.
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For example, research on antivaccination movements shows how celebrities, activists, and discredited physicians gain influence over vaccination policies, while also promoting quackery, misinformation, and conspiracies on social media.3 Although it is difficult to know who has been affected by health misinformation, best strategies to counter it focus on addressing "silent audiences" with direct, careful, and succinct messaging.4
Search engines and social media platforms are struggling to control the groundswell of new attention to COVID-19 and are having difficulty matching the right information to the right person at the right time. For example, searching Google, Facebook, Twitter, or YouTube for the phrase "Where can I get tested for coronavirus?" will return different information-or worse, fake news, a predatory scam, or malware (https://politi. co/3g9uzOE).
The pandemic lays bare how the algorithmic design of search engines and social media, which prioritize fresh and relevant content, contributes to confusion by mixing different kinds of information into a single feed: the mundane, the newsworthy, and critical medical recommendations (https://bit.ly/3iQoetq). Additionally, because many platforms are designed with advertising as their backbone, authoritative content from health agencies, health professionals, and local governments is often subsumed by advertising looking to grab clicks.5
The situation is dire. People need timely, relevant, and local information on COVID-19. Likewise hospitals, governments, health agencies, and universities are overwhelmed with inquiries and need to use mass communication to reach everyone. Any communication strategy must use redundancy by getting the same information out across as many different channels as possible.
Here are five recommendations based on our research about medical misinformation at the Shorenstein Center:
1.Domain registrars have reported upward of 120 000 domains with keywords related to coronavirus or COVID-19. Although most of the new domains have no content, scammers are using custom domains to target people seeking information about treatment, the worried well, and those suffering financial hardships because of COVID-19 (https://nbcnews.to/3iT5QQu). Public health and health care organizations with already established and functioning Web sites should not register new domains because it is difficult to gain traction within search engines and social media. Instead, these organizations should make a page dedicated to the particular health emergency, in this case COVID-19, on their already existing Web site and update it regularly, even if there is nothing newsworthy to report. Updates provide fresh signals to algorithms, which will rank it accordingly.

2.Debunking every rumor, every conspiracy theory, and all political punditry exhausts critical resources. Furthermore, there has been a deluge of requests for interviews with medical personnel and public health advocates. Health communicators should establish a monitoring protocol to decide which misinformation is gaining traction and approaching a tipping point, such as when misinformation moves across platforms or someone newsworthy, such as a politician or celebrity, distributes it. We recommend routinely checking the Federal Emergency Management Agency's rumor database (https://bit.ly/ 3kSOKUO) and Google's fact-checking database of recently debunked news stories (https://bit.ly/2Ebnwbg). Scan comments posted to local social media groups and public messaging apps, such as Nextdoor. Keep a log of comments the organization receives via social media accounts, telephone, or e-mail. Importantly, no one should respond to misinformation unless there is good reason to do so and they have a plan for communicating it publicly (https://bit.ly/3j4PKnh). It is recommended not to respond to individuals but rather to debunk major misinformation themes.

3. Keeping up with the demand for new information during this pandemic will require a shift to mass communication strategies. In terms of risk communication, working with journalists is key to fighting misinformation. Building two-way communication bridges between health communicators and local journalists will ensure visibility and trust across professional sectors when communication emergencies happen. This is different from hosting press conferences. It's about creating real relationships, where public health is the shared goal. Helping journalists debunk misinformation and providing key recommendations will raise the credibility and visibility of public health recommendations to broad audiences.

4. If using social media to communicate, which all public health organizations should do, contact the platforms and request free public service advertising. In a crisis like this, online advertising systems can be repurposed to reach local audiences (https:// bit.ly/3gcHpfc). Local television news remains a reliable way to inform many people quickly and locally.

5.Local governments and health agencies should set up text messaging systems and SMS (short message service) push notifications, where possible, to reach people outside social media. Although emergency management strongly advises that governments set up these systems before a disaster, the pandemic is an opportunity to enroll many people. Alternatively, emergency alert systems do not require a signup and could be adapted to reach people in a certain geographic area. For example, New York City has used emergency alerts to request health care workers.

Right now, search and social media companies are not designed to deliver authoritative, timely, relevant, and local information. Tech companies are at a crossroads, where the alliances and coalitions built now to tackle the COVID-19 pandemic will shape the future of risk communication on the Internet. It is crucial, therefore, that health communication professionals understand the limitations of social media and actively work to mitigate misinformation to lessen the harms caused by unchecked scams, hoaxes, and conspiracies; the public must be able to access timely, local, and relevant information when they need it most. ÂfPU

Joan Donovan, PhD

CONFLICTS OF INTEREST

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Sidebar

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Ethical Considerations for Digitally Targeted Public Health Interventions

Susser, Daniel, PhD

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ABSTRACT (ENGLISH)

Researchers, advocates, and policymakers increasingly worry that the Internet generally, and social media specifically, have become vectors of misinformation, manipulation, and other forms of malign influence.1,2 Unlike older forms of media, such as radio and television, Internet-driven influence differs in its capacity for individualized targeting, the speed with which messages can be transmitted and amplified, and the extent to which the creation and distribution of messages can be automated. While much attention has focused on the effects of such messaging on political discourse, researchers have traced equally concerning impacts on discussions pertaining to health-related issues, such as vaccine safety.3 Searching for ways to respond, public health officials and public health scholars have suggested a range of approaches, including increasing existing efforts to promote information and health literacy, devising strategies for publicly rebutting misinformation, and preparing clinicians and public health officials to address misinformation one on one.4

FULL TEXT

Researchers, advocates, and policymakers increasingly worry that the Internet generally, and social media specifically, have become vectors of misinformation, manipulation, and other forms of malign influence.1,2 Unlike older forms of media, such as radio and television, Internet-driven influence differs in its capacity for individualized targeting, the speed with which messages can be transmitted and amplified, and the extent to which the creation and distribution of messages can be automated. While much attention has focused on the effects of such messaging on political discourse, researchers have traced equally concerning impacts on discussions pertaining to health-related issues, such as vaccine safety.3 Searching for ways to respond, public health officials and public health scholars have suggested a range of approaches, including increasing existing efforts to promote information and health literacy, devising strategies for publicly rebutting misinformation, and preparing clinicians and public health officials to address misinformation one on one.4

Such strategies are uncontroversial. Yet some contemplate going further, asking whether the same tools contributing to these problems-targeted, automated digital messaging-might be utilized to mitigate their negative effects. For example, while acknowledging potential risks, Dunn et al. explore ways "social media data are used to predict or model health-related behaviours and outcomes" and "how these methods might be operationalised in the design of precision behavioural interventions."5 One can imagine public health analogs of YouTube's "redirect method," which identifies users interested in terrorist or extremist videos and redirects them to antiextremist countermessaging.

Though research in this area is preliminary, it raises significant ethical questions that ought to be addressed in advance of further developments.

MANIPULATION AND AUTONOMY

In part, these proposals mirror ongoing debates about the use of so-called "nudging" to promote individual and public health, and they prompt some of the same normative considerations. Nudging involves shaping people's choice environments in such a way that subtly steers them toward individually or socially beneficial decisions. Because such interventions are often designed to bypass people's capacity for conscious deliberation, and function instead by triggering preconscious decision-making heuristics ("cognitive biases"), they are fraught with questions about paternalism and manipulation.

While no consensus has been reached about the extent to which such worries are justified, they highlight morally relevant costs of intervening in people's decision-making that might otherwise be neglected from the cost-benefit calculations public health officials have to make. We value autonomy (i.e., our capacity to make independent decisions), even when it means deciding to make ourselves worse off.Of course, situations can arise in which the potential harm is so grave that preventing it outweighs the cost of violating a person's autonomy (e.g., in cases of suicidal ideation). But such situations ought to be treated as the exception rather than the rule. As researchers and public officials weigh the costs and benefits of utilizing digital influence strategies to promote health-especially precisely targeted (or "personalized") interventions, which I and others argue raise particularly acute manipulation worries2-they ought to seriously contemplate the costs of circumventing people's capacity (and their right) to think and choose for themselves. If they decide to utilize such strategies, they should design interventions that targets can easily contextualize and understand-for example, by clearly indicating who is behind the messaging, why the person seeing it has been targeted, where they can find more information, and how they can opt out of future interventions.

PRIVACY

Privacy concerns arise because targeting individuals with relevant, timely public health messages requires collecting and processing information about them. One reason public health scholars are enthusiastic about the potential for these kinds of interventions is that ubiquitous digital technologies, such as smartphones and fitness trackers, create huge amounts of data that can be used to make predictions about individual and population-level health events. However, privacy scholars and advocates caution that the existence of such information does not entail that it is "up for grabs." People share information about themselves in particular contexts, with the expectation that it will be accessed by specific recipients and used for specified ends.6 Just as technology companies like Facebook and

Cambridge Analytica faced backlash from the public when it learned they used information disclosed through social media to target political advertisements, public health officials ought to exercise caution before using such information to target health messaging, unless they have received clear, explicit, affirmative consent.

BIAS

Researchers have shown, time and again, that the algorithms used to deliver targeted content online are deeply susceptible to unintended, discriminatory bias. Using such tools to mitigate social media-driven misinformation or to promote truthful public health messaging thus raises the possibility ofmissing certain groups or targeting them with inaccurate information. As public health practitioners are unlikely to build message targeting systems themselves, relying instead on platforms like Google's and Facebook's, they ought to carefully consider the risk that their interventions might not reach all intended audiences (and indeed, that they might exclude already marginalized groups). At the very least, public heath campaigns that do utilize ad targeting or other content recommendation platforms should be regularly audited to detect issues before they become widespread.

ACCOUNTABILITY

Finally, questions about accountability come to the fore whenever powerful institutions intervene in people's lives. Such questions are especially urgent in this context because machine learning and artificial intelligence (the computational techniques that power most targeting and recommender systems) are known for their opacity, which derives from the fact that their inner workings are often protected by corporate trade secrecy laws, and their decision-making logics are difficult even for experts with proper access to understand.7 If public health organizations are going to use such tools ethically, they will need to go out of their way to create structures of transparency and accountability. That might involve storing messages for post hoc review, carefully logging who has seen them, and making that information readily available to auditors.

CONCLUSION

Dealing successfully with these ethical questions will require balancing difficult tradeoffs. On one hand, the troves of personal data collected about each of us are incredibly revealing, and the tools for leveraging those data to target digital messages are powerful and readily available. It is easy to understand why researchers and public health practitioners are eager to explore the good they could do with them.

On the other hand, targeted digital public health interventions might also involve considerable ethical costs. The data that power targeting technologies are often collected in ways that disrespect data subjects' privacy. Such technologies are liable to target messages in ways that discriminate against marginalized groups. They create barriers to accountability. And targeted digital public health interventions threaten to influence our decision-making in ways that violate our autonomy. Whether the benefits ofthese interventions outweigh the costs should be determined on a case-by-case basis. To make such determinations, practitioners should consider both the severity of the health risks they are addressing (e.g., promoting healthy diets vs suicide intervention or combating health misinformation during a pandemic) and the extent to which they can minimize potential harms (e.g., whether messaging can be made transparent, and targeting data can be collected in ways that respect people's privacy). Of course, the ethical issues discussed here are not exhaustive-rather, they suggest a place from which discussions about the ethics of targeted digital public health interventions can start. >4jPUI

Daniel Susser, PhD

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CONFLICTS OF INTEREST

The author has no conflicts of interest to disclose.

Sidebar

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DETAILS

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Document 20 of 61

Social Media and Cancer Misinformation: Additional Platforms to Explore

Walsh-Buhi, Eric R, PhD, MPH

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ABSTRACT (ENGLISH)

This special issue of AJPH, sponsored by the National Cancer Institute, represents important and exciting research addressing the major issues of misinformation on social media and cancer. There are excellent research articles and editorials included in this issue on topics such as breast cancer prevention and treatment misinformation on Pinterest (Wilner and Holton, p. S300), bots (Dunn et al., p. S319) and human papillomavirus (HPV) vaccine opposition (Bonnevie et al., p. S326) on Twitter, and cannabidiol (CBD)-related misinformation on GoFundMe (Zenone et al., p. S294). Misinformation, defined as false or inaccurate information, regardless of intentional authorship,1 is not a new issue to society or to public health. While misinformation, truth framed as “fake news,” and other efforts to spread false stories have likely been around as long as humans have lived in groups, according to the World Economic Forum (WEF), digital misinformation is becoming pervasive in online social media; in fact, it has been listed by the WEF as a global risk and one of the main threats to society

FULL TEXT

This special issue of AJPH, sponsored by the National Cancer Institute, represents important and exciting research addressing the major issues of misinformation on social media and cancer. There are excellent research articles and editorials included in this issue on topics such as breast cancer prevention and treatment misinformation on Pinterest (Wilner and Holton, p. S300), bots (Dunn et al.,p. S319) and human papillomavirus (HPV) vaccine opposition (Bonnevie et al., p. S326) on Twitter, and cannabidiol (CBD)-related misinformation on GoFundMe (Zenone et al., p. S294). Misinformation, defined as false or inaccurate information, regardless of intentional authorship,1 is not a new issue to society or to public health. While misinformation, truth framed as "fake news," and other efforts to spread false stories have likely been around as long as humans have lived in groups, according to the World Economic Forum (WEF), digital misinformation is becoming pervasive in online social media; in fact, it has been listed by the WEF as a global risk and one of the main threats to society.2

Although research on cancer-related misinformation on social media is still in its infancy-that is, we do not have a 50-plus-year history, like with tobacco and health research, to fall back on-this special issue on cancer and social media misinformation contains strong articles focusing on social media platforms such as Twitter (5 research articles), Pinterest (2 research articles), and Facebook and GoFundMe (1 research article each). Readers may notice an absence of studies, however, focusing on other important and popular social media platforms. For example, more work is desperately needed on cancer misinformation on YouTube, Instagram, TikTok, and Reddit.

YOUTUBEAND MISINFORMATION

YouTube is the most popular social media platform in the United States, with almost three quarters of US adults (73%) reporting using the video-sharing site.3 Its popularity is cause for concern as we learn more about how YouTube is vulnerable to cancer misinformation. A preliminary search of PubMed for "YouTube and misinformation and cancer" yielded only 43 results, and many of those results were unrelated to misinformation. One of those research articles, however, reporting on prostate cancer videos on YouTube, noted that 115 videos (or 77% of the analyzed sample) contained potentially misinformative or biased content within the video or comments section, with a total reach of more than six million viewers.4 The influences on and impacts of such misinformation on one of the world's most popular social media platforms remain largely unknown.

INSTAGRAM AND MISINFORMATION

Instagram is another a platform on which more research is needed. With more than one billion monthly active users, Instagram is the third most popular social media platform in the United States, behind YouTube and Facebook.3 Each day, Instagram users upload more than 500 million photos, videos, and stories (a combination ofvideos, text, and photos). A second search conducted on PubMed, similar to the one noted earlier and substituting the term "Instagram" for "YouTube," resulted in fewer research studies on misinformation and cancer (n = 15); and, again, most of those search results were unrelated to misinformation. Major gaps remain in terms of surveilling cancer misinformation on social media, but especially on Instagram, as well as evaluating the influence of misinformation on health, and developing and testing interventions combatting cancerrelated misinformation on Instagram (see Chou et al., p. S273).

TIKTOK AND MISINFORMATION

While other social media platforms, such as Reddit and TikTok, are becoming popular worldwide, very limited research has been published on them and the presence of cancer-related misinformation. A third search on PubMed, as previously noted and with the terms "Reddit" and TikTok," respectively, substituted in place of "Instagram," resulted in five and zero research studies, respectively. The latter could be attributable to the fact that TikTok does not provide open access to its post data via a public application protocol interface (API), as does Twitter. While data are not necessarily easily accessible from these platforms, it is critical that we in public health strive to study cancer-related misinformation across a variety ofplatforms. Now more than ever, partnerships with companies like Google (owner of YouTube), for example, are needed. The reason is simple. TikTok is home to a new generation of social media users: young people. In November 2019, the TikTok app surpassed 1.5 billion downloads combined on the Apple App Store and Google Play store, ranking above both Facebook and Instagram.5 The most popular group ofTikTok users are adolescents. Relatedly, as noted earlier, two thirds of Instagram users are people younger than 30 years. If we are to meet young people where they are and protect a critical generation from the potential perils of misinformation, then we must focus on the social media platforms these priority populations use.

RESEARCH OPPORTUNITIES AND FUTURE DIRECTIONS

The nature of certain platforms also makes them important for additional study. For example, there are many "healthy lifestyle "-related Instagram accounts. However, we do not know whether information provided via such accounts is accurate regarding healthy diets, or whether the account owners or content creators make unsubstantiated claims about certain foods (e.g., "superfoods") or products (e.g., vaping and tobacco product ads, vaper influencers on TikTok). To know if we should be concerned about misinformation on Instagram and TikTok, we need to explore the content being shared systematically, survey users for their exposure and experiences, or both.

How might we partner with tech companies like Facebook, Instagram, and TikTok? Although much of the existing research focuses on Twitter, because the platform offers greater access to their data via public APIs, companies like Facebook and Instagram have increasingly closed public access to its data for a variety of reasons but largely because of breaches in data privacy and trust regarding use of users' data (see the Cambridge Analytica scandal6). Efforts must be reignited by researchers to forge new relationships with tech companies. One way to do this effectively is by creating "win-win" or mutually beneficial relationships with tech partners. Researchers must take the time to rebuild trust and make their use of social media data beneficial to the platforms or companies themselves. Strategies such as community-based participatory research (CBPR) may be fruitful, for example. CBPR emphasizes that all parties at the table have an equitable footing in asking research questions, conducting the research, and owning the process. In this case, the tech companies serve as the community. CBPR would place tech companies front and center so that their questions are the ones being asked, with help from researchers. This is also important because some companies lack the tools to analyze their own data, even though a rich supply is available (i.e., from academic researchers). In a positive move, certain entities are now serving as third-party platforms for accessing Facebook and Instagram (e.g., CrowdTangle), and such efforts are already opening the door to making a greater proportion of social media data more available and transparent to researchers.

It is also critical that we advocate for additional federal funding to study such areas. As an illustration of current support for social media misinformation research, a brief search of active National Institutes of Health (NIH) funding support for "social media" and "misinformation" yields five results (see Figure A, available as supplement to this article at https://www. ajph.org). If our elected officials are moved to curb the dangers of misinformation, then increases in allocations of the NIH budget, with a particular focus on funding research related to social media platforms utilized by young people and misinformation related to health, is warranted. Such funding allocations are critical as we respond to what the WEF has termed a global risk and one ofthe main threats to society.

Eric R. Walsh-Buhi, PhD, MPH

CONFLICTS OF INTEREST

The author has no conflicts of interest to disclose.

Sidebar

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DETAILS

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Document 21 of 61

Implementation of a Statewide Policy Mandating School-Based Fitness Assessment Screening, Georgia: 2018

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ABSTRACT (ENGLISH)

Objectives. To evaluate the statewide implementation of childhood fitness assessment and reporting in Georgia. Methods. We collected survey data from 1683 (919 valid responses from a randomdigit-dialed survey and 764 valid responses from a Qualtrics panel) parents of public school students in Georgia in 2018. Results. Most parents reported that their child participated in fitness assessments at school, yet only 31% reported receiving results. If a child was identified as needing improvement, parents were significantly more likely to change the diet and exercise of both the child and the family. Conclusions. A state-level mandatory fitness assessment for children may be successful in state-level surveillance of fitness levels;parental awareness of the policy, receipt of the fitness assessment information, and action on receiving the screening information require more efforts in implementation.

FULL TEXT

Headnote

Objectives. To evaluate the statewide implementation of childhood fitness assessment and reporting in Georgia.
Methods. We collected survey data from 1683 (919 valid responses from a randomdigit-dialed survey and 764 valid responses from a Qualtrics panel) parents of public school students in Georgia in 2018.
Results. Most parents reported that their child participated in fitness assessments at school, yet only 31% reported receiving results. If a child was identified as needing improvement, parents were significantly more likely to change the diet and exercise of both the child and the family.
Conclusions. A state-level mandatory fitness assessment for children may be successful in state-level surveillance of fitness levels;parental awareness of the policy, receipt of the fitness assessment information, and action on receiving the screening information require more efforts in implementation. (Am J Public Health. 2020;110: 1564-1566. doi:10.2105/AJPH.2020.305834)

Childhood obesity remains a serious and costly public health concern in the United States, with a prevalence of 18.5% among those younger than 20 years.1 The prevalence of obesity among middle and high school students in the state of Georgia is the eighth highest in the nation. As a response to the national epidemic on childhood obesity, the Centers for Disease Control and Prevention recommended that fitness assessments be used as screening tools in schools.2 In addition to effects on childhood obesity, physical fitness has effects on academic performance and later health outcomes. Childhood obesity is complex, and many social, socioeconomic, and cultural factors play a role. As such, school-based policy alone does not provide a solution; nevertheless, it has the potential to touch millions of students each day to address childhood obesity. POLICY INTERVENTION

To combat the childhood obesity epidemic in Georgia, the state legislature passed the Student Health and Physical Education (SHAPE) Act in 2009. This act requires each local school system to conduct an annual fitness assessment for students in grades 1 through 12 during a physical education course.3 The fitness assessment is based on the FitnessGram, which is a standardized tool used to assess health-related fitness, including aerobic capacity (PACER test, 1-mile walk and run), muscular strength, endurance, flexibility, and body composition (height and weight measurement for body mass index [BMI]).4 Several US states require BMI screening, with considerable variability in policy implementation, assessment protocols, and reporting.5 In Georgia, the SHAPE Act requires that each school report (1) the individual FitnessGram results to the parent or guardian of each student, including the child's fitness zone (green = healthy; yellow or red = needs improvement); and (2) the aggregate FitnessGram results to the State Board of Education. With this approach, the policy is designed to monitor physical fitness to aid in describing fitness trends (surveillance) and to use individual reporting to help increase parents' awareness and involvement in their child's health.2 Figure A (available as a supplement to the online version ofthis article at http://www.ajph.org) outlines the implementation of the SHAPE Act.

We evaluated the SHAPE Act based on 4 attributes of policy implementation: (1) parental awareness of the policy, (2) parental awareness of the child's assessment results, (3) use of results for modifying behavior and seeking medical care, and (4) parental perception of BMI screening and fitness assessment in schools.

METHODS

We evaluated implementation of the SHAPE Act through surveys that included questions on awareness of the act and FitnessGram activities; changes in the family's or child's diet or physical activity or use of medical care based on assessment results (as suggested by the information provided in the FitnessGram); and perceptions of schoolbased BMI screening and fitness assessments. Nearly 931 000 students were enrolled in elementary and middle schools across Georgia ABOUT THE AUTHORS

in 2018; most public school students were White (38.9%) or Black (36.6%), with an equal proportion of male and female students.6 We surveyed participants via a statewide randomdigit-dialed telephone survey from April to

December 2018. Participants were drawn from a general population sample and were eligible if they were at least 18 years old, had a child attending a public school in Georgia from fifth to eighth grade, could respond in English or Spanish, and were not employed as a public school teacher or administrator. A separate sample of general population participants was gathered from an online Qualtrics panel from October to November 2018. The second survey, which was Web-based, was the same in terms of eligibility and survey questions. This study's results were from the aggregated sample of 1683 parents: 919 valid responses from the random-digit-dialed survey and 7 64 valid responses from the Qualtrics panel. Results were compared across samples to identify any significant differences in respondent demographics or responses, and no significant differences were noted.

We calculated basic summary statistics of all measures, including means and ranges for continuous responses and frequencies and proportions for categorical responses. Statistical comparisons were made using the proportion test for binary responses and the %2 test for responses with more than 2 options. We used R (R Foundation for Statistical Computing, Vienna, Austria) for all analyses.

RESULTS

Survey respondents were, on average, 41.6 years old and mostly female (68.4%), White (63.4%), or Black (26.1%). Child gender (47.1% female) and grade were almost equally distributed. Approximately two thirds of the parents reported that their child was "about the right weight," with the remainder reporting "overweight" (18.9%) or "underweight" (8.6%); this represents a slightly healthier than average population compared with statewide FitnessGram results.

Few parents in the survey (7.6%) reported having heard about the SHAPE Act, whereas twice as many (18.3%) reported having heard about the FitnessGram. However, many more parents were aware of their child receiving a BMI screening (52.6%) and completing the 1-mile walk and run test (55.7%) or a strength test (64.4%).

A total of 526 (31.3%) parents reported receiving fitness assessment results for their child. Half recalled the BMI (49.6%) information, whereas 23.6% recalled data on aerobic capacity. Of these parents, 38.3% and 34.7%, respectively, did not recall what fitness zone was reported for their child.

For parents who received results, 65.0% reported talking to their child about the report; 43.7% reported talking to the child's physician. Table 1 contains survey responses stratified by fitness zone (healthy vs needs improvement) from parents who reported receiving the assessment report and who remembered the fitness zone (n = 161). If a child was identified as needing improvement, parents were significantly more likely to change the diet and exercise of both the child and the family. However, they were not significantly more likely to talk to the child or to the child's physician.

Parents were most likely to support healthy eating and physical activity opportunities in schools, with most strongly supporting this as a requirement (Figure B, available as a supplement to the online version of this article at http://www.ajph.org). Parents were most likely to oppose activities related to measuring BMI and reporting student's BMI results to parents, although more parents supported conducting physical activity assessments and reporting to parents.

DISCUSSION

Fewer than one third of parents reported receiving the FitnessGram results, suggesting a need for improving the reporting of individual-level fitness screening results. Although most parents in this study were in favor of nutrition education and physical activity opportunities for their children in schools, fewer parents were in favor of mandatory BMI screening as a state policy. Previous findings on parents' perceptions of BMI screening at schools have shown mixed results.7,8

Although the awareness ofthe SHAPE Act itself was low, this population may not be reflective of all parents in Georgia, and this study does not provide an understanding of school-level differences in implementation. Even so, awareness was relatively high when parents were asked about specific components of the fitness assessment, including the PACER test and the 1-mile walk and run. Awareness of the FitnessGram and receipt of the associated report were closely correlated. For those parents receiving the FitnessGram report, many used it to talk to their children about their health. Parents reported lifestyle changes with respect to diet and physical activity and were significantly more likely to do so if their child was not in the healthy fitness zone. This finding has added evidence to the current literature on what works for addressing childhood obesity.9

PUBLIC HEALTH IMPLICATIONS

Overall, this study showed that a statelevel mandatory fitness assessment for children may be successful in state-level surveillance of fitness levels. However, increased efforts may be needed to improve public awareness of the full policy, parental receipt of fitness assessment (screening) information, and parental perception of the appropriateness of the policy. These efforts could include a targeted marketing campaign at the state or school level. These findings should be useful for other states that require screening for surveillance purposes only but have called for research to identify interpretable and actionable reporting for parents.

CONTRIBUTORS

P.S. Corso and M. Davis conceptualized the full study, and P. S. Corso provided supervision over all aspects of this study.J. Ingels andJ. Rajbhandari-Thapa analyzed the data. All authors participated in the development of the data collection instrument and prepared the final article.

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Note. The contents are solely the responsibility of the authors and do not necessarily reflect the views or policies of the National Institutes of Health.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

This study was approvedby the institutional reviewboards ofKennesaw State University (19-320) and the University of Georgia (MOD00006846).

Sidebar

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Document 22 of 61

Trends in Extreme Distress in the United States, 1993–2019

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ABSTRACT (ENGLISH)

Objectives. To investigate changes from 1993 to 2019 in the percentage of US citizens suffering extreme distress. Methods. Using data on 8.1 million randomly sampled US citizens, we created a new proxy measure for exceptional distress (the percentage who reported major mental and emotional problems in all 30 of the last 30 days). We examined time trends for different groups and predictors of distress. Results. The proportion of the US population in extreme distress rose from 3.6% in 1993 to 6.4% in 2019. Among low-education midlife White persons, the percentage more than doubled, from 4.8% to 11.5%. Regression analysis revealed that (1) at the personal level, the strongest statistical predictor of extreme distress was "I am unable to work," and (2) at the state level, a decline in the share of manufacturing jobs was a predictor of greater distress. Conclusions. Increasing numbers of US citizens report extreme levels of mental distress. This links to poor labor-market prospects. Inequality of distress has also widened. Public Health Implications. Policymakers need to recognize the crisis of an ever-growing group of US citizens in extreme distress. (Am J Public Health. 2020;110:1538-1544. doi: 10.2105/AJPH.2020.305811)

FULL TEXT

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In this article, we document evidence of rising levels of extreme distress in the United States between 1993 and 2019. We also demonstrate widening inequality of distress. The article builds upon previous research on ill-being in the United States1 9 and previous literature on mental health and happiness across time and age group.10-21 Some of this work can be traced back to Easterlins ideas15,16 on the weak connection in modern society between economic growth and human happiness. Most research has focused upon the representative citizen-that is, upon the mean level of well-being.

Stimulated particularly by the work of Case and Deaton, a new branch ofresearch- one concerned explicitly with life and death among disadvantaged citizens-has recently emerged.12,13 This modern literature considers the possibility that there are increasing numbers of deaths of despair among midlife White US persons with low levels of educational attainment. Although it is accepted that premature mortality has gone up among this segment of the population, what is still contested is the full explanation.9 The deathsof-despair thesis is that some in the United States have become particularly unhappy with their lives and have reacted by committing suicide and taking dangerous quantities of opioids and alcohol. Consistent with aspects of this idea is work by Graham et al.18-21 Other social scientists and medical researchers have discussed complementary evidence, often focusing on the loss of lower-skill jobs in the United States and on citizens who are in midlife.22-25

Yet is it actually true that extreme mental ill-being has become more common over recent decades in the United States? Ifso, has that happened particularly strongly among White, low-education, midlife citizens? 14 The later analysis is an attempt to address these questions. It connects to earlier-cited references and a range of modern writings on despair,26-28 midlife unhappiness,11,25,29,30 depression,31 and the possibility of midlifecrisis phenomena.32-34

In this study, we could not in a literal sense examine despair. In our data, there was no way to measure that concept in a consistent way from the start of the 1990s-partly because a definition of despair arguably implies something subtle about expectations of the future. Even if the next generation of statistical surveys could ask an appropriate question (perhaps with a wording such as how often would you say that you have moments of despair in everyday life?), that would presumably still not make it possible to understand despair, in a genuinely retrospective sense, in US history.

We therefore pursued a different avenue. This article offers evidence that there was an apparently inexorable rise in a proxy for extreme distress within the US population. The proxy captures, ifno doubt imperfectly, a sense of exceptional bleakness of life. We then inquired into a possible mechanism. We explored an economic-loss hypothesis- namely, that extreme distress among a generation of low-education White individuals in the United States has been triggered in part by those individuals observing the decline of manufacturing jobs in the area where they live. This type of hypothesis, emphasizing financial insecurity and disappointment, has been suggested in previous research.12(p15081)

Even though we held a large number of independent variables constant in the later empirical analysis, and we performed various statistical checks, this study used observational data and was not able to establish truly definitive cause-and-effect findings with the persuasiveness of a randomized trial. We hope that our article contributes toward that longer-run ideal.

METHODS

We used data from the Behavioral Risk Factor Surveillance System (BRFSS) from survey years 1993 to 2018. Information in the survey is collected monthly, by telephone, with a standardized questionnaire and with technical and methodologic assistance from the Centers for Disease Control and Prevention (CDC). The BRFSS collects state data about US residents regarding their health-related risk behaviors, chronic health conditions, and use of preventive services.

The data set provides information on more than 8 million US citizens, randomly sampled between 1993 and early 2019. One particular BRFSS question asks individuals, "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" This is the question we exploited. We concentrated on, and classified as in extreme distress, those people who gave the highest answer feasible in the BRFSS survey (namely, 30 days out of 30) and who thus directly signaled, in a sense, that "every day of my life is a bad day." To our knowledge, researchers have not previously focused on this extreme point on the BRFSS scale.

Established in 1984 with 15 states, BRFSS now collects data in all 50 states as well as the District ofColumbia and 3 US territories. We made use of data files from 1993 because that is the year the key question on bad mental-health days was first asked. Sample sizes increased from around 100 000 in 1993 to 450000 in 2018.

The 2011 survey saw a change in weighting methodology and the addition of cell phone- only respondents (see the Appendix material, such as Table G, available as a supplement to the online version of this article at http:// www.ajph.org), because an increasing number of US citizens were known to be using cell phones. Evaluations conducted by CDC using 2010 and 2011 BRFSS data indicated that the addition of cell phone-only households improved survey coverage for certain population groups. For example, it was found that the proportion of interviews conducted with respondents with lower incomes, with lower educational levels, orwho were in younger age groups increased, because these groups more often exclusively rely on cellular telephones for personal communications.

Case and Deaton13 reported, in their Figure 20, the proliferating levels of morbidity in the United States. They used the BRFSS up to 2013 and 2 other data sources for people aged 45 to 54 years, who were White and non-Hispanic. Case and Deaton also offered evidence from the National Health Interview Survey and the National Health and Nutrition Surveys. One concern, however, is that estimates for 2011 to 2013 may be biased upward by the alteration in sample design. For example, the authors found that the mean number of days that mental health was not good for 2011 to 2013 was 4.16, an increase of 1.06 from the mean for 1997 to 1999. They did not discuss sample design changes.

The BRFSS data files each year from 2011 were constructed by using information on landline and cell phones identified with the variable QSTVER. Values less than 20 indicate that the interview was conducted by landline phone, and 20 and higher indicate a cell phone interview. The incidence of extreme distress was higher among cell phone users, but the gap narrowed over time. Most of the sample are cell phone users at this point, as older persons are adopting cell phones in higher numbers. Cell phone use accounted for 14% of the sample in 2011 compared with 63% in 2018. In post-2011 regressions, we included a cell phone dummy, which came in positive and significant in extreme distress equations.

We also mapped in data on manufacturing jobs for the state·year cell from 1993 to 2019 using seasonally adjusted data on establishments from the Bureau of Labor Statistics from the current employment statistics (https:// www.bls.gov/data). We downloaded nonfarm employment data by state and year, which allowed us to construct the proportion of nonfarm employment in manufacturing industry. We averaged the monthly data in each year. In 2019, we averaged the data from January through July. There has been a decline in manufacturing employment in the United States since 1939. Manufacturing jobs were then at a high of 19.5 million and declined steadily to 11.5 million in March 2010 but picked up subsequently. Manufacturing employment as a percentage of nonfarm employment peaked at 38.7% in 1944; it has steadily declined since then and at the end of 2019 was 8.5%. The ratio defined as manufacturing to nonfarm employment rates show declines in every state. Rates more than halved, for example, in states as far apart as Florida and Massachusetts. Further details are in Table A (available as a supplement to the online version of this article at http:// www.ajph.org).

States with high rates of extreme distress, such as West Virginia, have also recently had high suicide-by-overdose deaths. The Appendix, as in Figure F, shows percentage numbers in extreme distress by state, against poisonings, using CDC data from the following source: https://www.cdc.gov/nchs/ pressroom/sosmap/drug_poisoning_mortality/ drug_poisoning.htm.

We estimated linear least-squares regression equations. However, equivalent results, using a Probit estimator, are provided in the Appendix, as in Table B. The main dependent variable was the probability of reporting extreme distress as measured by saying "30 days out of 30" on the key BRFSS question. The Appendix gives background results for some other dependent variables, such as the probability of saying "I am unable to work."

Later regression analysis allowed for a large set of covariates (e.g., adjusting for people's demographic characteristics, employment type, educational characteristics) at the personal level and, in 1 case, at the state level. The estimates have standard errors that are corrected for clustering in a way equivalent to the use ofmultilevel modeling. As is well known, failing to recognize hierarchical structures would produce standard errors of parameter estimates that are likely to be underestimated, leading to overstatement of statistical significance.

We also included a full set ofstate dummy variables, of year dummies, and of age dummies in later regression equations. These adjust for any deep unchanging differences (such as climate) across different US states, for any US-wide annual influences (such as movements in the value of the dollar against other currencies), and for any effects from biological age.

RESULTS

The first finding is shown in Table 1. It is that the aggregate level of the study's extreme-distress proxy-effectively "every day of my life is a bad day"-has trended upward since the early 1990s. In 1993, the proportion ofUS adults with a reported level of distress this severe was 3.6%. In 2019, that proportion had increased to 6.4% of US adults. Figure 1 provides an illustration by gender. There was a fairly smooth time trend, both for men and women, among the adult population. Table 1 gives exact numbers for every year and subgroup. Each column of Table 1 reveals a similar picture of increasing levels of extreme distress. As commonly found in psychological distress research, women exhibited greater levels, even though men were more prone to convert distress into the physical act of suicide.11,17

A further result emerges from Table 1. Importantly, the growth in extreme distress was only slightly faster than average among those US citizens who have low educational qualifications (from 4.5% being classified as in extreme distress using our proxy measure in the early 1990s and then expanding to 8.6% in 2019). Hence, the trend in aggregate extreme distress was not driven solely by the disadvantaged portion of the US population.

However, 1 pattern stands out. In Figure 2 there is evidence of a marked increase in the extreme-distress proxy among White middle-aged US citizens who had no college education-from less than 5% of people in that subsample being in extreme distress in 1993 to more than 11% in 2019. There were increases in extreme distress among the other 3 midlife groups depicted in Figure 1 (those groups being Whites with at least some college, non-Whites with no college, and non-Whites with at least some college). Yet those 3 trend lines in Figure 2 are flatter. They imply only approximately a single percentage point extra over a quarter of a century. Therefore, 1 kind of inequality in distress had very noticeably accumulated. Something fundamental appears to have occurred among White, low-education, middle-aged citizens. It is important to record that Appendix Figure A shows that younger US citizens also exhibited growth in extreme distress, although somewhat less strongly than for midlife citizens.

From these data, the United States appears to have a problem of middle-aged extreme distress that stems, as a matter of statistical composition, disproportionately from within the White, low-education section of the US population. This finding seems consistent with the related work by Graham.18 Further graphs, for different subsamples, including Figures A and B, are provided in the Appendix.

Table 2 provides regression equations. Here, the dependent variable was a measure of extreme distress (coded as 1 for those who reported 30 bad days out of 30, and zero for all those who did not). The sample size in Table 2 was approximately 8.1 million adults; this is for the full sample ofobservations. The mean of the dependent variable in, for example, the first column of Table 2 was approximately 0.05 (that is, 5% of people were classified by our proxy measure as being in extreme distress). Appendix Table C also gives a regression for low-education midlife adults, for Whites and non-Whites. Appendix Table E allowed for cohort dummies, and Appendix Table F gives the complete specification of Table 2's regression equation in the article.

Table 2 suggests that an influential role was being played by the labor market. At the personal level, for example, "unable to work" entered with the single largest parameter estimate (0.176, with a tightly defined 95% confidence interval). Two unemployment variables-1 for out of work for a year or less and 1 for out ofwork more than a year-also had large positive parameter estimates in an extreme-distress equation. These facts are reminders of the potential importance of jobs as demonstrated in research by Krueger22 on the phenomenon of "disappearing" work and workers in the United States.

It might be conjectured that "unable to work" was not really about the labor market but was instead proxying some form of disability. On probing that, however, Appendix Table G reveals a strong role for "unable to work," even after correcting for a large number of health conditions (for the limited subsample of time periods in which BRFSS data allow that to be done in a consistent way).

A range of other personal variables, especially for education and marital status, had statistically significant effects in Table 2. Non-White persons in the United States reported lower levels of extreme distress, ceteris paribus, than did Whites. It is not possible to be certain why this was, although a reviewer of this article pointed out that Black persons in the United States may, for long historical reasons, tend to have different expectations. Age dummies (and year dummies and state dummies) were included in the equations but not reported explicitly in Table 2. However, Table E in the Appendix reports the full specification for the extreme distress regression equation. It also gives the estimated hump-shaped age profile, which is reminiscent of a quadratic shape in general well-being discussed in other sources. Broadly similar patterns in personal-variable parameter estimates were found in the subsamples in Table 2.

What is the role of the external labor market in the geographical area where a person lives? Table 2 also includes 1 state-level variable: the share of workers in manufacturing industry in the state. It enters with a statistically significant parameter estimate. The size of the parameter estimate, of -0.044 in the first column, implies that a drop of approximately 10 percentage points in a state's share of manufacturing workers would be associated on average with slightly less than a 0.5-percentage-point increase in extreme distress in that state (from a mean level of approximately 5 percentage points). It should be emphasized that this is to be thought of as a state fixed-effects panel estimate; it is not an elementary crosssectional pattern in the data.

Table 2 shows that there was a noticeable difference in the size of the parameter estimates on the state manufacturing employment variable. For White workers, the parameter estimate was -0.066, and the 95% confidence interval comfortably excluded the value of zero. However, for non-White workers in Table 2, it is not possible to reject the null hypothesis of zero on the state manufacturing variable, and the point estimate itself was positive. This asymmetry seems consistent with ideas proposed by Case and Deaton.12,13

The Appendix, for example in Table C, gives further results for low-education midlife US citizens. Those imply (as in b = -0.211 in Table C) that a 10-percentage-point drop in the share of manufacturing jobs in a state would be associated with a 2-percentagepoint increase in extreme distress among White, low-education, midlife US adults. We observed a somewhat weaker result of this sort for non-Whites (the sign in both cases was negative).

The statistical results in Table 2 should be kept in perspective. First, they cannot be viewed as causally definitive. They rest upon correlations in observational data. Second, the findings on the role of state-level manufacturing shares do not account for the majority of the aggregate increase in extreme distress in the United States. The year dummies (not reported, although they are given in the Appendix, as in Table F) hadlarge positive parameter estimates near the end of the 1993 to 2019 period. This means that much remains to be discovered.

DISCUSSION

This study was an attempt to decide whether exceptional levels of mental distress have become more common in the United States since the 1990s. We cannot, in a strict sense, adjudicate on the much-debated hypothesis that US "despair" has gone up. Nevertheless, this article proposes, and reports the patterns in, a new proxy measure for extreme distress (by examining the subsample of the population who in effect say "every day of my life is a bad day"). Since the early 1990s, the article's proxy measure has increased. The growth in this extreme indicator of distress has occurred particularly noticeably among White, midlife, low-education men and women. The Appendix provides other kinds of subsample checks, such as in Figure A.

A natural possible concern remains to be considered: have US citizens simply changed the way they use language, so that they merely "say" that they are more distressed since the 1990s? Because we studied reported human feelings, it is impossible to be certain that such an objection is misplaced. However, there is a related point, one that might be viewed as relevant and a potential counterobjection. This study demonstrated that some groups have had markedly faster growth in the measured level ofextreme distress than others (this is true even after adjustment for cohort effects), which seems inconsistent with an explanation that relies on the idea that there has merely been a broad-based alteration in the use of English-language words.

One valuable study that does address a version of this article's research question is by Goldman et al.2 That study used 2 sweeps of the Midlife in the United States study data covering approximately 1995-1996 to 2011- 2014. By using an interaction-test statistical structure, it produced the interesting finding that US citizens of lower socioeconomic status have had declining mental health and well-being relative to those of higher socioeconomic status. The size of sample was fairly small (approximately 4600) compared with the one used in the current article, but it is arguably one of the closest studies in the same spirit. A difficulty for the analysis of the broader debate is that the authors were unable to assess the role of racial/ethnic influences and, thus, could not make a ruling on whether trends were different for, say, White US citizens in midlife.

To probe the possible roots of the expansion in US distress, we considered an "economic-loss" hypothesis. In our analysis, we found evidence that the role of the labor market may be central to the growth of midlife extreme distress. We found that (1) at the personal level, the strongest statistical predictor of extreme distress was "I am unable to work," and (2) at the state level, a decline in the share of manufacturing jobs is a predictor ofincreased extreme distress. These findings seem to mesh with other evidence on the psychological damage created by economic insecurity.10,15

Limitations

This study could not say whether severe distress leads to death itself!9,12,13,26,34 However, it is to be hoped that the article's evidence is of independent and complementary interest to public health researchers, health economists, and other medical and social scientists.

Public Health Implications

This study revealed that the modern United States has an ever-rising percentage of citizens who report extreme levels of mental distress. Some groups have suffered particularly harshly. More than 11% of White, low-education, midlife US citizens now report that they had major mental and emotional problems in all 30 of the last 30 days. The upward trend in exceptional distress shows no sign of slowing (see Figure 1, both for men and women). It demands policy-makers' attention.

CONTRIBUTORS

The authors jointly originated the idea for the project. D. G. Blanchflower handled the data and estimated the regression equations. A.J. Oswald wrote the first draft. Both authors agreed on the final article.

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CONFLICTS OF INTEREST

Neither author had a conflict of interest.

HUMAN PARTICIPANT PROTECTION

The data used in this study were from a publicly available data set.

Sidebar

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Document 23 of 61

Community Resistance as Public Health Activism in Puerto Rico

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ABSTRACT (ENGLISH)

After nearly three years, Puerto Rico is still recovering from the consequences of these hurricanes. Since the summer of 20 19, it has also been dealing with political and economic bankruptcy, earthquakes, air pollution, and the COVID-19 pandemic.3,4 As we know in Puerto Rico. when a disaster strikes, it blows the leaves away from the rotten problems that lay beneath them. Rivera Joseph et al. suggest a human rights approach as a way to "assess the ongoing human rights violations of the quality of life to support millions of American citizens on the island."(p1512) I agree with the authors' rights-based approach, but such a response is warranted not because Puerto Ricans are US citizens but because we are humans. [...]the remedy for colonization is self-determination, a prerequisite to the full enjoyment of all other human rights. In their essay, Rivera |oseph et al. highlight a variety of human rights violations in Puerto Rico, including those affecting the right to water, electricity, and health care access; these are, in fact, well-documented inequities affecting people living in Puerto Rico.

FULL TEXT

See also Rivera Joseph et al., p. 1512.

In their ainhtic.il essay, Rivera |oseph et al. (p. 1512) provide a mechanism to respond to an argument raised after the impact of Hurricanes Irma and Maria: colonialism is the ultimate social determinant of health in Puerto Rico.1,2 The experience after these devastating hurricanes in the archipelago evidenced the calamities caused by centuries of oppression and other humanmade disasters. After nearly three years, Puerto Rico is still recovering from the consequences of these hurricanes. Since the summer of 20 19, it has also been dealing with political and economic bankruptcy, earthquakes, air pollution, and the COVID-19 pandemic.3,4

As we know in Puerto Rico. when a disaster strikes, it blows the leaves away from the rotten problems that lay beneath them. At this point, we could picture Puerto Rico as an island of leafless trees, but nothing could be further from the truth. Indeed, the aftermath of Hurricanes Irma and Maria in Puerto Rico drew attention to the long history of colonial neglect. Rivera Joseph et al. suggest a human rights approach as a way to "assess the ongoing human rights violations of the quality of life to support millions of American citizens on the island."(p1512) I agree with the authors' rights-based approach, but such a response is warranted not because Puerto Ricans are US citizens but because we are humans.

Moreover, the remedy for colonization is self-determination, a prerequisite to the full enjoyment of all other human rights. Selfdetermination means allowing the people of Puerto Rico to decolonize as they see fit, by seeking statehood, independence, or some other status. Furthermore, rather than "rebuilding the island" and "reconciling" all that has been lost, I propose an assets-based approach in which we sustain good practices for autonomy and move Puerto Rico from a pervasive relationship with the United States.

In their essay, Rivera |oseph et al. highlight a variety of human rights violations in Puerto Rico, including those affecting the right to water, electricity, and health care access; these are, in fact, well-documented inequities affecting people living in Puerto Rico. Structural changes to address these social determinants of health are needed. A rights-based approach is appropriate, but these changes will take time to be enacted and even more time to have an impact on the people of Puerto Rico. As these changes happen, our communities are using their grassroots knowledge and resources.

In Puerto Rico, communities are not waiting for governmental or political changes. Casa Pueblo serves as an example of how communities in Puerto Rico are not waiting fora systemic change and are thoughtfully taking action. For years, Casa Pueblo has worked on initiatives to achieve energy self-sufficiency based on local, clean, renewable resources. It has supported electrical microgrids in which each independent generator supports neighboring generators. Its work is environmentally conscious, helping reduce greenhouse gas emissions, which contribute to global warming. Casa Pueblo has supported the rebuilding of homes affected by Hurricane Maria with solar roofs that do not require the purchase of gasoline or diesel or the risks of transporting, storing, and using these fuels.5 This is social justice in action.

Similarly, farmers in Puerto Rico are responding to the old problem of food insecurity by building community capacity through food sovereignty advocacy. Food sovereignty is serving food advocates in Puerto Rico as a framework to understand the security, public health, and development repercussions of food-import dependency as well as to articulate a farmer- and community-centered model of food production.6 Several projects, such as El Departamento de la Comida, are serving as queerled model farms that host workshops on using permaculture and agroecology.

Despite the frustration, abuse, and compounding disasters, communities in Puerto Rico have embraced their quintessential role in public health by documenting their history and supporting organizations and the most vulnerable among them. Communities are working to ensure that we have the best conditions possible to keep the people of Puerto Rico healthy. Public health is political, and we are all called to do our part. Staying silent when our humanity is challenged is being complicit. ÂfPU

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CONFLICTS OF INTEREST

There are no conflicts of interest to disclose.

Sidebar

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Document 24 of 61

Rural Legal Deserts Are a Critical Health Determinant

Statz, Michele, PhD; Termuhlen, Paula, MD

ProQuest document link

ABSTRACT (ENGLISH)

We introduce "rural legal deserts," or rural areas experiencing attorney shortages, as a meaningful health determinant. We demonstrate that the absence of rural attorneys has significant impacts on public health-impacts that are rapidly exacerbated by COVID-19. Our work builds on recent scholarship that underscores the public health relevance of attorneys in civil and criminal contexts. It recognizes attorneys as crucial to interprofessional health care teams and to establishing equitable health-related laws and policies. Attorney interventions transform institutional practices and help facilitate the stability necessary for health maintenance and recovery. Yet, critically, many rural residents cannot access legal supports. As more individuals experience unemployment, eviction, and insecure benefits amid the COVID-19 pandemic, there is a need for attorneys to address these social determinants of health as legal needs. Accordingly, the growing absence of attorneys in the rural United States proves particularly consequential-because of this pandemic context but also because of rural health disparities. We argue that unlessa collaborative understanding of these interrelated phenomena is adopted, justice gaps will continue to compound rural health inequities. (Am J Public Health. 2020;110: 1519-1522. doi:10.2105/AJPH. 2020.305807)

FULL TEXT

Headnote

We introduce "rural legal deserts," or rural areas experiencing attorney shortages, as a meaningful health determinant. We demonstrate that the absence of rural attorneys has significant impacts on public health-impacts that are rapidly exacerbated by COVID-19. Our work builds on recent scholarship that underscores the public health relevance of attorneys in civil and criminal contexts. It recognizes attorneys as crucial to interprofessional health care teams and to establishing equitable health-related laws and policies. Attorney interventions transform institutional practices and help facilitate the stability necessary for health maintenance and recovery. Yet, critically, many rural residents cannot access legal supports. As more individuals experience unemployment, eviction, and insecure benefits amid the COVID-19 pandemic, there is a need for attorneys to address these social determinants of health as legal needs. Accordingly, the growing absence of attorneys in the rural United States proves particularly consequential-because of this pandemic context but also because of rural health disparities. We argue that unlessa collaborative understanding of these interrelated phenomena is adopted, justice gaps will continue to compound rural health inequities. (Am J Public Health. 2020;110: 1519-1522. doi:10.2105/AJPH. 2020.305807)

In 2017, the Legal Services Corporation, a federally established nonprofit organization, published The Justice Gap: Measuring the Unmet Civil Legal Needs of Low-Income Americans.1 The report estimated that 10 million rural Americans have incomes below 125% of the federal poverty line. Three quarters of low-income rural residents experience at least one civil legal problem in a year, and nearly one quarter face six or more civil legal needs in a year. Critically, the most common type of legal issue low-income rural residents report is access to health care.1 Despite the clear need, there is ample evidence that increasing numbers of rural individuals cannot access legal assistance in civil and criminal matters because of growing attorney shortages. Indeed, many rural US counties now have few attorneys, if any.2 Defined as rural legal deserts, this phenomenon is accelerated by the graying bar-attorneys who are retiring but not being replaced because of declining law school enrollments and limited specialized training for students interested in rural practice. These rural justice gaps are further exacerbated by the challenge of recruiting and retaining attorneys in areas with struggling local economies and underresourced educational and health care systems.

What results, then, is that only 14% of rural individuals receive assistance for their civil legal problems-a rate less than half the national average.1 Rural residents do not necessarily fare better when it comes to criminal matters. For instance, because ofa shortage in defense counsel, rural criminal defendants in Wisconsin have to wait as many as two months before receiving a public defender.3 In rural tribal courts, many of which cannot afford to provide public defenders to tribal litigants, individuals are nearly always self-represented.4 The absence of legal counsel renders individuals experiencing housing precarity, intimate partner violence, or opioid addiction further vulnerable. Access to critical supports and treatments is delayed, and family stress is compounded. Most simply, a lack of attorneys propagates a cycle of increased risk for further health problems.

Drawing on our work with rural patients and stakeholders, we identify this ruraljustice gap as a public health concern. Despite meaningful attention to social and structural determinants of health-many of which are intrinsically legal-and to physician-attorney collaboration, there has so far been little, if any, formal recognition ofthis unique rural disparity among public health researchers. This is surprising, given that the same US regions experiencing hospital closures and physician shortages, often characterized as rural health care deserts,5 are largely also classified as rural legal deserts. Although increasing numbers of policymakers are attending to these so-called deserts, their efforts are largely exclusive to either health care or law: so far no one has formally identified rural health care gaps as justice gaps, or vice versa. The consequences of this siloed approach are vast, particularly as we consider the health and socioeconomic effects ofthe COVID-19 pandemic. In response, we argue for meaningful acknowledgment of rural justice gaps as critical determinants of health. A collaborative understanding of this legal context will lend necessary insights to mitigating urgent rural health needs.

THE HEALTH-LAW INTERFACE

Recent public health scholarship has importantly documented the health outcomes of exposure to the US criminal justice system.6 It has likewise underscored the need to advance research aimed at improving health outcomes for criminal justice-involved populations.7 Other work has highlighted the public health effects of what are generally understood as civil legal needs, among them substandard housing, benefits or wage disputes, food insecurity, and education and employment barriers.8 10 These issues are commonly identified as social and structural determinants of health and often discussed in the context of medical-legal partnerships (MLPs).

This scholarship underscores the public health relevance of courts and court personnel in the context ofboth criminal and civil matters. It recognizes attorneys as valuable members of interprofessional health care teams, as MLP attorney interventions lower emergency room visits, decrease health care avoidance stemming from concerns about health insurance and costs, and reduce stress and increase personal well-being.11,12 Recent public health research also appreciates how attorneys' strategic litigation can improve or enforce laws that influence health.13 At a fundamental level, this awareness reflects a principle of medical ethics, namely that physicians respect the law and recognize their responsibility to seek changes to those requirements contrary to the best interest of 14 patients. Even when not formally involved in the health care setting, legal assistance powerfully mitigates and even prevents health issues. Significantly, these complex needs are not deferred during a pandemic. Rather, rapidly growing numbers of individuals are facing unemployment, eviction, insecure benefits, and limited or restricted access to health care systems. In rural regions already familiar with this precarity, the trajectory of COVID-19 has magnified deep sociospatial vulnerabilities. Presently, the rate of US cases and deaths appears to be increasing more rapidly in rural areas, with rural regions described as a tinderbox for SARS-CoV-2. Rural residents are older, experience more chronic conditions, and are more likely to be essential workers and at a greater risk for exposure.15 At a structural level, many rural communities also contend with underresourced or even shuttered hospitals; labs, grocery stores, and pharmacies "at the end of the supply chain"; and limited or absent infrastructure necessary for telehealth.16

RURAL HEALTH AND LEGAL DISPARITIES

As they pertain to the rural United States, the health and legal consequences of the COVID-19 pandemic must be situated within a broader context of poverty and structural vulnerability. Rural US poverty rates have exceeded urban poverty rates every year since 1959, and persistently highpoverty counties are overwhelmingly rural.2 Migrant farm workers may endure substandard housing and abusive working conditions. The elderly, disabled, and veterans are all disproportionately represented in the rural United States, and all need diverse supports. American Indians and Alaska Natives are often rural and contend with high poverty rates, health inequities, and a complex interplay of state, federal, and tribal laws.2 Rural communities also disproportionately experience environmental hazards and degredation.2

It is perhaps unsurprising that rural regions exhibit marked health disparities, including poorer health outcomes than urban areas and what Cosby et al. describe as the "rural mortality penalty."17 Rural communities also face significant legal disparities when compared with metropolitan areas. Not only is there a shortage of private practitioners, but low-income rural individuals are often at a significant distance from nonprofit legal aid organizations, which tend to be centered in urban areas. Metropolitan regions, additionally, offer larger firms that can take on pro bono or "low bono" cases, better resourced law libraries, courthouses accessible by public transit, consistent digital connectivity, and law schools that may provide specialized free legal assistance through housing and family law clinics. Simply put, the same sociospatial aspects that affect rural community members' access to health care-vast distances, professional shortages, insufficient or nonexistent public transit, a lack of reliable communication tools- also limit their access to justice. These challenges are further exposed and exacerbated by the pandemic, as social-distancing requirements result in curtailed or eliminated public supports (e.g., Internet access at a local library) just as the need for electronic communication, secure document transmission, and remote court appearances grows.

THE PUBLIC HEALTH COSTS OF RURAL DESERTS

If not resolved in an appropriately multifaced way, legal needs compound existing health issues, and health needs impede access to justice. Without rural attorneys, health care professionals cannot refer patients to civil legal aid or an immigrant advocacy organization. There are also fewer prospects for medical-legal partnerships-a reality reflected in the relative dearth of literature on rural MLPs.18 In rural legal deserts, there are fewer attorneys to advocate rural health at a policy level, either through local impact litigation or through systematic public health law. Of course, the absence of rural health providers proves just as consequential to the justice system. For instance, the rural per capita opioid overdose rate is 45% higher in rural than in urban areas,19 and treatment of chemical dependency is often delayed if a rural individual is involved in the criminal justice system and must wait for months to get a public defender. Not only does this leave an individual addicted to opioids in a highstress situation with a greater risk of reoffense, but she or he also has a lower likelihood of treatment options in a rural region. Many rural areas do not have a certified opioid treatment program, and only 3% ofphysicians with waivers to prescribe buprenorphine and methadone operate in rural communities.20

Other justice supports, including drug or driving while intoxicated courts, family dependency treatment courts, and mental health courts, likewise rely on health care professionals for diagnoses, assessments, protocol development, and education. These interprofessional courts are invaluable, and yet there are geographical differences in who benefits the most from them. The effectiveness of rural drug courts arguably lags behind urban courts, which may provide more culturally specific services, have larger program budgets, and are more likely to offer adjunct health, mental health, and social services.21

Just as the absence of rural attorneys influences the public's health, the absence of rural health care professionals uniquely impedes justice delivery. This is particularly significant now, as already limited health resources in the rural United States are redirected to other life-saving activities. These professional deserts add credence to the notion that disparities in access to justice and health care are a critical, deeply intertwined public health concern. With fewer opportunities for interprofessional advocacy on behalf of vulnerable community members, both individuals and systems are affected.

MOVING FORWARD

Amid the rampant physical, financial, and emotional hardships wrought by the COVID-19 pandemic, Americans are asking, "If I can't afford to pay all of my health care bills, which should I pay first?" "If I am unable to work from home [a reality for many rural Americans experiencing technology deserts], will I still get paid?" "What if I can't pay my utilities?" "What if I don't feel safe in my home?" These questions demonstrate legal needs and personal values, and they intimately involve the health and well-being of individuals, families, and communities. In rural areas experiencing shortages ofhealth and legal professionals, answers to such multidimensional questions are increasingly rare. We need to collaboratively address concomitant rural health care and legal deserts-and now more than ever.

As a first step, we propose dismantling the professional boundaries implicit in desert designations. Rural public health and justice challenges are deeply intertwined and together must acknowledge the unique sociospatial and structural barriers rurality presents. Any professional initiative that neglects this complex rural context will be insufficientatbest, impossible at worst. Consider, for instance, that the same legal scholarship that identifies public health as a key component of rural justice administration neglects growing rural attorney shortages.22 Although we commend the call for rural lawyers to incorporate public health law practices into their advocacy, rural lawyers must first be there. We accordingly encourage health and legal professionals to mindfully consider each other's presence and capacity. This requires conscious commitment: even in a small community, dwindling attorney numbers may not be evident to health professionals-especially if providers are overwhelmed or health systems are experiencing high turnover. We also firmly acknowledge the complex challenges that each sector individually confronts: declining law school enrollment, for instance, and prevailing payment models and prescription drug costs.

Merely expanding our conceptualization of rural deserts, however, necessarily grows a new professional rural spatial imaginary, or a new way of representing and talking about rural spaces. This is crucial for addressing both the immediate local and long-term structural consequences of health and justice gaps across the rural United States. What might this look like? For one thing, public health could widen its scope of care to include justice gaps. This could be as basic as enhancing metrics, such as including the availability ofattorneys as a social and economic factor in the "county health rankings &roadmaps" tool.23 It might mean that the US Health Resources and Services Administration, which in 2014 recognized civil legal aid as an enabling service and allowed health centers to use funding for MLPs, additionally considers the presence of attorneys as relevant to health professional shortage areas. Most simply, we must broaden our conception of what-and who-makes a healthy public.

Relatedly, we must scale up our interprofessional partnerships in light ofprofessional shortages. If an MLP is impossible owing to a dearth of local attorneys or clinic closures because of consolidation, then broader collaborations must be mobilized across regional legal aid organizations, community health clinics, firms willing to provide pro bono or low bono assistance, and state bar and primary care associations, as with the Montana Health Justice Partnership.24 A potential drawback of this suggestion is that it demands more of already overburdened health care and legal professionals. Accordingly, we must extend this professional rural spatial imaginary far into the future and beyond the health care and legal professions. This is, after all, the ultimate goal: that we understand that the solutions to health services and justice gaps-and likewise to technology, mental health, dental, and other rural deserts-are as interrelated as the problems themselves.

This means advocating initiatives and policies that improve the health ofa community and help recruit and retain professionals. An immediate example ofthis is expanded rural broadband and cellular coverage. As the COVID-19 pandemics has demonstrated, rural residents are among the likeliest to need and benefit from telehealth and telelegal solutions- and yet are the least likely to have consistent access to broadband Internet or cellular service.2 A longer-term example is the collective advancement of rural pipeline programs in which students engage law and health care as intrinsically related, observe the participation of attorneys and health care providers on equal justice committees and treatment courts, and find public health and legal professionals who reflect their identities and experiences. This is critical to innovating professional education and addressing complex, deeply interrelated needs.25 Relatedly, more medical and law schools must generate pathways to rural practice by selecting students who understand rural communities and by developing sustained and immersive rural educational experiences.

We have introduced rural justice gaps as a critical social and structural determinant of rural health. This adds dimension to prevailing understandings of rurality and rural health care provision, and it contributes a novel, spatially specific interpretation of interprofessional care. We make this argument at a critical time; growing numbers of individuals urgently need health care and legal supports amid the COVID19 pandemic. For rural health and justice systems that are underresourced and over capacity, these supports were already lacking. Without a meaningful recognition of such interrelated phenomena, justice gaps will continue to compound rural health inequities. Yet by correlating rural professional shortages, we demonstrate that acknowledging one rural gap-namely legal-provides critical context and a better understanding of other barriers to rural health care. This is a necessary first step, one that demands a collaborative approach to addressing urgent rural health disparities.

CONTRIBUTORS

M. Statz conceptualized and led the writing of the article. P. Termuhlen contributed to the writing. Both authors revised the article and reviewed and approved the final version.

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CONFLICTS OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this article.

Sidebar

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Katrina's Lesson:Time to Imagine an After COVID-19

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ABSTRACT (ENGLISH)

Some events are so powerful they mark our lives-before and after. In New Orleans, Louisiana, the split between what existed before and what came after is marked by Hurricane Katrina.

Hurricane Katrina started as a tropical depression in the Caribbean on August 23, 2005. It initially made landfall at the southern tip of Florida as a category 1 storm before spiraling back over warm Gulf of Mexico waters, where it intensified. It made landfall for a second time days later at the border between Louisiana and Mississippi before moving inland, slowly weakening. Many fled for safety as the storm grew and barreled toward the Gulf Coast. Others remained, some unwilling to leave, many more unable to leave because of lack of transportation, health concerns, or lack of financial resources. In the aftermath, the world watched as the levees failed and the floodwaters rose. The wind, flooding, and storm surge mowed down much of the Gulf Coast. Everyone in New Orleans has a story about after. Some are heartbreaking. Lost loved ones. Days spent in miserable conditions desperately waiting for help. Patients on hospital rooftops. The sick doing theirbest to care forthe sickest. Displacement to new cities, unprepared and knowing no one.

FULL TEXT

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Everyone in New Orleans has a story about after. Some are heartbreaking. Lost loved ones. Days spent in miserable conditions desperately waiting for help. Patients on hospital rooftops. The sick doing theirbest to care forthe sickest. Displacement to new cities, unprepared and knowing no one.

Even now, 15 years later, after is still visible. You see it in the flood markers on homes and businesses, plaques or painted lines in remembrance. In some cases, actual flood lines still remain.

Its apparent when you drive through some neighborhoods, such as the Lower Ninth Ward. Driveways, still intact, lead to empty lots where homes once stood. Entire school buildings remain shuttered and unused. The former city hospital, affectionately known as Big Charity, stands empty, a colossal, one million square foot Art Deco building-a reminder of the New Orleans of before- awaiting a better after.

Beyond the physical remains of the storm, Katrina looms large in local minds. Not a day goes by that the devastating hurricane isnt mentioned in some context. Real estate listings highlight never flooded, a badge of honor given that 80% of the city took on water. Many discussions still start with, Well, before Katrina, we . . . . Even COVID-19 brings reminders of the storm, once again Black and Brown bodies bearing a disproportionate burden of the devastation.

Some of what came after, however, has been positive. Hurricane Katrina served as a watershed moment-no pun intended. The US Army Corps of Engineers spent $14 billion to rebuild and reimagine the levees and network ofbarriers designed to hold back storm surge and protect the city from flooding. Some neighborhoods were rebuilt, often using better, more storm-resistant techniques. The citys and states emergency management systems became better organized and, importantly, made plans to help individuals unable to evacuate during a future storm.

The articles in this special section outline changes that occurred in reaction to Katrina. They describe how networks of public health professionals and government agencies used systems thinking to reimagine how this region prepares for and responds to emergencies of all kinds.

Still, theres a lot of work to do.

We are in the midst of another before and after moment, although we havent quite reached the after. It can be tempting to look longingly to the before of COVID-19. But we must resist the urge to look back. Instead we must look ahead and imagine a new after. A better after. An after worthy of the sacrifices of those who will not survive to reach it.

This is what Katrina must teach us. >4jPU

11 Years Ago

Mental Illness Among New Orleans Residents Displaced by Hurricane Katrina

Our results revealed very high levels of mental illness among residents of New Orleans who survived Hurricane Katrina.... [Wje determined that nearly 40% had probable mental illness 1 year after the storm.... These rates were substantially higher than rates of mental illness prior to Hurricane Katrina... [and] the prevalence of mental illness may not have declined in the year following. ... Our findings suggest that a particularly important factor . . . was the effect of severe damage to individuals' homes in New Orleans Apart from the financial losses, survivors whose housing was severely damaged or destroyed may have been unable to return to their neighborhoods or even to their city.

From AJPH, Supplement 3, 2009, p. S730.

14 Years Ago

Hurricane Katrina as a Public Health Disaster

Hurricane Katrina made it evident that natural disasters occur in the same social, historical, and political environmentin which disparities in health already exist. The hurricane was only the disaster agent; what created the

magnitude of the disaster was the underlying vulnerability of the affected communities. . . .These communities experienced social disparities in health before Katrina; their health status was linked to the quagmire of poverty, poor housing, lack of economic opportunities, and discrimination in which they lived.... Katrina exposed a broader, social, political, and economic system that does not work for the poor.... Rebuilding necessitates a true public health approach that works with communities to create new capacity to actively engage in the promotion of their own well-being.
From AJPH, February 2006, p. 204.

DETAILS

Subject:	Hurricanes; Tidal waves; COVID-19; Storm surges; Floods; Public health; Mental disorders; Flooding; Levees; Natural disasters; Disasters; Coronaviruses; Neighborhoods; Safety; Floodwater; Tropical depressions; Storms
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Document 26 of 61

Outbreak of Measles in a Residential Home for the Intellectually Disabled in Singapore in 2019

Kok, Valerie T J, MPH [1] ; Chiew, Calvin J, MPH [1] ; Ong, Sean Wei Xiang, MBBS [2] ; Mandar, Khine, MPH [1] ; Lee, Anne, BSc [1] ; Foo, Kelly, MPH; Cui, Lin, PhD; Ng, Yi Kai, PhD; Pung, Rachael, MSc; Lee, Tau Hong, MBBS; Said, Zubaidah, MSc; Lin, Raymond, MBBS; Lye, David Chien, MBBS; Leo, Yee-Sin, MPH; Lee, Vernon, PhD [1] Communicable Diseases Division, Ministry of Health, Singapore [2] National Centre for Infectious Diseases, Singapore

ProQuest document link

ABSTRACT (ENGLISH)

A measles outbreak involving 19 adults in a home for the intellectually disabled occurred in Singapore in 2019. Further investigation, including a serological survey, was conducted. Mass vaccination and infection control measures were implemented, terminating further secondary transmission. Seropositivity among residents aged 40 to 49 years (90.7%; 95% confidence interval = 78.4%, 96.3%) was lower than among the Singapore adult population (P<.001). This sheltered population, like others previously reported in the literature, had lower measles immunity than the general community, possibly because of limited social interaction. Targeted catch-up vaccination for similarly vulnerable populations should be considered. (Am J Public Health. 2020;110:1532-1534. doi:10. 2105/AJPH.2020.305820) An outbreak of measles occurred in a home for intellectually disabled adults in Singapore in 2019, involving 19 patients (16 intellectually disabled residents, two staff members, and one day-activity center client; Appendix, Figure A, available as a supplement to the online version of this article at http://www.ajph.org). This was unexpected, as measles vaccination was implemented in the national childhood immunization program in Singapore in 1975 and made compulsory in 1985.1 High natural immunity was expected in adults born before 1975, and the National Seroprevalence Survey in 2018 showed almost 100% measles immunity in adults aged 45 years and older (Ministry of Health, Singapore, unpublished data, 2018).

FULL TEXT

Headnote

A measles outbreak involving 19 adults in a home for the intellectually disabled occurred in Singapore in 2019. Further investigation, including a serological survey, was conducted. Mass vaccination and infection control measures were implemented, terminating further secondary transmission. Seropositivity among residents aged 40 to 49 years (90.7%; 95% confidence interval = 78.4%, 96.3%) was lower than among the Singapore adult population (P<.001). This sheltered population, like others previously reported in the literature, had lower measles immunity

than the general community, possibly because of limited social interaction. Targeted catch-up vaccination for similarly vulnerable populations should be considered. (Am J Public Health. 2020;110:1532-1534. doi:10.2105/AJPH.2020.305820)

An outbreak of measles occurred in a home for intellectually disabled adults in Singapore in 2019, involving 19 patients (16 intellectually disabled residents, two staff members, and one day-activity center client; Appendix, Figure A, available as a supplement to the online version of this article at http://www.ajph.org).

This was unexpected, as measles vaccination was implemented in the national childhood immunization program in Singapore in 1975 and made compulsory in 1985.1 High natural immunity was expected in adults born before 1975, and the National Seroprevalence Survey in 2018 showed almost 100% measles immunity in adults aged 45 years and older (Ministry of Health, Singapore, unpublished data, 2018).

INTERVENTION

Further investigation was conducted to investigate the reasons behind the outbreak and to assess baseline seroprevalence at the home. Infection control measures and mass vaccination for residents and staff were conducted to contain the outbreak.

PLACE AND TIME

The investigation was conducted from June to July 2019 at the residential home, which is a building with six levels (Appendix, Table B). Most residents had limited mobility and required full-time supervision, and therefore were restricted to their designated floors with limited mixing between floors.

There is a day-activity center on the ground floor for intellectually disabled adults who live off-site and commute to the center each day for activities. Apart from occasional shared use of the hall on level 2, the centers staff and space were separate from the rest ofthe home, and there was no interaction between the two groups (Appendix, Figure B).

PERSON

There were 188 intellectually disabled residents and 93 staff members (including 54 foreigners residing at the on-site staff dormitory, who may have come from countries with varying childhood vaccination programs). The day-activity center had 52 clients and 17 staff members. The attack rate was 8.5% among residents, 2.2% among home staff, and 1.9% among day-activity center clients. Ofthe 16 infected residents, all were born in Singapore and 14 (87.5%) were born before 1975. The two infected staff members were from the Philippines. Most of the residents had Down syndrome, without other significant medical comorbidities. Table A of the Appendix summarizes the epidemiological and clinical data.

PURPOSE

Further investigation was conducted with the objective of understanding the predisposing reasons behind this outbreak, in order to prevent similar outbreaks from occurring in other settings.

IMPLEMENTATION

Upon identification of the index case, six close contacts born after 1975 without prior documentation of measles vaccination were given postexposure vaccination. The home was advised to actively monitor for new cases through daily symptom screening and to report and isolate suspected cases.

As more cases were reported, a field investigation was conducted, and data on demographics and movement history were collected to identify potential exposures. Staff members tending to symptomatic residents were advised to practice airborne infection control precautions. Residents with confirmed or suspected measles were isolated separately. Group activities and nonessential medical appointments were suspended.

On-site mass measlesmumps-rubella vaccination was subsequently implemented for all residents and staff with no documented prior vaccination. Blood samples for serology were obtained prior to vaccination. Consent was taken from individual staff and guardians of the residents. Nasopharyngeal swabs were collected from suspected patients and tested for measles by polymerase chain reaction (PCR; methods in Appendix).

Measles immunity was compared with data from the National Seroprevalence Survey of 2018 (ethics approval from National Healthcare Group Domain Specific Review Board, Reference 2018/00502), which tested 956 blood samples taken from a population-based cross-sectional health survey among adult Singapore residents. Sera were tested with the same methodology.

EVALUATION

Because two patients developed symptoms after the incubation period of measles (7-21 days)2 from the symptom onset of the index case, there was probably secondary transmission beyond the first generation ofcases.

Vaccination was completed for 237 residents and staff from the home and 84 clients and staff from the day-activity center. Mass vaccination was likely effective at mitigating the spread of cases beyond the second generation. The outbreak was declared over when there were no new cases for two maximum incubation periods (42 days) from the last case's symptom onset.

A total of 228 serological samples were collected from 145 home residents and 83 staff members (Table 1). Overall seroprevalence for measles was 97.8% (95% confidence interval [CI] = 95.0%, 99.1%), and higher among staff (98.8%; 95% CI = 93.5%, 99.8%) than residents (97.2%; 95% CI = 93.1%, 98.9%). All 32 Singaporean staff members were seropositive, whereas 51 of 52 foreign staff members (98.1%) were seropositive. The lowest seroprevalence among residents was observed in the cohort aged 40 to 49 years (90.7%; 95% CI = 78.4%, 96.3%), significantly lower than for the local adult population aged 40 to 49 years (P <.001) and the only group below the herd immunity threshold of 93% to 95%.

Epidemiological investigation revealed that the index patient visited a primary care clinic 11 days prior to symptom onset for an unrelated consult, and was exposed to a measles patient who was part of another outbreak and was seeking care. They had an overlapping period of 50 minutes in the waiting area, and this was the likely route of transmission.

Twenty cases tested positive by measles PCR, including 19 infected with outbreak strain (genotype B3) and one with vaccine strain after vaccination (genotype A). Rubella vaccine strain (genotype 1a) was detected in three suspected cases who developed rashes after vaccination (Table 2).

The genotype B3 viruses detected were genetically similar and belonged to subgenotype group 7, also detected in another local outbreak (Appendix, Figure C), confirming the suspected link between these outbreaks. This subgenotype was not present in Singapore earlier (National Public Health Laboratory, Singapore, unpublished data, 2019).

ADVERSE EFFECTS

We did not observe any adverse effects from the implementation of the program.

SUSTAINABILITY

Mass vaccination appeared to be successful in preventing further secondary transmission. Among 12 residents who were seronegative when the vaccination exercise was conducted, one resident developed measles genotype B3 infection four days after vaccination. Given the incubation period of measles, he was likely exposed before vaccination. There was one patient with vaccine-derived measles who presented with only fever and three vaccine-derived rubella patients who presented with only rash. The clinical presentation of these cases was mild, and they would likely not have been picked up were it not for active surveillance. Further study is required to determine the costeffectiveness of mass vaccination as an outbreak control measure in similar settings where there are groups of individuals with potential risk due to low herd immunity.

Our study had several limitations. Twelve residents were already infected before the serological survey, and those with documented evidence of two doses of measles vaccine did not have their serology taken, probably resulting in an overestimation of seroprevalence among home residents. Secondly, the sample size was small; larger studies in similar settings could be conducted to corroborate our findings and guide vaccination recommendations for these populations. Thirdly, not all eligible residents were sampled, as we had to balance timeliness of vaccination against the challenge of obtaining samples from intellectually disabled residents.

PUBLIC HEALTH SIGNIFICANCE

Residents aged 40 to 49 years had lower seroprevalence than the general population of the same age. We hypothesized that this group of residents were less exposed to natural measles during childhood because of reduced interaction with the community, that they could have missed the national vaccination program,3 and that they may not have attended regular or special education schools where proof of vaccination is required for registration and where school-based childhood vaccinations are conducted. A previous Japanese study similarly reported lower measles seropositivity (91.1%) in 120 patients institutionalized for severe motor and intellectual disability.4 There is risk of community introduction of measles to these small pockets of susceptible population, resulting in outbreaks.

These findings may be applicable to other sheltered or isolated populations, underscoring the special needs of such populations. Consideration should be given to providing booster or catch-up vaccinations among similar vulnerable populations. Preadmission screening for immunity to measles and other vaccine-preventable diseases should be considered in similar homes to prevent outbreaks. -4JPI-I

CONTRIBUTORS

V.T.J. Koh, C.J. Chiew, and S.W.X. Ong contributed equally to this article. V.T.J. Koh, C.J. Chiew, S.W.X. Ong, T. H. Lee, Y.-S. Leo, D. C. Lye, and V. Lee designed the epidemiological investigation. L. Cui, Y. K. Ng, and R. Lin conducted the laboratory testing. V. T. J. Koh, C. J. Chiew, K. Nandar, A. Lee, K. Foo, R. Pung, Z. Said, and V. Lee collected the data and conducted the data analysis. V. T. J. Koh, C. J. Chiew, and S. W. X. Ong drafted the manuscript. All authors read and approved the final manuscript.

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CONFLICTS OF INTEREST

The authors have no conflicts ofinterest to declare.

HUMAN PARTICIPANT PROTECTION

Consent was taken from individual staff and guardians ofthe residents. Approval by an institution review board was exempted, as the study was carried out as part of outbreak investigation and response authorized by the Ministry ofHealth, Singapore.

Sidebar

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DETAILS

Subject:	Laboratories; Infections; Population; Intellectually disabled people; Vaccines; Rubella; Immunization; Internet; Measles; Outbreaks; Confidence intervals; Genotype &phenotype; Herd immunity; Intellectual disabilities; Serology; Patients; Children; Adults; Residents; Epidemics; Public health; Vaccination; Childhood; Disease control; Social interaction; Polls &surveys; Birth order; Physicians; People with disabilities
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Pets in Comprehensive Disaster Planning: The Post–Hurricane Katrina Experience

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ProQuest document link

ABSTRACT (ENGLISH)

Before Hurricane Katrina, the City of New Orleans, Louisiana, had emergency preparedness plans that focused on the care of pets in shelters. With required evacuation of the city, pets of families without transportation or other options were left behind or became separated. Many people refused evacuation efforts to remain with their pets, some to their own peril. People take great risks by refusing to evacuate and by seeking to retrieve pets.1 Including pets in disaster plans can benefit pet owners' physical and mental wellbeing, ensure an adequate workforce, and prevent the spread of zoonotic diseases and other consequences of unattended pets. As a direct consequence of Katrina, Congress passed the Pets Evacuation and Transportation Standards Act of 2006 (PETS Act; Pub L No. 109-308, HR 3858). The PETS Act and related legislation at the national, state, and local levels provide authorization and resources for care of pets and planning for disasters and emergencies. Following the guidance of the PETS Act and lessons learned from the experience ofKatrina, the City ofNew Orleans prepared a new evacuation plan for humans and animals. Three years later, Hurricane Gustav put the new plan to the test. People without other means of transportation brought their pets to parish pickup points. Owners and their pets received bar-coded wristbands and had their information entered into databases. People rode on buses and pets rode on trucks destined for the same sites. The basic requirements of a functional plan were met: people understood the plan, an adequate number of carriers and vehicles were available for pets, and few pets were lost in the process.

FULL TEXT

Before Hurricane Katrina, the City of New Orleans, Louisiana, had emergency preparedness plans that focused on the care of pets in shelters. With required evacuation of the city, pets of families without transportation or other options were left behind or became separated. Many people refused evacuation efforts to remain with their pets, some to their own peril. People take great risks by refusing to evacuate and by seeking to retrieve pets.1 Including pets in disaster plans can benefit pet owners' physical and mental wellbeing, ensure an adequate workforce, and prevent the spread of zoonotic diseases and other consequences of unattended pets.1,2

As a direct consequence of Katrina, Congress passed the Pets Evacuation and Transportation Standards Act of 2006 (PETS Act; Pub L No. 109-308, HR 3858). The PETS Act and related legislation at the national, state, and local levels provide authorization and resources for care of pets and planning for disasters and emergencies. Following the guidance of the PETS Act and lessons learned from the experience ofKatrina, the City ofNew Orleans prepared a new evacuation plan for humans and animals.

Three years later, Hurricane Gustav put the new plan to the test. People without other means of transportation brought their pets to parish pickup points. Owners and their pets received bar-coded wristbands and had their information entered into databases. People rode on buses and pets rode on trucks destined for the same sites. The basic requirements of a functional plan were met: people understood the plan, an adequate number of carriers and vehicles were available for pets, and few pets were lost in the process.3,4

Ten years later and 350 miles west of New Orleans, Hurricane Harvey hit Houston, Texas. Animals were included in evacuation efforts, but not all of the lessons of Katrina and Gustav for pets were learned. State animal plans were not available online and local plans were not known to key officials.5 There was a shortage of pet shelters and available staff.6 The key underlying issues were a lack of coordination and databases and the lack of widespread training and exercises.

After Gustav and Harvey, New Orleans further revised its plans to include people with medical needs and to provide more details on plans for the care of pets. The city developed a special needs registry to identify people who would need extra assistance because of medical or mobility issues. The registry includes information about pets. Because medical shelters do not allow pets, the Louisiana Society for the Prevention of Cruelty to Animals (LA-SPCA) will take custody of pets in the registry, which will then go to a women's prison that operates a pet shelter or an animal hospital for pets with medical needs. To ensure appropriate pet shelters and available staff, the New Orleans Health Department and LA-SPCA now work with each proposed shelter to prepare for the care of pets, including cohabitation of people and pets where appropriate, and to address any concerns.

As is the case for most cities, New Orleans' plan and system for pets focuses on cats and dogs. Federal Emergency Management Agency's (FEMA's) definition of household pets also includes birds, rabbits, rodents, and turtles. It does not includes other reptiles, amphibians, fish, insects, arachnids, or farm animals. Subject to owners having proper cages and the ability to manage temperature control, New Orleans can manage some additional animals. However, only care for pets on FEMA's list is available for emergency reimbursement. State and local plans should all be aware of FEMA rules. The rules themselves provide a checklist of items for inclusion in plans: supplies, labor, equipment, emergency veterinary services, transportation, shelter safety and security, cleaning, restoration, and cataloging and tracking systems. Properly documented and reasonable costs of evacuation and sheltering of pets are eligible for FEMA reimbursement.

Training and practice are essential components of planning. Louisiana has developed training for staff and volunteers and protocols to assist pet owners. Public health staff now conduct annual training sessions for pet owners and shelter volunteers, sessions that were previously only available to evacuation or fire department personnel. Among the seven Medical Reserve Corps units in Louisiana, the Louisiana State Animal Response Team Veterinary Medical Reserve Corps is statewide and dedicated to the care of animals. The Animal Response Team Veterinary Medical Reserve Corps trains people for shelters where animals will land and trains people to manage all of the required paperwork. Annual exercises include triage, tracking, and moving to shelter sites.

There are a number of guides available for communities to use in developing plans.1 New Orleans has made its plans and recommendations for pet owners available online.7 Rather than starting from scratch, the New Orleans model has been tested and can be modified by other communities as bases for their own plans.

Given what we now know about the importance of pets in the lives of families and the actions that can be taken to protect pets and families, good public health preparedness needs to include planning and training for pets. The lessons learned in New Orleans have resulted in plans that are available to communities at risk for disasters.

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CONTRIBUTORS

The authors contributed equally to this editorial.

CONFLICTS OF INTEREST

The authors have no conflicts ofinterest to declare.

Sidebar

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DETAILS

Subject:	Hurricanes; Animal shelters; Evacuations &rescues; Public health; Disasters; Shelters; Pets; Disaster management; Reptiles &amphibians; Emergency preparedness; Dogs; Animal welfare; Zoonoses; Evacuation; Legislatures; Transportation; Cities; Evacuation of civilians; Motor trucks; Natural disasters; Trucks; Legislation; Animal human relations; Reimbursement; Planning
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Document 28 of 61

Impact on Nonfirearm Deaths of Firearm Laws Affecting Firearm Deaths: A Systematic Review and Meta-Analysis

Smart, Rosanna, PhD; Schell, Terry L, PhD; Cefalu, Matthew, PhD; Morral, Andrew R, PhD

ProQuest document link

ABSTRACT (ENGLISH)

Background. There is debate whether policies that reduce firearm suicides or homicides are offset by increases in non-firearm-related deaths. Objectives. To assess the extent to which changes in firearm homicides and suicides following implementation of various gun laws affect nonfirearm homicides and suicides. Search Methods. We performed a literature search on 13 databases for studies published between 1995 and October 31, 2018

(PROSPERO CRD42019120105). Selection Criteria. We included studies if they (1) estimated an effect of 1 of 18 included classes of gun policy on firearm homicides or suicides, (2) included a control group or comparison group and evaluated time series data to establish that policies preceded their purported effects, and (3) provided estimated effects of the policy and inferential statistics for either total or nonfirearm homicides or suicides. Data Collection and Analysis. We extracted data from each study, including study timeframe, population, and statistical methods, as well as point estimates and inferential statistics for the effects of firearm policies on firearm deaths as well as either nonfirearm or overall deaths. We assessed quality at the estimate (study-policy-outcome) level by using prespecified criteria to evaluate the validity of inference and causal identification. For each estimate, we derived the mortality multiplier (i.e., the ratio of the policy's effect on total homicides or suicides; expressed as a change in the number of deaths) as a proportion of its effect on firearm homicides or suicides. Finally, we performed a meta-analysis to estimate overall mortality multipliers for suicide and homicide that account for both within- and between-study heterogeneity. Main Results. We identified 16 eligible studies (study timeframes spanning 1977-2015). All examined state-level policies in the United States, with most estimating effects of multiple policies, yielding 60 separate estimates of the mortality multiplier. From these, we estimated that a firearm law's effect on homicide, expressed as a change in the number of total homicide deaths, is 0.99 (95% confidence interval = 0.76, 1.22) times its effect on the number of firearm homicides. Thus, on average, changes in the number of firearm homicides caused by gun policies are neither offset nor compounded by second-order effects on nonfirearm homicides. There is insufficient evidence in the existing literature on suicide to indicate the extent to which the effects of gun policy changes on firearm suicides are offset or compounded by their effects on nonfirearm suicides. Authors' Conclusions. State gun policies that reduce firearm homicides are likely to reduce overall homicides in the state by approximately the same number. It is currently unknown whether the same holds for state gun policies that significantly reduce firearm suicides. The small number of studies meeting our inclusion criteria, issues of methodological quality within those studies, and the possibility of reporting bias are potential limitations of this review. Public Health Implications. Policies that reduce firearm homicides likely have large benefits for public health as there is little evidence to support a strong substitution effect between firearm and nonfirearm homicides at the population level. Further research is needed to determine whether policies that produce population-level reductions in firearm suicides will translate to overall declines in suicide rates. (Am J Public Health. 2020; 110: e1-e9. doi:10.2105/AJPH.2020.305808)

FULL TEXT

Headnote

Background. There is debate whether policies that reduce firearm suicides or homicides are offset by increases in non-firearm-related deaths. Objectives. To assess the extent to which changes in firearm homicides and suicides following implementation of various gun laws affect nonfirearm homicides and suicides. Search Methods. We performed a literature search on 13 databases for studies published between 1995 and October 31, 2018

(PROSPERO CRD42019120105). Selection Criteria. We included studies if they (1) estimated an effect of 1 of 18 included classes of gun policy on firearm homicides or suicides, (2) included a control group or comparison group and evaluated time series data to establish that policies preceded their purported effects, and (3) provided estimated effects of the policy and inferential statistics for either total or nonfirearm homicides or suicides. Data Collection and Analysis. We extracted data from each study, including study timeframe, population, and statistical methods, as well as point estimates and inferential statistics for the effects of firearm policies on firearm deaths as well as either nonfirearm or overall deaths. We assessed quality at the estimate (study-policy-outcome) level by using prespecified criteria to evaluate the validity of inference and causal identification. For each estimate, we derived the mortality multiplier (i.e., the ratio of the policy's effect on total homicides or suicides; expressed as a change in the number of deaths) as a proportion of its effect on firearm homicides or suicides. Finally, we performed a meta-analysis to estimate overall mortality multipliers for suicide and homicide that account for both within- and between-study heterogeneity. Main Results. We identified 16 eligible studies (study timeframes spanning 1977-2015). All examined state-level policies in the United States, with most estimating effects of multiple policies, yielding 60 separate estimates of the mortality multiplier. From these, we estimated that a firearm law's effect on homicide, expressed as a change in the number of total homicide deaths, is 0.99 (95% confidence interval = 0.76, 1.22) times its effect on

the number of firearm homicides. Thus, on average, changes in the number of firearm homicides caused by gun policies are neither offset nor compounded by second-order effects on nonfirearm homicides. There is insufficient evidence in the existing literature on suicide to indicate the extent to which the effects of gun policy changes on firearm suicides are offset or compounded by their effects on nonfirearm suicides. Authors' Conclusions. State gun policies that reduce firearm homicides are likely to reduce overall homicides in the state by approximately the same number. It is currently unknown whether the same holds for state gun policies that significantly reduce firearm suicides. The small number of studies meeting our inclusion criteria, issues of methodological quality within those studies, and the possibility of reporting bias are potential limitations of this review. Public Health Implications. Policies that reduce firearm homicides likely have large benefits for public health as there is little evidence to support a strong substitution effect between firearm and nonfirearm homicides at the population level. Further research is needed to determine whether policies that produce population-level reductions in firearm suicides will translate to overall declines in suicide rates. (Am J Public Health. 2020; 110: e1-e9. doi:10.2105/AJPH.2020.305808)

PLAIN-LANGUAGE SUMMARY

There is substantial public interest in identifying policies to reduce firearm deaths. However, the overall value of such laws will depend on the extent to which the changes in firearm deaths caused by a law are offset or compounded by corresponding changes in nonfirearm deaths. For example, a law that prevents 1000 firearm suicides would have little benefit if it leads to 1000 additional suicides by other means. Conflicting views about these second-order consequences of gun laws contribute to disagreements between those who support stricter gun regulation and those who oppose it. We analyzed data from 16 studies that provided 60 estimates of the effects of firearm laws on firearm deaths as well as either nonfirearm or overall deaths, and we found little evidence that the effects of firearm laws on firearm homicides are either offset or compounded by effects on nonfirearm homicides. Findings suggest that if a gun law prevents 100 firearm homicides, it is expected to prevent 99 total homicides after accounting for possible lethal means substitution, violence contagion, and other possible second-order effects. There is insufficient evidence in the existing literature on suicide to accurately assess the extent of the secondorder effects of firearm laws on nonfirearm suicides.

In 2017, there were 47 173 suicides in the United States, half of which were firearm-related. Another 19 510 individuals were killed by homicide, nearly 75% ofwhich were firearm-related.1 While the scale of gun violence in the United States has led to public debate regarding policies that can reduce firearm death and injury, the overall benefits of policies that successfully reduce firearm-related suicides or homicides will depend on the extent to which any prevented firearm deaths are offset by increases in non- firearm-related deaths. As a hypothetical example, a gun law with a direct effect of reducing 1000 firearm deaths will have minimal public health benefit if 1000 additional individuals are killed by other means. Some have hypothesized that this type of deadly means substitution could substantially undermine any benefit of gun laws.2

Alternatively, the total public health benefit ofa firearm law may be larger than just its effects on firearm outcomes. For example, reducing 1000 firearm homicides may break cycles of retaliatory violence, improve police effectiveness at crime prevention, or change community norms in ways that reduce nonfirearm homicides as well. Such spillover or behavioral contagion effects have been hypothesized for both suicide3 and homicide,4 although it is unclear how large such positive synergies might be.

Conflicting views about these second-order consequences ofgun laws contribute to disagreements between those who support stricter gun regulation and those who oppose it. A survey of gun policy experts found that those favoring more-permissive gun laws expected that 90% of individuals prevented from dying by firearm suicide or homicide would still die by an alternative lethal means. By contrast, experts favoring more-restrictive gun laws expected that only 20% ofprevented firearm deaths would result in death by alternative means.5 Existing public health research demonstrating that some gun policies reduce firearm deaths may be entirely unconvincing to those who believe that the policy's second-order effects will systematically offset those reductions.

Although disagreements about the second-order effects of gun laws appear to play a large role in divergent policy views, it is a challenging issue to systematically investigate because this theory ties a policy's effect on nonfirearm deaths directly to its effect on firearm deaths. Therefore, the point of disagreement cannot be resolved by reviewing evidence for the effects of firearm laws on nonfirearm deaths alone; effects on nonfirearm deaths instead need to be evaluated as a function of the policy's effects on firearm deaths, and no empirical literature has presented such estimates. While several studies find support for small and partial lethal means substitution at the individual level for both suicide6,7 and homicide,8 individual-level means substitution is just 1 of several mechanisms that could undermine or enhance the effect of gun laws, so such studies may not address broader concerns about potential second-order mortality effects.

Although existing literature has not attempted to estimate the extent to which, on net, potential unintended effects of gun policies tend to undermine or enhance their direct effects on firearm outcomes, it does contain information that may allow us to estimate those effects. For example, many studies present causal effect estimates for firearm policies on both firearm homicide and nonfirearm homicide. Using this information, we estimated a mortality multiplier (i.e., a meta-analytic parameter relating a gun law's effect on all homicides or suicides to the size and direction of its effect on firearm homicides or firearm suicides). This provides valuable information on the extent to which hypothesized second-order effects of firearm laws (e.g., lethal means substitution, violence contagion) undermine or enhance the effects of gun laws on firearm deaths.

METHODS

We performed this study in 4 stages. First, we systematically reviewed the literature to identify research on the association between 18 classes of gun policy and 8 outcomes. Second, we extracted those studies that evaluated the relationship between firearm policy and both firearm deaths (homicide or suicide) as well as either total or nonfirearm homicide or suicide deaths. Using information within each study, we derived an estimate ofa mortality multiplier, the ratio ofthe change in the number of total homicides or suicides attributable to the law as a proportion of the change in the number of firearm homicides or suicides attributable to the law. Finally, we created meta-analytic estimates across studies for homicide and suicide separately.

Search, Indusion Criteria, and Data Extraction

Our review and meta-analysis followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Identification of studies to inform these analyses followed from our systematic review of the effects of gun policy.9 We registered the review protocol in PROSPERO (CRD42019120105) and preregistered the protocol for this study via Open Science Framework (https://osf.io/saem7). We set search strategy and inclusion criteria a priori according to this protocol.

Search. In November 2018, we searched 13 databases (PubMed, PsycInfo, Index to Legal Periodicals, Social Science Abstracts, Web of Science, Criminal Justice Abstracts, National Criminal Justice Reference Service, Sociological Abstracts, EconLit, Business Source Complete, WorldCat, Scopus, and LawReviews [LexisNexis]) for English-language working papers, books, or peer-reviewed journal articles that estimated a relationship between 1 of18 classes ofgun policies and 1 of 8 outcomes, including homicide and suicide. We used a broad set of search terms relevant for firearm policy (e.g., "gun," "firearm," "concealed carry") and for outcomes (e.g., "suicide," "murder"; details in Appendix A and Appendix B, available as supplements to the online version of this article at http:// www.ajph.org). The search timeframe covered January 1, 1995, through October 31, 2018.

Screening. Two trained reviewers independently screened titles and abstracts of identified articles, using a set of screening criteria developed by the research team. Discrepancies were resolved by consensus with input from a third reviewer. Final inclusion of studies was based on full-text evaluation. All screening was conducted in DistillerSR.

Inclusion criteria. Eligible studies were those that estimated an effect of 1 of our 18 classes of gun policy, evaluated time series data to establish that policies preceded their effects, and included a control or comparison group in model estimation. For the purposes of this study, we further required that the article provided estimated effects and standard errors for (1) firearm homicide death and either nonfirearm or total homicide death or (2) firearm suicide death and either nonfirearm or total suicide death. To allow greater comparability across study estimates, we excluded studies of homicide or suicide in specific subpopulations (e.g., intimate partner homicide), although we considered these in sensitivity analyses.

Extraction. Extracted information included metadata (e.g., title, authors), study features (e.g., timeframe, data sets), statistical methods (e.g., model type, analytic unit), and estimated effects (e.g., coefficient estimates, standard errors). One reviewer (R. S.) extracted data into a pretested standardized spreadsheet-based form. A second reviewer independently extracted information on estimated effects and checked other fields for accuracy; discrepancies were resolved by consensus.

Many studies provided multiple effect estimates. A single study may have estimated the effects of multiple different policies (e.g., waiting period laws and background check laws), assessed effects across different populations (e.g., children and adults), or estimated effects using different model specifications (e.g., linear and log-link models). When a study provided the required information for multiple different policies, we extracted each of these estimates; thus, a single study could contribute multiple estimates. When a study provided results for multiple populations, we extracted effects for the most representative population provided. Ifa study presented different estimates based on different model specifications, we extracted information only from the specification considered best suited to estimating the policy's causal effect. This was typically the authors preferred specification; in a few cases, we selected a linear model although the authors preferred a log-link model because deriving the construct of interest from linear effect estimates requires fewer assumptions.

Quality assessment. We assessed risk of bias by using prespecified criteria shown to be important methodological considerations in quasi-experimental policy evaluations, and particularly in firearm policy research.10,11 We conducted quality assessment for each estimate (study-outcome-policy) through discussion with the full review team regarding the following domains:

* evidence of model overfit,
* adjustment for serial correlation,
* validity of model assumptions,
* sensitivity of results to model specification,
* number of treated units and pre- and posttreatment data, and
* other threats to causal identification (e.g., failure to adjust for confounds).

We indicated whether each estimate had an issue on each domain as described in Appendix C (available as a supplement to the online version of this article at http:// www.ajph.org). We used quality criteria to perform standard error adjustments for estimates that failed to adjust for serial correlation (see "Sensitivity Analysis") and to narratively describe the quality of the underlying studies contributing to the meta-analyses.

Estimating the Mortality Multiplier

We aimed to estimate the extent to which causal effects on firearm suicide or homicide translate into changes in overall suicide or homicide. Thus, we defined the mortality multiplier (m) as the total effect of the firearm policy on all homicides or all suicides, given a unit change in firearm homicide or firearm suicide, where the causal effect ofthe policy only affects nonfirearm mortality through its effects on firearm mortality. We expressed m separately for homicide and suicide as

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where A is the direct effect of the firearm policy on firearm death rates, ANF is the second-order effect of the policy on nonfirearm death rates, and AT is the total effect of the policy on homicide or suicide. The interpretation of m is

1. m >1: spillover or contagion (e.g., policies that increase firearm suicides generate spillovers that increase nonfirearm suicides, or policies that decrease firearm suicides have spillovers that reduce nonfirearm suicides);
2. m = 1: the effect of the firearm policy is exclusive to firearm outcomes with no effects on nonfirearm deaths,
3. 0 <m <1: partial substitution (e.g., policies that decrease firearm homicides are partially offset by increases in nonfirearm homicides),
4. m = 0: complete lethal means substitution (e.g., preventing firearms suicides is fully offset by increases in nonfirearm suicides), and
5. m <0: more than perfect substitution (e.g., preventing firearm suicides results in more total suicides).

Our conceptualization of m was neutral regarding the direction of the policy's first-order effect on firearm deaths. Specifically, it assumed that the extent to which policy effects on firearm deaths are offset or compounded by effects on nonfirearm deaths is equivalent for policies that increase firearm deaths and policies that decrease firearm deaths. This allowed m to be estimated from policies that were found to increase or to decrease firearm deaths.

As no study provided a direct estimate of m, we had to convert estimated causal effects from each study into estimates that reflected this construct. For linear models, effect estimates were already expressed as differences in rates, the required units to compute the A quantities. However, for studies that expressed effects as incidence rate ratios (IRRs), we needed to convert the provided effect sizes and SEs. This required knowing the ratio of firearm to nonfirearm deaths (suicides or homicides) for each study (proof in Appendix D, available as a supplement to the online version of this article at http:// www.ajph.org), information not always provided in the articles themselves. To apply this information consistently across studies, we used data on firearm and nonfirearm homicides and suicides from the National Center for Health Statistics12 for the specific years of each study, using these base rates to convert IRRs and confidence intervals (CIs) into differences in rates.

The process for computing the distributional characteristics of m using information extracted from the studies was more complex than for many other statistics. Specifically, m was a ratio of 2 statistics, each of which had an approximate normal distribution. While the probability density function of the resulting ratio was fully defined, the mean and variance ofthat distribution may be undefined because the dispersion of the distribution of m can be infinite if the denominator (AF) contained substantial density near zero; thus, a study that estimated a zero effect of a policy on firearm deaths provided little information about m. This corresponds to the observation that when a policy had zero causal effect on firearm deaths, any estimated causal effect on nonfirearm deaths cannot be interpreted as substitution or contagion.

Given the AF and ANF distributions from each study, we derived an estimate of m for each effect through a statistical simulation. We dropped estimates of m before meta-analysis when they had extremely large variance (SE >2; i.e., a 95% CI width for m exceeding 8; Appendix D). These would have received effectively zero weight in the meta-analysis, had they been included. We meta-analyzed the individual estimates of m by using the meta package in R.13 While we had neither a priori nor substantial empirical evidence of excessive dispersion across studies, we present both fixed- and random-effect estimators of m because the CIs of the fixed-effect estimators may be too narrow if m varied across different types of firearm regulations. We weighted fixed-effect meta-analytic estimates based on the inverse variance of the individual estimates, assuming all individual estimates were drawn from a single common distribution. Random-effect estimates allowed for variance in the true value ofm across studies, assessed by using Cochran's Q, allowing greater uncertainty in the overall meta-analytic estimate as that variance increased. To provide an upper bound on the statistical uncertainty in the overall estimate, we used the Sidik and Jonkman14 estimate of the random-effects dispersion parameter because it yielded larger CIs than other standard options.

Sensitivity Analyses

We used prespecified sensitivity analyses to address concerns about either the underlying studies or our methods ofextracting estimates from them. One serious concern about these studies was the extent to which the SEs for the effects presented in the original studies were correct. Studies have shown that failure to use a cluster correction to address the violation of the independent error assumption in these data results in SEs underestimated by a factor of 2.5 averaged across a range of model types and policy distributions.15-19 About 16 out of 60 estimates we extracted from the literature did not use the required cluster correction. To avoid giving these methodologically weaker studies the largest weights, we performed an SE correction by multiplying the unclustered SEs by 2.5. However, we also present a sensitivity analysis using the original SEs.

In addition, to assess the dependence ofour results on assumptions required to convert IRRs into linear effect estimates, we conducted sensitivity tests in which we varied the assumed ratio ofnonfirearm to firearm deaths used in this conversion. Specifically, we re-estimated the meta-analytic m after (1) increasing the ratio by 20% and (2) decreasing the ratio by 20%.

Finally, 2 exploratory analyses considered whether m may vary across different populations or forms of violence. First, because adolescents may show different patterns of substitution or contagion than the broader population,20 we included a sensitivity test in which we excluded sources that exclusively used child or adolescent populations. Second, while our primary analysis excluded studies of homicide subtypes, we conducted a secondary meta-analysis of m for intimate partner homicide (Appendix F, available as a supplement to the online version of this article at http://www.ajph.org).

Meta-analytic estimates of m were minimally affected by the type of reporting bias that presents concerns in most meta-analyses (i.e., failure to publish small and nonsignificant effects on the primary outcome). This is because one cannot estimate the effect of reducing firearm homicides on total homicides if there is no effect on firearm deaths. Because the variance ofm approaches infinity when the estimated effect on firearm deaths is zero, the inverse variance weighting of meta-analyses effectively drops such estimates from the meta-analytic estimate. Unlike most meta-analyses, the normal reporting biases of the field result in the omission of precisely those studies whose results would not inform our estimate (Appendix A provides further discussion).

RESULTS

We screened titles and abstracts of 21 700 studies. From those, 357 merited full-text review, from which 16 provided point estimates and inferential statistics that we could use to generate estimates of m (Figure 1). Appendix A presents details on search strategy, inclusion and exclusion decisions, and risk of reporting bias.

In total, the 16 included studies provided 60 usable estimates to inform m (Table 1). For homicide (15 studies; 37 estimates), the most commonly studied policies were concealed carry laws (27% ofestimates) and background check requirements (24%), followed by age prohibitions (14%) and waiting periods (8%). For suicide (8 studies; 23 estimates), the most commonly evaluated policies were background check requirements (30%) and age prohibitions (30%), followed by waiting period (13%) and child access prevention laws (9%). All studies evaluated the US context and used a quasi-experimental differences-in-differences type design, controlling for year fixed-effects and geographic fixed or random effects. Based on our quality assessment, all but 8 estimates had at least 1 methodological concern; none had more than 2 flags for methodological issues (Appendix C, Table C1).

Only 3 studies27,28,35 provided linear effect estimates. For the remaining studies, we transformed the estimated effect sizes as discussed previously. The estimated firearm and nonfirearm effects, their SEs, and the simulated distribution of m are presented for each study and law combination in Appendix D, Tables D1 and D2.

Our meta-analysis of the mortality multiplier for suicide suggests that the available literature does not yet support such an estimate (m =1.41; 95% CI = 0.97, 1.84; Appendix E, Figure E1). A single source, a child access prevention law estimate,33 received 90% of the weight in the meta-analytic combination. Only 2 other sources ' provided marginally useful information (i.e., CI width <8). Relying on this single study is particularly problematic because this effect was based only on the subpopulation aged 18 to 20 years, which was not the population hypothesized to show the full effect of the child access prevention laws; because a comparable effect was not found in the adolescent population where the effect was hypothesized, the authors themselves discounted this estimate as spurious or non-causal. Thus, our meta-analytic estimate was effectively based on a single source, estimated in a small subpopulation that was not where the authors hypothesized a causal effect.

By contrast, our meta-analysis of the mortality multiplier for homicide provides a more informative estimate, with 14 sources contributing useful information (Figure 2).

The fixed-effect meta-analytic estimate was 0.99 (95% CI = 0.76, 1.22). The random-effect estimate was functionally identical, finding no evidence of significant dispersion in the true value of m across policies and studies (Q = 1.57; df= 13; P = .99). Notably, half of the contributing estimates exhibited at least 1 methodological quality concern, primarily related to potential model overfit or failure to adjust for serial correlation; even with our applied SE adjustment factor, the pooled estimate may understate uncertainty around m.

The meta-analytic estimate ofm and its CI for homicide were highly consistent across sensitivity tests designed to assess robustness of the estimate to our methodological choices (Table 2). The alternative specification with the largest effect on the estimate was removing the SE adjustment factor. This change had a small effect on the estimate itself, but greatly reduced the CI for the overall fixed-effect estimate.

Our m estimate for homicide suggests that a gun law that prevents 100 firearm homicides is expected to prevent 99 total homicides after accounting for possible means substitution, violence contagion, and other second-order effects. There remains substantial uncertainty around this estimate, but the meta-analysis rules out dramatic second-order effects.

DISCUSSION

Although a broad literature has evaluated how various gun laws affect firearm-related homicide and suicide,11,37,38 none directly estimate the extent to which effects on firearm-related mortality are offset or compounded by second-order effects on non-firearm-related mortality. While many studies recognize the potential for these second-order effects, they address this by estimating policy effects on total homicides or suicides and comparing the sign and significance of this effect to that for firearm-specific fatalities.2 However, one cannot accurately assess the size or direction of these second-order effects by comparing statistical significance between the effect on firearm homicide and total homicide; a difference in significance should not be interpreted as a significant difference. This is an important gap in the current evidence base.

The primary aim of this meta-analysis was to use information from existing studies to examine whether policies that affect firearm deaths have second-order effects on nonfirearm deaths that undermine or enhance their public health impact. Our results suggest that preventing 1 homicide death by firearms has a net effect of preventing 1 homicide in total; while this estimate is relatively imprecise, we can effectively rule out the possibility of substantial homicide substitution or contagion (i.e., >30%) at the population level. This does not necessarily rule out substantial lethal means substitution at the individual level. It may be that individual-level substitution (e.g., individuals switch from firearm to nonfirearm assaults) does not fully offset duced mortality given the higher case-fatality rate for firearms.39 It could also be that there is both individual-level lethal means substitution (undermining benefits of gun laws) and violence contagion (enhancing effects of gun laws), resulting in minimal net change for nonfirearm homicides. We cannot provide an informative meta-analytic estimate about the mortality multiplier for suicide because the studies that included the necessary information generally found only weak law effects on firearm suicide. This is somewhat surprising because several published studies have identified significant effects of firearm regulations on on firearm suicide.40-42 However, those studies had to be excluded from the analysis because they (1) did not present effect estimates for both firearm suicides and total or nonfirearm suicide or (2) used synthetic control methods and a single implementing state, in which case there is no accurate way to get standard errors for the effect estimate from the paper.

Limitations

As in any meta-analysis, our findings relied on the validity of studies that informed our estimates. Specifically, we required that study estimates represent the causal effect ofa given policy on firearm deaths and that, conditional on covariates, the causal effect on nonfirearm mortality occurred only through these effects on firearm mortality. While we restricted our sample to studies that used causal inference designs, all studies were quasi-experimental, and some of these estimates may not reflect true causal effects. Furthermore, the estimates that contributed the most weight to the meta-analytic results had some methodological limitations that might result in our CIs around the meta-analytic m being too narrow.

Our definition of the mortality multiplier assumed that it has a constant value across different policies, time periods, and populations. We did not find significant variance in m across the policies and studies we included, but it is possible that these assumptions were incorrect and will require additional research as more estimates become available. While our review considered a broad range of gun laws, many were not included; incorporating evidence from other gun violence prevention interventions (e.g., urban blight remediation, community-based outreach), may have yielded better information to construct pooled estimates of the mortality multipliers, particularly if these other policies have much larger effects on firearm-related homicides or suicides.

Our conversion of study effect estimates to mortality multipliers relied on several assumptions. While we provide analyses to test the importance of these assumptions, our study-specific and pooled estimates were necessarily approximations. In addition, the meta-analysis combined studies that used overlapping data sets that were not fully independent; thus, it is unclear whether the independent errors assumption of the metaanalysis was met. A direct estimate of the mortality multiplier from a single study jointly estimating policy effects on firearm and nonfirearm deaths using the most complete data and optimal statistical methods might produce a more accurate estimate of the mortality multiplier than the meta-analytic estimates presented here.

Finally, the number of studies excluded from this review for lack of relevant results presents concerns about potential reporting bias. While a failure to publish studies showing nonsignificant effects on firearm deaths would not bias our estimate of m, if there was systematic bias against presenting results showing a specific pattern of effects across firearm homicide and total homicide, this could bias our results, although the direction of this potential bias is unknown.

Conclusions

Policymakers and researchers have sometimes argued that most or all of any firearm violence reduction benefits of gun policies will be counteracted by adverse, unintended consequences of those benefits, such as through lethal means substitution.2,43 This review estimated the direction and magnitude of these unintended, second-order effects of gun laws. Our estimates rule out the possibility that more than 30% of any reductions in firearm homicides attributable to a gun policy would be counteracted by systematic increases in nonfirearm homicides. However, the current literature does not support a useful estimate of such effects for suicide.

CONTRIBUTORS

R. Smart, T. L. Schell, and A. R. Morral conceptualized the research. All authors contributed to developing the statistical methodology, conducting the analyses, interpreting the results, and writing the article.

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CONFLICTS OF INTEREST

Authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

RAND's institutional review board determined that this project does not involve human participants as defined by the regulations at 45 CFR 46.102(f).

Sidebar

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DETAILS

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Identifying Incidents of Public Health Significance Using the National Poison Data System, 2013–2018

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ABSTRACT (ENGLISH)

Data System. The American Association of Poison Control Centers (AAPCC) and the Centers for Disease Control and Prevention (CDC) jointly monitor the National Poison Data System (NPDS) for incidents of public health significance (IPHSs). Data Collection/Processing. NPDS is the data repository for US poison centers, which together cover all 50 states, the District of Columbia, and multiple territories. Information from calls to poison centers is uploaded to NPDS in near real time and continuously monitored for specific exposures and anomalies relative to historic data. Data Analysis/Dissemination. AAPCC and CDC toxicologists analyze NPDS-generated anomalies for evidence of public health significance. Presumptive results are confirmed with the receiving poison center to correctly identify IPHSs. Once verified, CDC notifies the state public health department. Implications. During 2013 to 2018, 3.7% of all NPDS-generated anomalies represented IPHSs. NPDS surveillance findings may be the first alert to state epidemiologists of IPHSs. Data are used locally and nationally to enhance situational awareness during a suspected or known public health threat. NPDS improves CDC's national surveillance capacity by identifying early markers of IPHSs.

FULL TEXT

Headnote

Data System. The American Association of Poison Control Centers (AAPCC) and the Centers for Disease Control and Prevention (CDC) jointly monitor the National Poison Data System (NPDS) for incidents of public health significance (IPHSs).

Data Collection/Processing. NPDS is the data repository for US poison centers, which together cover all 50 states, the District of Columbia, and multiple territories. Information from calls to poison centers is uploaded to NPDS in near real time and continuously monitored for specific exposures and anomalies relative to historic data.

Data Analysis/Dissemination. AAPCC and CDC toxicologists analyze NPDS-generated anomalies for evidence of public health significance. Presumptive results are confirmed with the receiving poison center to correctly identify IPHSs. Once verified, CDC notifies the state public health department.

Implications. During 2013 to 2018, 3.7% of all NPDS-generated anomalies represented IPHSs. NPDS surveillance findings may be the first alert to state epidemiologists of IPHSs. Data are used locally and nationally to enhance situational awareness during a suspected or known public health threat. NPDS improves CDC's national surveillance capacity by identifying early markers of IPHSs. (Am J Public Health. 2020;110:1528-1531. doi: 10.2105/AJPH.2020.305842)

Since 2000, the American Association of Poison Control Centers (AAPCC) and the Centers for Disease Control and Prevention (CDC) have worked together to develop and implement the National Poison Data System (NPDS) as a tool for public health surveillance.1

DATA SYSTEM

NPDS data collection started in 1983 with the beginning of the AAPCC national data collection system. Data are available from 2000 onward and are accessible by a secure Web-based interface.1

CDC uses NPDS to (1) improve CDC's national surveillance capacity for public health threats, (2) identify early markers of incidents of public health significance (IPHSs), and (3) enhance situational awareness and inform public health response during a suspected or known public health threat.2 A primary surveillance activity conducted by CDC using NPDS is to identify and track IPHSs associated with chemical, radiological, and infectious exposures. During 2008 to 2012, NPDS surveillance identified 384 such incidents.3

DATA COLLECTION/ PROCESSING

Members of the public, health care professionals, and other local, state, and federal agencies contact their regional poison center by calling a national toll-free number (800-222-1222). Call topics range from information about a drug, chemical, or poison (information calls) to advice after a known or suspected exposure (exposure calls).4 All 55 US poison centers are members of the AAPCC. Together, AAPCC member centers provide coverage to all 50 states, American Samoa, the District of Columbia, the Federated States of Micronesia, Guam, Puerto Rico, and the US

Virgin Islands. In 2018, NPDS recorded 368 025 information calls and 2099 751 human exposure calls.4

Calls to poison centers are answered by specialists in poison information (SPIs) and poison information providers (PIPs). SPIs are mainly nurses and pharmacists who have received specialized education in toxicology. PIPs are allied health professionals who, under the supervision of an SPI, manage information calls and low-acuity exposure calls. PIPs and SPIs document calls by using 1 of 4 AAPCC-approved electronic medical record systems designed to collect required exposure information. Data elements recorded using standardized guidelines include demographics (e.g., age, gender, geographic location), exposure information (e.g., reason for exposure, exposure duration, location of exposure), clinical effects (e.g., tachycardia, vomiting, agitation), treatments given before the call, treatments recommended, treatments provided according to poison center recommendations (e.g., antiseizure medications, antidotes, antivenoms, and extracorporeal treatments), and medical outcomes. Poison centers routinely provide ongoing management guidance and attempt to follow cases to a known medical outcome. If a caller reports an exposure involving multiple persons, additional records are created to reflect the number of persons affected.

NPDS utilizes the POISINDEX products database (IBM Micromedex POISINDEX, IBM Watson Health, Greenwood Village, CO) as its primary products database. The database contains more than 444 000 products, each associated with a unique 7-digit code.4 SPIs and PIPs choose the most specific product or substance possible. Product codes represent specific substances in multiple broad categories, including name-brand prescription medications, name-brand nondrug products, disease vectors (e.g., mosquito, dog), and infectious diseases (e.g., rabies). Product codes map to 1 of 1112 broader generic codes in a structured hierarchical system.4 If a specific product name involved in a case is not known, cannot be verified, or is not found in the system, a generic code is selected (e.g., rubbing alcohols: unknown). Signs, symptoms, and laboratory abnormalities (termed "clinical effects"), if known, are chosen from 169 active options. Treatments performed before the call, recommended by the poison center, or recommended and performed are chosen from 112 currently available options.

Data collection using NPDS is a public health surveillance activity conducted by public health authorities (poison centers). Per the Health Insurance Portability and Accountability Act privacy rule, 45 CFR 164.512(b), authorization is not required to disclose information for this purpose.5 Data are automatically uploaded to NPDS in near real time with a median time of 7.72 minutes (interquartile range = 6.90-12.0 minutes).4

data analysis/ DISSEMINATION

Automated algorithms continuously monitor NPDS data using call volume, clinical effects, and case-based definitions. When an anomaly of any of the 3 types is detected, an alert is sent to the AAPCC surveillance team and CDC staff members, who then review the exposure calls within the anomaly to determine if they represent an IPHS. The AAPCC surveillance team includes medical and clinical toxicologists and is a distributed system with team members located across the United States.

Call volume anomaly detection compares the volume of calls to a historical baseline for each poison center to detect unusual increases in call volume. The classical historical baseline is defined as the average call volume at a specified poison center, at the same hour, during the same 14-day period, over the preceding 3 years. A call volume anomaly is defined as an hourly call volume more than 3 SDs above the historical baseline, with at least 8 calls.

Clinical effect anomaly detection is triggered when the number of calls with a given clinical effect nationwide within the previous 24 hours exceeds 2 SDs above the classical historical baseline. Similar to call volume surveillance, the historical baseline is defined as the average clinical effect frequency, per 24 hours, for the same 14-day period over the preceding 3 years.

Case-based anomaly detection identifies individual exposure calls matching a specified definition. These definitions are designed to detect specific exposures that have already been identified by the caller (via product or generic codes), as well as clusters of clinical effects suggestive ofan exposure (often referred to as a toxidrome). CDC staff currently monitor 9 definitions considered high-priority exposures that might represent a sentinel event: arsenic, botulism, ciguatera, ricin, paralytic shellfish poisoning, pufferfish, radiation, nerve agents, and weapons of mass destruction.

Any ofthe 3 anomaly types might indicate a potential outbreak, but manual review is required to determine whether they represent IPHSs. When an anomaly is detected, the NPDS surveillance team reviews all anomalies for public health significance (PHS) according to consensus criteria and confers with the regional poison center within 24 hours. Anomalies matching the weapons ofmass destruction definition are reviewed more rapidly, within 6 hours. These findings are then shared with the CDC. The criteria foran anomaly to be ofPHS are the following:

* importance to the appropriate state or national public health entity (e.g., a reportable disease),
* a case or calls of unusual severity involving more than 1 household (or exposure site outside the home) and with clinical effects reported,
* association with a known or suspected terrorism event,
* part of a state or national public health investigation,
* a pattern not normally attributable to the implicated exposure,
* a geographic or spatial pattern, and
* a high index of suspicion, credible threat, or other rationale in the judgment of the NPDS surveillance team member.

The AAPCC surveillance team member contacts the poison center to obtain additional information about the call(s). After review, anomalies are classified as PHS "yes," "no," "unknown," or "other." When a PHS "yes" anomaly is identified, CDC generates a notification detailing the identified incident and sends it to the regional poison center and state public health department for situational awareness and appropriate public health action.

Interpretation Issues

Several interpretation issues temper the use of poison center data as a public health surveillance tool. In particular, poison centers rely on voluntary reporting (NPDS is a passive reporting system) of exposures by members of the public and health care providers. Variability in exposure reporting is well documented and can vary significantly by geographic region.6 As a result, NPDS likely will only detect a portion of the total exposures associated with a given incident.

In most cases, poison center data are also limited by a lack of objective (laboratory) confirmation in most exposures, introducing the possibility that an exposure might be misclassified. In addition, the clinical effect and case-based surveillance definitions rely on analysis of coded data. Transcription error might occur, and coding might differ between poison centers when data are entered into the poison center electronic medical record. Human review of all anomalies, including direct communication between the NPDS surveillance team and poison centers, helps to minimize this risk. Lastly, not all persons exposed to a potential hazardous substance will call a poison center. Therefore, poison centers are not a representative data source to calculate burden of illness or absolute numbers of persons exposed to a particular substance of interest. There are only estimates of the denominator of all poison exposures.

In total, 1431 of the 39 107 anomalies identified by case volume, clinical effects, and case-based surveillance during 2013 to 2018 were determined to represent IPHSs, a positive predictive value (PPV) ofapproximately 3.7% (range for individual years = 3.2%4.3%; Table A, available as a supplement to the online version of this article at http://www.ajph.org). Despite iterative improvement by the NPDS surveillance team to refine anomaly detection algorithms, the overall PPV did not significantly change; a Poisson regression by year for annual PPV from 2013 through 2018 yielded a P value of .11. It is notable that the PPV did improve from 3.2% in 2017 to 4.1% in 2018; this is likely attributable to a restriction in specific case-based surveillance algorithms in 2018 that required treatment information be recorded to increase likelihood that the exposure did occur. This low PPV is expected because the surveillance anomaly definitions have intentionally low thresholds to increase the system's sensitivity to detect IPHSs. However, this low detection threshold must be weighed against the work required to review a high number of falsepositive anomalies. At present, the scope ofthis work lies entirely within the NPDS surveillance team. Anomalies that do not meet the threshold for IPHSs are not forwarded to public health officials. Therefore, the present system allows a high sensitivity and high quality ofdata without work on the part ofthe end users. Finally, while NPDS captures many incidents called to poison centers in near real time, the statistical methods employed may not capture all IPHSs called to poison centers.

Data Linkage and Accessibility

In addition to CDC and AAPCC, 28 poison centers, at least 5 state public health departments, 1 county public health department, and 1 state police department conduct surveillance activities using NPDS.4 Several state public health organizations actively integrate these data with emergency medical services and emergency department systems to form a robust syndromic surveillance system.7-9 CDC and AAPCC have published multiple studies attesting to the utility of poison center data as a national public health surveillance tool.1,3,10,11 Patient-level data for poison center electronic medical record encoded fields can be obtained through a standardized request form to AAPCC.12

IMPLICATIONS/IMPACT

The primary strength ofNPDS is its ability to identify IPHSs for federal, state, and local public health situational awareness through multiple methods of anomaly detection. Overlap between the call volume, clinical effect, and case-based surveillance methodologies is minimal: among 39 107 total anomalies, there were only 16 IPHSs that triggered 2 or more anomaly types, supporting the use of all 3 methodologies. The total number of call volume anomalies detected between January 1, 2013, andDecember31, 2018, was 26 833, of which 850 (3.2%) were determined to represent IPHSs. In some cases, more than 1 call volume anomaly was associated with a single incident. In total, 278 distinct IPHSs were identified (Table 1).

On an annual basis and overall, the most commonly reported agent associated with an IPHS identified using call volume-based surveillance was carbon monoxide, which was reported in 59 distinct incidents (21.2%). The most common location for an IPHS identified using case volume-based surveillance was a workplace, which was reported in 104 distinct incidents (37.4%; Table B, available as a supplement to the online version of this article at http://www.ajph.org). Several IPHSs were associated with anomalies over a period of days to weeks and therefore aided in situational awareness, including a 2014 chemical spill in West Virginia,13 a 2015 outbreak of synthetic cannabinoid-related illness,14 and a 2016 outbreak of listeriosis resulting from contaminated salad products.15 Further details regarding each anomaly type, on a yearly basis and overall, are available in Table B.

Among the 5862 clinical effect anomalies detected during the study period, 174 (3.0%) were determined to represent 44 distinct IPHSs (Table 1). The reported agent most frequently leading to an IPHS identified via clinical effect-based surveillance was carbon monoxide, which was reported in 7 distinct incidents (16%). The most frequent body system affected was neurologic (43%), and the most common reported symptom was dizziness/vertigo (16%; Table C, available as a supplement to the online version of this article at http://www.ajph.org). Clinical effect anomalies were particularly useful as a public health surveillance tool in 2018, providing situational awareness during an outbreak of bleeding caused by contaminated synthetic cannabinoids.16 More than 90 clinical effect anomalies were recorded in association with this outbreak.

Table 2 shows details of the 6412 casebased anomalies detected during the study period. Arsenic was the most common case-based anomaly detected, with 1873 anomalies (29% of all case-based anomalies). Of the case-based anomaly definitions, botulism had the highest PPV: 131 out ofthe 332 (40%) botulism-based anomalies were associated with an IPHS, and 90 (27%) were associated with a unique IPHS not identified by another anomaly. No IPHSs were associated with the weapons of mass destruction case-based anomaly definition. This was expected because the algorithm is designed to detect what is currently only a theoretical scenario. The remainder of the case-based anomaly definitions are designed to detect unusual or rare diagnoses. Notably, the botulism case-based anomaly did detect an outbreak of botulism linked to illicit alcohol, known as "pruno," in a Mississippi correctional facility in 2016.17

From 2015 to 2016, CDC surveyed state epidemiologists regarding the effect of NPDS surveillance notifications.11 Among the 59 survey respondents, 49 (83.1%) took public health action in response to an incident. Although many were already aware of the incident before receiving a notification from CDC, 27 (45.8%) said they did not previously know about the incident. Within the subset of respondents who did not know about the incident before notification, 17 (63.0%) said that CDC notification contributed to initiating public health action.

Situational awareness is perhaps NPDS's greatest asset. NPDS surveillance can be used to track the status of an ongoing incident to inform the public health response. Besides the incidents mentioned previously, NPDS data provided critical situational awareness during the 2010 Deepwater Horizon oil spill of the progression of the incident at the national level.11 Multiple agencies also used these data to create public health messaging about the spill. NPDS surveillance data have also informed recommendations from Consumer Reports on the safety oflaundry detergent pods and legislative actions to protect children from exposure to liquid nicotine used in electronic cigarettes.11

CONCLUSIONS

NPDS surveillance activities have been able to identify incidents called to poison centers in near real time and communicate about incidents to state and local public health. During the study period, this surveillance identified and tracked several important incidents associated with industrial chemical releases, drugs of abuse, and even infectious diseases. Although the PPV of the surveillance activities is low, standardized, internal review of potential IPHSs provides high-quality data to inform state and local public health personnel as they respond to outbreaks and epidemics. ÂfPU

CONTRIBUTORS

J. E. Carpenter performed the data analysis and wrote the article. R. K. Law originated the study and contributed to data collection, analysis, and writing of the article. A. S. Chang, A. C. Bronstein, and R. G. Thomas contributed to interpretation and revising the article. All authors approved the final article and agreed to be accountable for all aspects of the work.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

HUMAN PARTICIPANT PROTECTION

This project was not human participant research and was determined to be exempt from review by the Centers for Disease Control and Prevention institutional review board.

Sidebar

Correspondence should be sent to Royal Law, PhD, MPH, 4770 Buford Highway S106-08 Atlanta, GA 30341 (e-mail: rlaw@cdc.gov). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Note. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position ofthe Centers for Disease Control and Prevention.

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DETAILS

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Access to Firearms, Homicide, and Suicide: Role of the Mortality Multiplier

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ProQuest document link

ABSTRACT (ENGLISH)

[...]if m = 0.8 for the effect of a given set of firearm laws on homicide, for every 10 firearm homicides averted by the laws there would be two additional nonfirearm homicides that would not have occurred in the absence of the laws, resulting in eight homicides averted. [...]the mortality multiplier is an index of the extent of lethal substitution of nonfirearm means when firearm deaths decline (increase) and of contagion, or secondary feedback effects, on nonfirearm homicide when firearm deaths increase or decrease. In particular, although the meta-analysis that generated the mortality multiplier for homicides drew on 16 studies, only a single study,4 of child access prevention laws, effectively determined the metaanalytic m for suicides. [...]as Smart et al. note, the direct effect measure used to calculate m from this study was based on the reported effect of child access prevention laws on those aged 18 to 20 years, rather than on those aged 14 to 17 years, even though those aged 18 to 20 years were chosen as negative controls by the original investigators. [...]studies from other countries have shown that when populationlevel policies substantially reduce the ready availability of highly lethal, culturally acceptable, commonly used methods of suicide (e.g., coal gas [CO2], pesticides in Sri Lanka, firearms in the Israeli military), sustained declines in overall suicide results, driven by declines in suicide by the restricted method, with minimal compensatory increases in suicides by nonrestricted methods.5 Moreover, a large and compelling body of empirical studies supports a causal connection between access to firearms and the risk of dying by suicide, driven, in effect, by an elevated rate of firearm suicide, with at best modest lethal substitution of nonfirearm methods. [...]handgun ownership was associated with a greatly elevated and enduring risk of suicide by firearm, with minimal second-order substitution effects.

FULL TEXT

See also Smart et al., p. 1545.

In "The Effect of Changes in Firearm Mortality on Nonfirearm Deaths: A Systematic Review and Meta-Analysis of the Impact of Firearm Laws" (p. 1545), Smart et al. take a thorough and methodologically sophisticated approach to estimating the net effect of state-level firearm legislation on homicide and suicide using data from the small number of extant studies that met their thoughtful inclusion criteria.

Smart et al. use a meta-analytic measure, the mortality multiplier (m), to express the effect of firearm-focused legislation as a change in the total number of violent deaths for a unit change in firearm deaths. For example, if m = 0.8 for the effect of a given set of firearm laws on homicide, for every 10 firearm homicides averted by the laws there would be two additional nonfirearm homicides that would not have occurred in the absence of the laws, resulting in eight homicides averted. Thus, the mortality multiplier is an index of the extent of lethal substitution of nonfirearm means when firearm deaths decline (increase) and of contagion, or secondary feedback effects, on nonfirearm homicide when firearm deaths increase or decrease. The construct, m, implicitly assumes that (1) the point estimates from the literature used in the meta-analysis are reasonable estimates of the direct causal effect of the law in question on firearm suicide and firearm homicide, and (2) changes in nonfirearm outcomes (referred to as second-order effects) are caused by the first-order changes in firearm fatalities. The mortality multiplier does not differentiate lethal substitution from contagion.

Putting aside for the time being whether these assumptions are warranted for homicide, suicide, both, or neither and, more fundamentally, whether the legislation evaluated plausibly causes large enough changes in exposure (i.e., firearm availability) to produce observable changes in mortality, the authors' finding with respect to homicide is striking. With a mortality multiplier of 0.99, firearm laws that reduce firearm homicide are associated with virtually no second-order mortality effects- no compensatory increase in nonfirearm homicide (i.e., lethal substitution) and no virtuous decrease in nonfirearm homicide from negative feedback (i.e., contagion mitigation). It is worth noting that this general finding is not new, but rather comports with earlier approaches to assessing the possibility of means substitution and contagion that have found an instrumental, rather than an incidental, role of firearms in encounters that put people at risk for homicide.

For example, Cook1 evaluated robbery over time for 43 large cities and found that rates of robbery-homicide were tightly related to whether firearms were used in the robbery: an increase of 1000 gun robberies resulted in three times as many additional deaths as an increase of 1000 nongun robberies; little else distinguished the encounters. Cross-sectional population-level data also suggest minimal lethal substitution ofnonfirearm methods for firearms in places where household firearms are less prevalent. For example, the association between state-level household firearm prevalence and homicide victimization is driven by gun-related homicide rates, with non-gunrelated homicide rates showing no material association with household firearm prevalence.2,3

Smart et al. conclude that the available literature does not yet support estimation of a mortality multiplier for suicide. In particular, although the meta-analysis that generated the mortality multiplier for homicides drew on 16 studies, only a single study,4 of child access prevention laws, effectively determined the metaanalytic m for suicides. Moreover, as Smart et al. note, the direct effect measure used to calculate m from this study was based on the reported effect of child access prevention laws on those aged 18 to 20 years, rather than on those aged 14 to 17 years, even though those aged 18 to 20 years were chosen as negative controls by the original investigators. The authors rightly do not use the point estimates of those aged 14 to 17 years, because the published point estimates for firearm suicide, overall suicide, and nonfirearm suicide for this age group are internally inconsistent.

Unable to estimate a stable mortality multiplier for suicide, Smart et al. call for further research to determine whether "policies that produce population-level reductions in firearm suicides will translate to overall declines in suicide rates" (p. 1545). Although reasonable, this exhortation conflates two distinct issues: (1) whether legislative firearm policies that exist in the United States today produce quantitatively meaningful changes in exposure to guns sufficient to result in discernable population-level changes in rates of suicide, and (2) whether interventions that could produce quantitatively meaningful changes in exposure to firearms would, in fact, result in reductions in overall suicides, not simply in firearm suicides. Far stronger evidence supports the second idea than the first. Indeed, studies from other countries have shown that when populationlevel policies substantially reduce the ready availability of highly lethal, culturally acceptable, commonly used methods of suicide (e.g., coal gas [CO2], pesticides in Sri Lanka, firearms in the Israeli military), sustained declines in overall suicide results, driven by declines in suicide by the restricted method, with minimal compensatory increases in suicides by nonrestricted methods.5

Moreover, a large and compelling body of empirical studies supports a causal connection between access to firearms and the risk of dying by suicide, driven, in effect, by an elevated rate of firearm suicide, with at best modest lethal substitution of nonfirearm methods. Consider, for example, the largest and most recent of the individual-level studies that contribute to this evidence base: a cohort study that identified handgun acquisitions and deaths among 26 million residents of California, aged 21 years or older, who had not previously acquired handguns.6 Cohort members were followed for up to 12 years; nearly 18 000 died by suicide, of which almost 7000 were suicides by firearm. Rates of suicide by any method were higher among handgun owners, with an adjusted hazard ratio (HR) of 3.7 for handgun owners compared with nonowners. These rates were driven by rates of suicide by firearm that were nine times higher and by relatively little substitution of suicide by nonfirearm methods (HR = 0.7; 95% confidence interval = 0.6, 0.8). In short, handgun ownership was associated with a greatly elevated and enduring risk of suicide by firearm, with minimal second-order substitution effects. Taken as a whole, empirical evidence strongly suggests that were policies or other interventions in place that did, in fact, materially reduce exposure to firearms at the population level, declines in overall suicide would result.

The meta-analytic article in the current issue of AJPH is carefully written and admirably detailed. The authors are transparent about their methods, generous in sharing their code, and thoughtfully inclusive of sensitivity analyses that together help the reader place the findings in proper context. In so doing, Smart et al. usefully add to the methodologic toolkit available to firearm researchers. The appendices and supplemental materials provided are also a boon to anyone interested in the topic. The materials are both comprehensive and informative and point out, in the winnowing down from hundreds to fewer than 20 studies that meet their criteria for inclusion in the analysis, the poverty of much of this literature. One criterion, responsible for jettisoning more than 40 peer-reviewed studies from consideration, deserves special mention: studies must compare outcome measures before versus after legislation was enacted (i.e., no cross-sectional analyses). That so many necessarily uninformative crosssectional studies have been and continue to be published, including in AJPH, is a sobering reflection of how far short of the standards adopted by Smart et al. are those that have too often governed the peer review process and editorial stewardship, at least as it pertains to studies that purport to quantify the effect of firearm legislation.

Any work, including the meta-analysis published in the current issue, that seeks to evaluate how legislative policies affect mortality will be hampered to the extent that measuring exposure remains a largely unmet challenge. A national firearms registry, like the one that made the California cohort study possible, would allow researchers to approximate, rather than assume, changes in firearms availability induced by legislative policies. What we know already, however, is that if we can develop interventions that do, in fact, meaningfully change access to firearms, particularly among people at elevated risk for suicide, lives will be saved. /4JPI-I

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Sidebar

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DETAILS

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Speaking Truth to Power on How Hurricane Katrina Beat Us

Honore, Russel L, MA

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ABSTRACT (ENGLISH)

Hurricane Katrina beat us.1 We lost the ability to communicate, transport by land and air, and provide health care for the population. Louisiana and Mississippi communities sustained a complete collapse of their civil infrastructures, including police, fire, medical and public health, and communication. The storm and its ensuing flooding caused the largest forced migration in US history. Hurricane Katrinas eastward path spared metro New Orleans, Louisiana, from a direct hit. However, the coastal storm surge, combined with surge in a manmade canal (Mississippi River Gulf Outlet) that over 30 years destroyed important protective wetlands, severely strained the levee system.2 The result was 12 feet of flooding in 80% of New Orleans.

The Mississippi River Gulf Outlet project, constructed to provide a shorter route between New Orleans and the Gulf of Mexico, is widely described as a dangerous alteration to the areas ecosystem.2 In addition, state and federal authorities approved construction of a levee system to withstand a Category 3 storm when evidence showed the eventual likelihood ofa Category 5. On average, 70% of New Orleans sits between two and five feet below sea level. The Mississippi River, which divides the city, ranges from 4 to 20 feet above sea level based on seasonal flood stages.

FULL TEXT

This historical perspective on experiences of the Commander of Joint Task Force-Katrina speaks courageously about policies that, over time, created vulnerabilities to our national safety and security.

KATRINA'S IMPACT

Hurricane Katrina beat us.1 We lost the ability to communicate, transport by land and air, and provide health care for the population. Louisiana and Mississippi communities sustained a complete collapse of their civil infrastructures, including police, fire, medical and public health, and communication. The storm and its ensuing flooding caused the largest forced migration in US history.

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JOINT TASK FORCE-KATRINA

The art of command is to enter a situation and unconfuse people.1 The catastrophic conditions given the collapsed infrastructures and public perception of civic abandonment necessitated establishing order as a critical and immediate role for Joint Task Force-Katrina, in unity of effort with other military partners.

The legal authority for the US Army to deploy troops during disasters and other national emergencies dates to 1865-4 years after the Civil War, when troops assisted with introducing former slaves to daily American life.3 The Department of Defense (US Northern Command in Colorado Springs, Colorado) established Joint Task Force-Katrina on August 30, 2005. The mission was to provide relief and recovery efforts as prioritized by Louisiana, Mississippi, and federal leadership.

Upon arrival of Task Force leadership on August 31, 2005, there was already total failure of all communication and emergency services in both states. As a consequence, Katrina caused an 80-year setback in available technology.1 Against these obstacles, 22 000 active-duty troops, 20 ships, and 200 airplanes and helicopters were quickly put into action in the affected region.1

Response operations began rapidly in collaboration with 46 000 National Guardsmen in both states. The exhaustive span of relief and recovery support included efforts to restore communications; direct search, rescue, and recovery maneuvers; coordinate evacuations; provide medical care; assist with public health disaster surveillance; gather human remains; conduct damage assessments; distribute food and water; open ports; provide food to livestock and pets; and restore civil order.1 The magnitude of deploying active-duty, National Guard, and Reserve forces was the largest since the Civil War.1

SPEAKING TRUTH TO POWER ON INJUSTICES

During disasters, vulnerable populations suffer the most. National safety and security, in fact, are compromised when populations are vulnerable. The social challenges of vulnerability are often created through policies that promote injustices. The military cannot come into a disaster situation and fix in a few days the challenges created through injustices that have festered for centuries, decades, and every day of the year.

When founded in 1718, New Orleans was roughly 10 feet above sea level. Ecosystem changes over three centuries to accommodate flood mitigation, urbanization, and industrialization altered the topography and literally sank the city.4 This created environmental injustices and put generations of people at risk.

Most of the redesign policies to the New Orleans topography, and particularly projects in the 20th century, did not consider impacts on the entire population. Value judgment criteria used to justify some policies excluded analysis of impacts on vulnerable populations who reside in low-lying flood-prone areas because residential development and public policy priorities placed them there. Inadequate levee plans were implemented despite evidence for designs that would endure higher-risk scenarios. Especially alarming were the New Orleans disaster evacuation policies despite recent planning exercises that showed that more than 100 000 residents lacked the socioeconomic status and practical means to leave during disasters. Images of people stranded in floodwaters are heart wrenching, exposing their vulnerabilities to the world.

Unjust policies that create vulnerable populations do not advance positive health benefits for all sectors of the population either. When ranking the population health status across the 50 states, the state of Louisiana ranked 50th in 2004 and 49th in 2018, up from 50th in 2017.5,6 Average life expectancy in Orleans Parish is 75.8 years compared with 79.0 nationally, an indication that unjust policies designed to give one group an advantage over others negatively affects the ability to create healthy communities.7 The statistic showing a low disparity in health status between high-school graduates and those without a high-school diploma among all races and socioeconomic classes across the entire Louisiana population vividly illustrates that point.6 Collectively, these measures of health suggest that many residents across all sectors are likely to be at risk for dying prematurely.

People living in poverty suffer more during and in the aftermath of a disaster. Poverty negatively affects the well-being of adults and children. The rate of New Orleans children living in poverty is 39% compared with the US rate of 18% (https://datacenter. kidscount.org). Workforce programs aligned with state goals to improve credentialed educational attainment as a pathway to better-paying jobs and lifting people out of poverty should be rigorously promoted in New Orleans.

PROFILES IN COURAGE

It takes courage to speak truth to power. Profiles of leaders who courageously promoted improvements across society can be found in Louisiana. Illustrations include Louisiana Governor John Bel Edwards with the expansion of Medicaid; Larry Hollier, MD, chancellor of Louisiana State University Health Sciences Center-New Orleans who, amid highly valid and heartfelt public debate, advocated health system improvement through the construction and opening in 2015 of University Medical Center to replace Charity Hospital built in 1939; Dorothy Mae Taylor, the first African American woman elected to the Louisiana House of Representatives, who fought tirelessly for policies to end segregation and other practices that fostered injustices; and leaders of the Green Army, an alliance of community, civic, and environmental groups successfully advocating environmental reforms in the state of Louisiana.

CALLS TO ACTION

Suggested action to confront injustices, reduce vulnerabilities, and improve preparedness and response capabilities in the future include

* Rapidly implementing preevent unified command and control structures;
* Ensuring a unity of effort among federal, state, and local responders;
* Building secure alternative communication systems that maintain functionality during disasters;
* Requiring disaster planning that must include response planning;
* Creating credentialed educational pathways for advancement into better paying jobs and ending poverty;
* Organizing communities to fight against injustices; and
* Empoweringpeopletovoteas a mechanism to effect needed change.

CONCLUSION

Hurricane Katrina unmasked truths about injustices imposed on society over multiple generations. The unequal negative impacts will continue with every disaster and public health emergency as seen with COVID-19. These revelations should inspire action to mitigate risk and eliminate the injustices. Historical narratives of this horrific event, like those ofprevious deadly storms, will be passed along with intense emotions to future generations-forever.

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CONFLICTS OF INTEREST

The author has no conflicts of interest.

Sidebar

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Drug Shortages and the Defense Production Act

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ABSTRACT (ENGLISH)

Amid the COVID-19 pandemic, US hospitals have faced shortages of critical drugs, including sedatives and neuromuscular blocking agents needed to intubate patients and maintain ventilatory support, opioids for pain control and sedation, antibiotics to address secondary bacterial infections, and bronchodilators to open airways.1 In response to limited supplies of ventilators and personal protective equipment, the Trump administration invoked the Defense Production Act (DPA), but shortages of personal protective equipment remain. Although the DPA-if applied more broadly-could be effective in helping to address remaining shortages of personal protective equipment, using the DPA to address drug shortages is more challenging, and additional government interventions to support the drug supply chain are needed.

The DPA is a Korean War era law that enables the president to manage critical resources in times of scarcity by providing authority to gather confidential business information, allocate existing supplies, expand domestic production, and compel private industry to fulfill government manufacturing contracts.2 Use of the DPA does not require a large-scale crisis but must support the national defense, including the protection of critical infrastructure. For example, in 2011, the government used the DPA to gather information about the US health care sector-considered critical infrastructure- finding a "very high degree" of dependence on international pharmaceutical manufacturers.3 Presidents have also used the DPA to prevent electrical blackouts, combat espionage, and provide adenovirus vaccines to military personnel.

FULL TEXT

Amid the COVID-19 pandemic, US hospitals have faced shortages of critical drugs, including sedatives and neuromuscular blocking agents needed to intubate patients and maintain ventilatory support, opioids for pain control and sedation, antibiotics to address secondary bacterial infections, and bronchodilators to open airways.1 In response to limited supplies of ventilators and personal protective equipment, the Trump administration invoked the Defense Production Act (DPA), but shortages of personal protective equipment remain. Although the DPA-if applied more broadly-could be effective in helping to address remaining shortages of personal protective equipment, using the DPA to address drug shortages is more challenging, and additional government interventions to support the drug supply chain are needed.

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In the current crisis, the government first needs more information from drug manufacturers and compounding pharmacies. In its $2.2 trillion COVID-19 aid package, Congress required drug manufacturers to report additional information to the Food and Drug Administration (FDA) concerning shortages, such as the source of active pharmaceutical ingredients, alternative sources, reason for the shortage, and expected duration.4 More information may be needed to thoroughly assess supply chain vulnerabilities. For example, the FDA issued guidance for COVID19-related drug shortages, recommending that manufacturers provide information beyond that required by Congress,4,5 including details on inventories, emergency reserves, market shares, proposals to mitigate disruption, and monthly sales volumes.5 But manufacturers consider much of this information confidential. If information is not rapidly forthcoming, the administration could use the DPA to require disclosure. The secretary of Health and Human Services could also use the DPA allocation authorities delegated to him by executive order on March 18, 2020 to redistribute drugs that are in regional but not national shortage. If the government uses the DPA for this purpose, it will be important to allocate supplies equitably among states based on public health need and to avoid political favoritism of certain states over others. The government could also use its DPA authority to compel manufacturers to accept production contracts, thereby helping to overcome business dynamics that might otherwise frustrate efforts to increase supply. For example, manufacturers may be capable of shifting capacity to the production ofscarce drugs but reluctant to undermine existing business relationships and contractual obligations, unless ordered to do so under the DPA. The administration could even augment private manufacturing facilities by installing federally owned equipment if required to increase drug production.

Statutory DPA authority is primarily limited to domestic industry, constraining the president's ability to address supply issues in an increasingly global market. An estimated 72% of manufacturing facilities making active pharmaceutical ingredients supplied to the United States are located abroad,6 primarily in China and India. Different parts of the drugmanufacturing process may occur across several countries, creating complex and vulnerable supply chains. As global drug demand increases, disruption in international supply chains could worsen domestic shortages. For example, India has altered its drug export policies throughout the COVID-19 pandemic. Depending on the severity of disruptions, manufacturers may be unable to fill orders of critical drugs. More information is needed on drug-manufacturing capabilities to assess whether the DPA could be used to prioritize government contracts for drugs in shortage.

Expanding domestic drug production by upgrading facilities could be challenging, owing to complexities in the manufacturing process. Although General Motors produced 30 000 ventilators within a month, drugs require time-consuming sterility and stability testing. Sterility testing is especially important for injectable drugs, which comprise many of the medicines needed to treat patients hospitalized with COVID19. Manufacturers have indicated that doubling production within certain drug categories-including antibiotics, sedatives, and vaccines-would require three months to two years.3 These estimates were made assuming that facilities would be running at maximum capacity and that labor and material availability would reflect normal market conditions, meaning lead times in the current crisis could be longer.

As policymakers consider invoking the DPA to address shortterm supply issues, they should be mindful of other potential pitfalls and unintended consequences. Responding too slowly could lead to wasted resources if government-produced drugs arrive only after the private market has rallied. Headlines with ominous predictions of ventilator shortages in March were replaced by those announcing a potential glut of ventilators in May. By contrast, excessively rushing to production could compromise product quality and lead to overproduction if demand estimates turn out to be inaccurate. The government stockpiling of 63 million doses of hydroxychloroquine, a discredited treatment for COVID-19, was based on almost no evidence from the start and now looks wasteful. More fundamentally, use of the DPA could, in the long term, limit incentives for the health care industry to invest in improvements that could avert future shortages at lower cost, such as strengthening contractual supply-assurance provisions, engaging with multiple suppliers, preparing alternate treatment protocols and other contingency plans, and holding larger inventories in reserve.

Another concern is the government's willingness to use the DPA in the pharmaceutical sector at all. Global shortages of masks garnered widespread media attention in January, but the president did not sign an executive order invoking the DPA for medical products until mid-March-too late to avert widespread shortages of masks and other personal protective equipment, which persisted for many weeks. Concerns over COVID-19-related drug shortages were voiced as early as February 27, but the administration still has not compelled the production of any drugs. Such hesitancyto use the DPA could render its authorities futile if critical drugs are not produced in time to address patient needs.

Alternative options are needed to address pressing COVID-19-related drug shortages. Efforts in Congress have been made to increase transparency and support domestic manufacturing. For example, Senator Gary Peters (D, MI) recently introduced legislation that would increase the frequency of manufacturer reporting and expand requirements to include data on all drug-manufacturing facilities and production unit volumes.7 A separate proposal from Senator Peters would advance domestic drug manufacturing by offering grants and forgivable loans as incentives. Congress could codify into law the suggested shortagerelated reporting information included in FDA guidance5 and extend reporting requirements relating to inventories and emergency reserves to compounding pharmacies and suppliers ofactive pharmaceutical ingredients. The president could negotiate treaties promoting reciprocal arrangements by which each nation's drug regulatory body would recognize certain qualifying drug approvals (e.g., unpatented generic drugs) ofits foreign counterparts, which would allow drugs approved for sale in other well-regulated markets to be sold in the United States with limited additional administrative requirements.

Regulatory agencies can also help and have already taken several measures. The FDA issued a temporary policy allowing compounding facilities-even those not registered with the FDA-to supply hospitals experiencing shortages with copies of drugs needed to treat COVID19 and loosened restrictions on repacking injectable propofol, a sedative used for ventilatory support. The Drug Enforcement Agency authorized additional production and imports of certain controlled substances also needed for mechanical ventilation. Going forward, government health officials could advise clinicians about therapeutically similar products that could be considered for substitution and offer recommendations for doing so safely. They could also help hospitals coordinate efforts to address shortterm needs by sharing surplus supplies.

Because it is unknown how this pandemic will evolve in the coming months, more information is needed about inventories and supply chains to ensure long-term availability of essential products. More knowledge on production capacity and capabilities could also help clarify the extent to which the DPA could be used, while limiting unintended consequences as much as feasible. But given the government's reticence to use the important authorities provided by the DPA, additional strategies should be considered to gather information and supply medicines throughout the ongoing COVID19 response. Without these medicines, ventilators acquired at great expense may become unusable, patients will suffer, and health care workers will continue to face difficult decisions when allocating limited supplies.

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Sidebar

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DETAILS

Subject:	Bronchodilators; Incentives; Production; Vaccines; Personal protective equipment; Shortages; Contingency plans; Hospitals; Information industry; Pharmaceutical industry; Anesthesia; Antibiotics; COVID-19; Pandemics; Bacterial diseases; Sedatives; Manufacturing; Production capacity; Coronaviruses; Inventory; Business information; Defense programs; Ventilators; Inventories; Narcotics; Presidents; Opioids; Drugs; Defense Production Act 1950-US; Scarcity; Medical supplies; Contingency; Equipment; Suppliers; Protective equipment; Government contracts; Editorials; Pharmacy; Supply chains; Executive orders; Pain; Masks; Safety equipment; Military personnel; Espionage; Health care industry; COVID-19 vaccines; Korean War; Industrial development; Public health

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Disability, Ethics, and Health Care in the COVID-19 Pandemic

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ABSTRACT (ENGLISH)

This article considers key ethical, legal, and medical dilemmas arising for people with disabilities in the COVID-19 pandemic. We highlight the limited application of existing frameworks of emergencyplanning with and for people with disabilities in the COVID-19 pandemic, explore key concerns and issues affecting the health care of people with disabilities (i.e., access to information and clinician-patient communication, nondiscrimination and reasonable accommodations, and rationing of medical goods), and indicate possible solutions. Finally, we suggest clinical and public health policy measures to ensure that people with disabilities are included in the planning of future pandemic-related efforts. The devastation evoked by the COVID-19 pandemic raises challenging dilemmas in bioethics. It also speaks to social justice issues that have plagued historically marginalized communities in the United States. Responses to the pandemic must be bound by legal standards, principles of distributive justice, and societal norms of protecting vulnerable populations- core commitments of public health-to ensure that inequities are not exacerbated, and should provide a pathway for improvements to ensure equitable access and treatment in the future.

FULL TEXT

Headnote

This article considers key ethical, legal, and medical dilemmas arising for people with disabilities in the COVID-19 pandemic. We highlight the limited application of existing frameworks of emergencyplanning with and for people with disabilities in the COVID-19 pandemic, explore key concerns and issues affecting the health care of people with disabilities (i.e., access to information and clinician-patient communication, nondiscrimination and reasonable accommodations, and rationing of medical goods), and indicate possible solutions. Finally, we suggest clinical and public health policy measures to ensure that people with disabilities are included in the planning of future pandemic-related efforts.

The devastation evoked by the COVID-19 pandemic raises challenging dilemmas in bioethics. It also speaks to social justice issues that have plagued historically marginalized communities in the United States.

Responses to the pandemic must be bound by legal standards, principles of distributive justice, and societal norms of protecting vulnerable populations- core commitments of public health-to ensure that inequities are not exacerbated, and should provide a pathway for improvements to ensure equitable access and treatment in the future. (Am J Public Health. 2020;110:1523-1527. doi:10. 2105/AJPH.2020.305837)

The COVID-19 pandemic has stretched the capacities of health care systems and raised challenging ethical dilemmas. With the unprecedented, rapid spread of infection, COVID-19 testing and care capacities have been overwhelmed. As health care professionals, families, and society grapple in real time with life-or-death decisions regarding equitable access to testing, shortages in personal protective equipment, rationing of medical goods, and clinicians' distress, the need for comprehensive emergency plans and guidelines is more critical than ever. Yet, as the pandemic wreaks havoc globally, its wide-ranging impacts on people with disabilities have received relatively little attention. Many people with disabilities-a large and diverse group encompassing individuals with a range of functional impairments, from mobility limitations to blindness or low vision and intellectual disability-are not necessarily at higher risk for contracting COVID-19. However, some subgroups are, and, more generally, the absence of strong national policies to accommodate the needs of this population significantly disadvantages the ability of many people with disabilities to protect themselves from COVID-19. This neglect may result in many people with disabilities being left behind.

People with disabilities have only recently begun to be recognized by the field of public health as a population with significant health disparities. Notwithstanding its large size-20% of children and 26% of adults in the United States, by estimates of the Centers for Disease Control and Prevention (CDC)1,2-this community remains highly marginalized and is underserved and underresearched. Compared with the general public, people with disabilities have less education; more economic, food, housing, and employment insecurity; and less Internet access.3 Although the rate of chronic medical conditions (e.g., obesity and cardiovascular disease) may be higher among some subgroups (e.g., people with mobility and intellectual disability),3 the CDC reports that, overall, "adults with disabilities are three times more likely than adults without disabilities to have heart disease, stroke, diabetes or cancer."4 In addition, studies show that the prevalence ofdisability, including unmanaged chronic medical conditions, is disproportionately high among racial/ethnic minorities, including American Indian/Alaska Native communities.5 This puts people with disabilities in double jeopardy for marginalization in routine and preventive health care5,6 and, as demonstrated with COVID-19, in emergency preparedness and care.

There are only limited data on emergency planning for people with disabilities, but the need for tailored approaches to support this population during emergencies is not new. In the United States, such efforts have been catalyzed by media coverage of 9/11 and Hurricane Katrina, highlighting the failure to evacuate people with disabilities during times of disaster.7 More recently, during the H1N1 pandemic, the CDC called for recognition of people with mobility and cognitive disabilities as a high-risk group for developing influenza-related complications.8

Yet, existing emergency guidelines have limited application to the COVID-19 pandemic. For instance, the recommendation by the CDC and the Federal Emergency Management Agency (FEMA) that people with disabilities respond to disasters such as the H1N1 pandemic by utilizing a "personal support network" comprising several people8'9 has limited relevance to COVID-19. With stay-at-home and social distancing orders invoked because of the pandemic' the access of some people with disabilities to personal care assistants who provide direct support in their daily lives has been restricted.10 Although FEMA has in recent years highlighted the responsibilities of local governments to include people with disabilities in the planning' integration' and implementation of emergency programs'11 consolidated and consistent guidelines are lacking.12 As states' hospitals' health care systems' and residential settings for people with disabilities move to develop responses to the pandemic' it is critical to explore key issues likely to have an impact on their care. We consider 3 key issues: access to communication and medical information' nondiscrimination and reasonable accommodations' and rationing of medical goods.

COMMUNICATION AND MEDICAL INFORMATION

Although the scientific understanding of COVID-19 is limited, communicating the risks, measures of prevention' and treatment options before, during, and after the emergency are key to slowing down a pandemic and improving health outcomes. However, there are reasons to believe that people with some disabilities have been underinformed about COVID-19 and its ramifications. Consider the following: information conveyed via charts and graphs is inaccessible for blind and low-vision individuals and incomprehensible for people with intellectual disability (and others) if not provided in plain language. Similarly, news briefings conducted without captioning or qualified American Sign Language interpreters preclude deaf and hard-of-hearing individuals from being informed.

As underfunded organizations ofand for people with disabilities are forced to replace governmental functions and scramble to develop accessible information, additional challenges have emerged. The reliance on drive-through COVID-19 testing facilities when public transportation is restricted makes it difficult for blind and low-vision individuals and people with developmental disabilities to be tested and seek care. The transition to telehealth is appropriate in a pandemic but raises other challenges. For instance, automatic answering systems with multiple options are difficult, even impossible to use for many people with intellectual disability, deaf and hard-ofhearing individuals, or those with physical or speech-related disabilities that impede navigating these communication systems. Telehealth options may also be challenging for people with psychiatric conditions who, because of stigma, may conceal their condition and treatment from family members13 or who cannot conduct confidential clinician-patient conversations while shelter-in orders are in effect.

These examples are not intended to minimize the importance ofthe measures taken to facilitate care in the pandemic. However, they highlight significant informational disadvantages that people with disabilities may experience regarding COVID19-from prevention (e.g., social distancing) to symptom identification and treatment recommendations. And, while clinicians are often expected to fill patients' informational gaps, their ability to discharge this responsibility during a pandemic is limited. This difficulty is likely also felt "on the ground." In a recent survey of (mostly) people with intellectual and mobility disabilities (n = 2469), only 15% ranked health care providers/health systems as the most important source of information about COVID-19.10

Collaborations with and budgetary allocations for organizations of people with disabilities are critical for promoting high-quality, effective patient care in the pandemic. Currently, such organizations have been impelled to engage in public health activities for which they are not fully prepared or funded. Yet, as organizations with unique expertise in the needs of the populations they serve, they are invaluable players in ensuring better responses to pandemics. Such organizations can assist in developing disability-accessible information about COVID-19 (and future pandemics), admission procedures, and treatment options for a highly diverse population of people with disabilities. Federal, state, and local agencies must also utilize multimodal communication strategies (e.g., text, e-mails, radio, television) to maximize the number of individuals who are informed about the pandemic.12

NONDISCRIMINATION AND REASONABLE ACCOMMODATIONS

The prohibition of discrimination on the basis of disability, including the requirements of reasonable accommodations and modifications to ensure equal access to effective health care services, is well established in US and international law.14 17 While the requirement of reasonable accommodations and modifications is not absolute, it aims to ensure that policies, practices, and procedures are inclusive ofpeople with disabilities. Despite improvements, studies show that many health care facilities and medical equipment remain inaccessible, and that health care providers often have insufficient training about the needs of people with disabilities.18,19

Although these systematic deficiencies have resulted in poorer health outcomes among people with disabilities,5 the undisputed need for urgent response in the pandemic has exacerbated the challenges. For example, newly constructed alternative care settings may be impossible for blind and lowvision individuals to navigate; the use of nontransparent facial masks prevents lip-reading among some deaf and hardof-hearing patients; and the no-visitor order for adult patients comes at a time when an accompanying caregiver may be especially needed to facilitate communication and decision-making with some people with intellectual disability.20 Some of these challenges are unavoidable during a pandemic and may not be in violation ofthe legal requirement for reasonable modifications (e.g., use of alternative care settings). Other challenges, however, could have been addressed with earlier planning, such as acquiring transparent facial masks.

Systemic barriers that have persisted for decades (e.g., inaccessibility of facilities and equipment) cannot be instantly reversed. However, adopting measures to facilitate engagement of patients with disabilities in their care is essential. For example, informed consent processes should take place, as much as possible, through direct conversations with patients and their family members. The already expanded use of telemedicine options to facilitate communication among clinicians, patients, caregivers, and family members should include disability-friendly accessibility measures that can be downloaded into computers and mobile devices (e.g., remote audiovisual description services for blind and low-vision individuals, captioning or third-party remote connection with American Sign Language interpreter for deaf and hard-ofhearing people).

The requirement of reasonable accommodations and modifications is also key for treatment decisions. A patient with disabilities may require, for example, an extended period of ventilator use for recovery or bed allocation in an established (rather than an adhoc) care setting, where accessible equipment is more likely to be available. Classifying patients' usual caregivers as "essential personnel," who are entitled to provide support to hospitalized patients, should also be considered. Certainly, such a classification raises several dilemmas, including the possible risk of infection to caregivers, need for personal protective equipment at a time ofshortage, and determining that caregivers are not under undue pressure to risk their own lives to support the individual with disability. However, as attested by the growing number ofstates that have reversed their no-visit policy for people with disabilities,20 such accommodations allow caregivers to provide indispensable and necessary supports during the pandemic and throughout the admission and hospitalization period. Plain-language forms inquiring about the needs of a patient with disabilities at time of admission to health care facilities,21 coordinated efforts with communitybased organizations, and consultation with in-house experts (e.g., university disability services) can be instrumental in finding practical solutions and better addressing the needs of patients and providers with disabilities.

RATIONING

The issue of rationing medical goods and services is a controversial topic in the COVID-19 pandemic. The debate has been particularly relevant for people with disabilities, with several states reportedly having developed triage policies that recommended disability-based exclusion from lifesaving treatments. Washington State, for example, excluded patients with "loss of reserves in energy, physical ability, cognition and general health," while Alabama's (now reversed) policy excluded patients with "severe or profound mental retardation," "moderate to severe dementia," and "severe traumatic brain injury. "22(p2) Following complaints filed by disability rights organizations about these emerging discriminatory schemes, the US Department of Health and Human Services' Office for Civil Rights (OCR) issued an instructive bulletin on March 28, 2020, reaffirming the continued application of relevant disability laws in the pandemic to medical decisions relating to people with disabilities.23 Although reassuring, questions about rationing determinations and disability remain, especially as several similar complaints remain under review.

Rationing requires difficult decisions about allocation of scarce resources under conditions of extreme time pressure and limited data. Ethicists have long considered the values underpinning rationing decisions, and, although maximizing the number of saved lives is commonly the decisive goal,24-26 there are varying views about how to operationalize it and balance multiple, competing ethical and societal values. Another key question is how equality and nondiscrimination on the basis of disability are to be interpreted in rationing decisions.

Part of the challenge is that existing guidelines are often drafted by medical experts with little input from people with disabilities. Whether and how disability perspectives about resource allocation are incorporated into the guidelines is unclear. While the absence of disability voices on such drafting committees may result in unconscious bias27 being introduced into the guidelines, the presence of 1 person with disabilities among many clinicians on such committees may be insufficient to affect the outcomes (as has occurred with some community members serving on institutional review boards28). Inconsistent application and interpretation of existing standards may similarly result in discriminatory outcomes for people with disabilities. For example, New York State's 2015 Ventilator Allocation Guidelines26 (currently under review by the OCR) could be interpreted to allow the removal and reallocation of personal ventilators of people using them regularly if they arrive at a hospital from chronic care facilities and are deemed ineligible for treatment.26 Despite clarification that such an outcome was not intended by the drafters of the guidelines,29 worry is fueled by the absence of a clear, publicly available list of treatmentexclusion criteria and a history of disability discrimination in society, including health care.30

Rationing based on prognosis for survival-a reasonable criterion in a pandemic-similarly raises distress among people with disabilities. Common presumptions of disabilities as implying adverse health outcomes5 may result in inaccurate or biased prognoses. Subjective quality-oflife judgments may similarly enter rationing decisions and result in discriminatory outcomes. Key gatekeepers, including emergency department clinicians, nurses, and medical students, often rate the quality of life of people with disabilities much lower than do the individuals with disabilities themselves, and such biases have an impact on medical futility decisions.31

To prevent discrimination, health care facilities should explicitly distinguish between disability status (e.g., deafness and intellectual disability) and comorbidities that have been shown to affect survival (e.g., end-stage cancer) as a criterion for denying lifesaving treatment of COVID-19. They should endorse a clear, unbiased process to assess patients individually, ensuring that allocation decisions are based solely on objective medical evidence for likelihood of survival from COVID-19, rather than on perceived quality of life associated with disability. Transparency in rationing decisions is essential for maintaining public trust in the medical response to this pandemic, particularly given the history of disability discrimination, including the connection between eugenics and the medical profession.

Measures to safeguard against biases erroneously affecting rationing decisions are also needed. As initial assessments of patients are likely to affect subsequent decisions, it is crucial that they be re-evaluated by additional clinicians. Although disability training for clinicians is impractical at this time, educating members of ethics committees (who are likely already involved in the COVID19 response) and triage committees (if established) and creating diverse, interdisciplinary committees can be helpful. Triage committees are intended to "buffer" clinicians from the distress over decisions that contravene their patients' best interests (e.g., ventilator withdrawal) by entrusting "respected clinicians and leaders among their peers and the medical community" with rationing decisions.25(p2)

As regular contact with people with disabilities has been shown to reduce biases, triage committees should include members of health disciplines such as rehabilitation that hold more optimistic views of prognosis and quality of life of patients with disabilities.32 Including health care providers with disabilities, especially those who are also from racial/ethnic minorities, would be similarly invaluable. The prevalence ofdisabilities is higher among racial/ethnic minorities, and existing (limited) data suggest that health disparities are compounded among people with disabilities who belong to underserved racial/ethnic groups.5,6 Moreover, given the high stakes for people with disabilities in rationing decisions, representatives of organizations of people with disabilities or disability rights experts should be consulted in rationing decision-making processes. Although the need for diverse members of triage committees may add complexities, it could facilitate unbiased outcomes and increase trust in the decision-making process.

MOVING FORWARD

As we move from the apex of the pandemic-at least in terms of an initial wave-to its aftermath, marginalized groups such as people with disabilities must be included in future emergency preparedness and implementation efforts. First, data collection during and after this emergency can inform improvements of national and local responses to future pandemics. Currently, scarce data are available about disease, recovery, and mortality rates from COVID-19 among people with disabilities. Following media reports of disproportionately high infection and mortality rates in congregate settings, some states in the United States began recording such data. Although still incomplete, accumulated data indicate that, as of May 21, 2020, residents of long-term-care facilities account for 16% of the total cases across 42 states and 42% of the total deaths across 38 states.33 In addition, a first international study of electronic medical records ofCOVID-19positive patients found higher case-fatality rate among people with intellectual disabilities aged 0 to 17 years and 18 to 74 years compared with other patients with COVID-19.34

Yet, it is unknown how many people with disabilities in the United States, with or without chronic underlying conditions associated with COVID-19 such as diabetes, hypertension, lung diseases, and cardiovascular diseases,35 have been sick, died, or recovered from COVID-19. Given the cyclical interaction between poverty and disabilities (including unmanaged chronic conditions5) and reports ofhigher mortality rates from COVID-19 in impoverished neighborhoods and among racial/ethnic minorities,35,36 it is further likely that the infection and death toll in the disability community will be high. Collecting and analyzing local and national data that include documented underlying conditions and disability status, aggregated data from treatment decisions, and accurate recording of cause of death (a practice that has been previously found to be compromised with regard to people with intellectual and developmental disabilities who died from pneumonia37) will allow for developing equitable strategies for health care allocation in future health crises that are supported broadly by multiple constituencies, including those with disabilities.

Second, the need for identifying short- and long-term remedies (i.e., treatment and vaccination) is dire. Fair allocation is similarly necessary. Distributive justice and the societal value of protecting vulnerable populations requires that, after protecting front-line health care and service providers,26 those who are most vulnerable to COVID-19 come next. Although disability status alone would not qualify, rates of chronic medical conditions (e.g., diabetes, cardiovascular disease) associated with worse outcomes of COVID-19 are higher among this population.4,5 As people with disabilities are more likely to be insured through public sources,38 state and national governments must ensure that such high-risk individuals, including those who rely on personal care assistants for whom physical distancing is difficult,10 have access to critical COVID-19 interventions.

Finally, the unique vulnerability ofpeople with disabilities in group homes and residential facilities, psychiatric institutions, nursing homes, and prisons should also be prioritized. Such settings have been shown to be "ground zero" in the COVID-19 pandemic, especially nursing homes with high occupancy of Black/African American and Latino residents.39 The latter findings also highlight the impact of compounded health disparities: individuals (including seniors) from racial/ethnic minorities needing long-term care are more likely than Whites to reside in nursing homes that are overcrowded,39 underfunded, understaffed, and with poorer quality of care.40 The limited and inconsistent guidelines in such facilities regarding visitations, staff screening, and personal protective equipment,33 and their (in)ability to respond appropriately to COVID-19 is a result of systemic issues that need to be addressed. Future preparedness efforts must focus on increased funding to residential facilities and development of policies to mitigate risks. These include ensuring access to testing, separation of COVID-19 patients from other residents, provision of personal protective equipment for direct care staff, and improved training and support to ensure safe and high-quality implementation of emergency procedures.

The devastation evoked by this pandemic raises challenging bioethical dilemmas that speak to social justice issues that have plagued historically marginalized communities in the United States. The lack of preparedness in providing accessible COVID19 information, the delayed consideration ofthe unique health care needs of people with disabilities during the pandemic, and biased policies about allocation of medical goods are reflective of long-term neglect of this population in health care and in society. The pandemic also brings to the fore the dire impacts of compounded health disparities on health outcomes: although the impacts of health disparities are relevant for people with disabilities, as a group, these impacts are especially alarming, and disproportionally high, among people with disabilities from racial and ethnic minorities, including American Indian/Alaska Native communities. Responses to this pandemic should not exacerbate inequities faced by people with disabilities.

There is an urgent need for developing and implementing immediate measures to address the challenges. Clear guidelines to ensure accurate and comprehensive data recording are essential to inform our next steps. Enhanced consideration of the needs of this large community during the pandemic is necessary to ensure equitable access and treatment in the future. People with disabilities are equally valuable members of our society. Responses to the COVID-19 pandemic should not leave them behind. ÂIPU

CONTRIBUTORS

M. Sabatello conceptualized the article, prepared the initial draft, and revised and finalized the article for submission.

T. Blankmeyer Burke, K.E. McDonald, and P. S. Appelbaum provided substantive comments, critical revisions, and edits to the article's drafts. All authors gave final approval of the version to be published.

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CONFLICTS OF INTEREST

M. Sabatello is a member of the All ofUs Research Program's institutional review board. The authors declare no other conflict of interest.

HUMAN PARTICIPANT PROTECTION

This article is notbasedon a study involving human participants. Institutional review board approval was not needed.

Sidebar

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DETAILS

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Document 34 of 61

A Community-Based Participatory Research Approach to Hurricane Katrina: When Disasters, Environmental Health Threats, and Disparities Collide

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ABSTRACT (ENGLISH)

In 2005, Hurricane Katrina resulted in long-term flooding of 80% of New Orleans, Louisiana. Moldinfested homes gave rise to concerns about increased childhood asthma. To address these concerns, a diverse community-academic partnership used a community-based participatory research (CBPR) approach to implement the Head-off Environmental Asthma in Louisiana (HEAL) study in 2007. The study examined the relationship between post-

Katrina mold and other environmental exposures and asthma morbidity, while testing an asthma counselor (AC) intervention. Both the AC intervention and the CBPR approach were effectively implemented in the postdisaster setting. However, homes had lower levels of mold and other allergens than expected, possibly because of the timing of environmental sampling. Also, HEAL illustrated the vulnerability of the study community, especially to the interconnected threats of health disparities, environmental health stressors, and disasters. We examine the implications of these threats for public health science, policy, and practice, not only through the lens of Hurricane Katrina but also for future disasters faced by communities in the Gulf Coast and nationally.

FULL TEXT

Headnote

In 2005, Hurricane Katrina resulted in long-term flooding of 80% of New Orleans, Louisiana. Moldinfested homes gave rise to concerns about increased childhood asthma. To address these concerns, a diverse community-academic partnership used a community-based participatory research (CBPR) approach to implement the Head-off Environmental Asthma in Louisiana (HEAL) study in 2007.

The study examined the relationship between post-Katrina mold and other environmental exposures and asthma morbidity, while testing an asthma counselor (AC) intervention. Both the AC intervention and the CBPR approach were effectively implemented in the postdisaster setting. However, homes had lower levels of mold and other allergens than expected, possibly because of the timing of environmental sampling. Also, HEAL illustrated the vulnerability of the study community, especially to the interconnected threats of health disparities, environmental health stressors, and disasters.

We examine the implications of these threats for public health science, policy, and practice, not only through the lens of Hurricane Katrina but also for future disasters faced by communities in the Gulf Coast and nationally. (Am J Public Health. 2020;110:1485-1489. doi: 10.2105/AJPH.2020.305759)

Hurricane Katrina made abundantly visible the unique vulnerability facing many residents of the US Gulf Coast, especially children: a historic burden of health and other disparities, persistent environmental health threats, and recurring natural and technological disasters.1 For example, Louisiana is among the states with the highest rates of chronic health conditions such as asthma, cardiovascular disease, diabetes, obesity, and cancer.2 Recently, Wallace et al.3 showed that homicide is the leading cause of death among pregnant and postpartum women in Louisiana, a disturbing and fully preventable outcome. Economically, Louisiana has one of the highest child poverty rates (26%) in the country, with 43% of the states African American children living in poverty.4 Differences in average household income between Whites and minorities in Louisiana remain stark.5 The state is also home to a multitude of operating and abandoned chemical facilities and ranks near the top of the list for toxic releases nationwide.6 Although it is difficult to establish complete exposure pathways, the mere presence of these facilities drives fear and distrust among many community members.

Extensive, long-term flooding in New Orleans after Katrina resulted in widespread mold infestation of the built environment where children live, learn, and play-homes, schools, libraries, and playgrounds. The flood waters, affecting 80% of the city, remained for two to six weeks and led to environmental conditions never before experienced indoors or out.7,8 The pre-Katrina prevalence of childhood asthma in New Orleans was among the highest nationally.9 Community members and public health officials were concerned that the unprecedented levels of indoor mold could exacerbate childhood asthma. To address these concerns, a broad partnership of community leaders, research scientists from academia and private research enterprises, and federal and local government conducted the Head-offEnvironmental Asthma in Louisiana (HEAL) study from 2007 to 2009.

The HEAL study team developed a novel, field-applicable, hybrid intervention targeting 182 children with moderate to severe asthma, against the backdrop of three interconnected challenges: intransigent health disparities, persistent environmental health threats, and disasters. This postKatrina pediatric asthma study sought to reduce asthma morbidity by employing evidence-based interventions from previous trials tailored to families facing these interconnected risks. Informed by a clinical evaluation ascertaining the childs asthma and mold allergy status and an environmental assessment documenting exposure risks to mold and other allergens, the intervention consisted ofa customized exposure-reduction component andan asthma counseling component, both aimed at providing caregivers the knowledge, skills, and motivation to manage their children's asthma.9,10

Post-Katrina stressors exacerbated the burden of existing disparities faced by families and children. For example, at baseline, HEAL families moved an average of 3.1 times after the storm.10 Data from a previously unpublished needs assessment completed by 136 HEAL caregivers showed that 62% of children were attending a different school and 20% had fallen behind a grade or more. Forty-nine percent had a relative who moved away and 20% had a relative who died; 35% had a close friend who moved away and 4% had one who died. Fiftyfour percent had lost belongings and 19% had lost a pet.

The families' situations varied greatly, with some in extreme circumstances. In February 2008, 2.5 years after the storm, baseline evaluations were completed on two children. One was a highly atopic boy, still sleeping on his damaged mattress in a home that had flooded and using only expired asthma medications. The other was a girl sleeping in the family's car in the parking lot of an emergency room even though the family owned a house; her asthma was so severe that her mother was afraid to let her sleep at home after the child had been admitted twice the month before.

In this commentary, we revisit HEAL's findings and discuss how the study team implemented community-based participatory research (CBPR) in a postdisaster setting. We then examine the implications of interconnected health disparities, environmental health threats, and disasters in the context of current challenges and opportunities in public health science, policy, and practice.

THE HEAL STUDY

HEAL was a pre-post intervention of children aged 4 to 12 years with persistent moderate to severe asthma (Table 1). The intervention delivered patienttailored asthma counseling and case management, guidance for reducing exposures to environmental triggers, and resources to meet the needs of families living in the postdisaster setting. Enrollment occurred in 2007 and 2008, and participants remained in the study for one year. Study visits included two clinical evaluations, three home assessments, and at least two asthma counselor visits with follow-up calls. Outcomes were collected by phone quarterly to capture maximum symptom days in the preceding two weeks, defined as the largest number of the following variables: days with wheezing, chest tightness, or cough; nights of sleep disturbance; and days when activities were affected, such as the child slowing down or ending physical activities.10

Participants' homes were evaluated by visual inspection, temperature and moisture measurements, and air and dust sampling. Air was collected with vacuum-pump spore traps and analyzed for more than 30 mold taxa using bright field microscopy. Dust was collected from the children's beds and bedroom floors and analyzed for mouse (Mus m 1), dust mite (Der p 1), cockroach (Bla g 1), and mold (Alternaría mix) allergens using ELISA. Alternaría antigen was detected in dust from 98% of homes, with 58% having concentrations higher than 10 micrograms per gram. Geometric mean indoor and outdoor airborne mold levels were 501 and 3958 spores per cubic meter, respectively. Even though mold was found in homes, no children were found living in unhealthy conditions with copious amounts of mold. This may have been because sampling occurred two years after flooding and public awareness programs emphasized that no one should live in mold-ridden homes.12

At baseline, participants completed a clinical evaluation that included lung function, allergen skin testing, and study questionnaires. Of those enrolled, 89% of the children testedpositive to one or more indoor allergens: 67% tested positive to dust mites and 72% tested positive to at least one of the four primary molds (Alternaria, Penicillium, Cladosporium, and Aspergillus). There was no relationship between allergen concentrations in homes, skin test sensitivities, and asthma morbidity. This lack of relationship points to the complexity of attempting to assess these associations during rapidly changing social and environmental conditions, which was further complicated by home remediations already conducted by most participants.13

The asthma counseling intervention provided tailored asthma case management to HEAL families. Community health workers and asthma counselors were paired to enhance rapport with families and optimize care coordination.

Training competencies for the asthma counseling team included asthma physiology, medications, devices, cultural competency, communication skills, environmental control procedures, psychosocial issues, personal safety, and proper case management and documentation. Individualized counseling provided by counselors included educational modules tailored to each child's environmental risk (e.g., reported exposures, allergy skin test results), results from the clinical assessment, and the expressed needs of the child's family. Often, counselors had to address a family's social needs before addressing asthma management. Housing, transportation, and parental employment all affected the ability to manage a child's asthma.14

Postintervention changes in asthma symptoms (45% reduction in symptoms from baseline to 12 months; P <.001) were consistent with similar trials in nondisaster settings. Children whose families had contact with a HEAL asthma counselor by six months from baseline showed a 4.1-day decrease in symptom days, significantly greater than the 1.8-day decrease among those who had not yet seen a counselor (P< .001). At 12 months from baseline, the group that had seen a counselor had a 3.14-day improvement, compared with a 1.29-day improvement for those who had not (P = .06).9 Overall, children who attended more visits with the asthma counselor team had the greatest decrease in symptoms. After the intervention, participants were more likely to take medications as prescribed (P = .003), have a provider for follow-up care (P< .001), experience fewer financial and insurance problems for appointments (P = .006), and report fewer problems obtaining asthma medications (P = .005).14

POSTDISASTER PARTICIPATORY RESEARCH

After HEAL was completed, the research team assessed the degree to which the study applied Israel et al.'s CBPR principles.15 Although the principles were not designed for a disaster context, the team was interested in taking stock of the challenges of implementing populationbased research and CBPR after Katrina. Perhaps the most important principle, using a cyclical and iterative process (principle 6), was exemplified by the team's redesign of several study components based on community feedback and operational realities. Integrating knowledge and action (principle 4) and disseminating findings and knowledge to all partners (principle 8) were implemented when the team acted on study data and participant input to develop tailored information and a feedback loop encouraging collaboration and communication among study personnel and participants. Recognizing community as a unit of identity (principle 1) and promoting a colearning and empowering process reflective of social inequalities (principle 5) were also essential. When designing the intervention, the team took into consideration the socioeconomic challenges facing residents ofinner-city New Orleans and sought to empower study participants to address disparities (e.g., housing, health care access) and modify behavior to reduce asthma triggers.11

Building on the community's strengths and resources within the community (principle 2) and facilitating the collaborative, equitable involvement of all partners in all phases of the research (principle 3) had somewhat limited impact. Many study hurdles were successfully overcome by leveraging community resources, such as hiring local staff and heeding the advice of Community Advisory Group members. For example, the Community Advisory Group assisted in bolstering retention by identifying individuals who were employed as community health workers. On the other hand, the study was constrained by the lack of baseline preKatrina data on local assets that could be leveraged. Baseline data would have represented pivotal information since communities in the region have experienced repeated natural and technological disasters. Moreover, not all community partners could fully participate in all phases of the research given the unprecedented challenges they were facing.

Addressing health, including the social determinants of health, from positive and ecological perspectives (principle 7) was difficult given the destruction of the city's social and physical infrastructure. Likewise, securing a long-term commitment by all parties (principle 9) beyond the HEAL study was unrealistic considering the still stressed and transitioning communities several years after flooding.11 Drawing on lessons learned through HEAL, postdisaster health studies utilizing a participatory design should also integrate adisaster plan into the study design, incorporate the community's cultural context, and build on factors influencing community resilience16 to avoid exacerbating vulnerability.

IMPLICATIONS FOR SCIENCE, POLICY, AND PRACTICE

Fifteen years after Hurricane Katrina, challenges and opportunities can be effectively viewed through the traditional three lenses governing public health: science, policy, and practice. From a science perspective, although much progress has been made, significant research gaps remain. Delayed exposure assessments, evidenced after Katrina as well as the Deepwater Horizon oil spill five years later, continue to frustrate scientists and communities alike. Similarly, investment of financial and human resources to consistently monitor exposure to both chemical and nonchemical stressors during the interdisaster period is lacking, thus depriving public health scientists ofvaluable baseline data to inform postdisaster environmental epidemiological studies.1 Compounding these gaps in science is the potentially cumulative impact of climate change. Louisiana, already prone to frequent coastal flooding, faces the consequences of rising sea levels, land loss, and increased atmospheric temperatures. Coastal residents, ever resilient and mobile, are relocating farther inland.17

The challenges to effectively respond to Katrina prompted some important policy developments. In 2006, Congress enacted the Pandemic and All Hazard Preparedness Act (PAHPA).18 As an amendment of the Public Health Service Act, it established the Office of the Assistant Secretary for Preparedness and Response (ASPR) and augmented federal authority regarding the availability of medical counter measures following the H5N1 influenza pandemic. A key aspect of PAHPA was to no longer use siloed, disaster type-driven response strategies; rather, each aspect of the disaster management cycle-from preparedness to recovery-would take a "whole community" approach. PAHPA-related appropriations primarily resulted in greater coordination of disaster response efforts through ASPR as exemplified in the aftermath of Superstorm Sandy.19 Despite PAHPA and progress at the local level, many Gulf Coast communities lack sufficient resilience and social capital to be fully prepared for the impact of disasters given the underlying disparities and environmental health threats.16

Much has improved since Hurricane Katrina with respect to local disaster preparedness and response practice, based in part on the successes and possibilities illustrated by HEAL and other programs. The City of New Orleans received major financial resources through such investments as the federally funded Cities Readiness Initiative.20 It also created a special needs registry to coordinate evacuation efforts in advance of disasters for this vulnerable subpopulation. Greater coordination now exists among local stakeholders in the government public health and private sectors. Of note is the contribution to the city's disaster management workforce by Tulane University's disaster management degree program.16 The disaster response to Hurricane Katrina illustrated the infrastructure and disaster management gaps that existed in 2005. Although continuous improvements have been made in subsequent natural disasters- notably, the significant compliance with prestorm evacuations for Hurricane Isaac in 2008 and the identification of pediatric preparedness as a specific area of disaster management21-many challenges remain.

One example of public health capacity building after Katrina, in the aftermath of the Deepwater Horizon oil spill, was the Gulf Region Health Outreach Program.22 The goal of strengthening public health in the most affected counties and parishes was transdisciplinary in nature, addressing both infrastructure- such as implementing electronic health records and expanding primary care capacity-and discipline-specific services in mental health and environmental health. The $105 million program was a five-year allocation as part of the oil spill's medical settlement. The program can serve as a model for mitigating the impact of the interconnected threats facing Gulf Coast communities, and important lessons were learned regarding how best to sustain such investment. Among those lessons are integrating adult and pediatric mental health services-needed but often lacking after a disaster-into primary care clinics23,24 and embedding community health workers in federally qualified health centers serving as medical homes for minority and underserved individuals.25

Given the current and urgent impacts of a changing climate and severe weather events, there is a time-sensitive need for collaborative leadership and an action plan to address the gaps in science, policy, and practice to strengthen Gulf Coast communities' resilience. ÂfPU

CONTRIBUTORS

M. Lichtveld conceptualized, drafted, and edited the article. H. Covert drafted and edited the article. J. El-Dahr, L. F. Grimsley, R. Cohn, C. Hayes Watson, E. Thornton, and S. Kennedy drafted sections and edited the article.

CONFLICTS OF INTEREST

The authors have no potential or actual conflicts of interest to disclose.

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HEAL was a collaboration ofmany institutions, investigators, and staff. A complete list ofall involved is provided in Lichtveld et al.11

Sidebar

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DETAILS

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Document 35 of 61

Exploration of the STOP Act and Opioid Deaths in North Carolina, 2010–2018

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ABSTRACT (ENGLISH)

Objectives. To examine the impact of North Carolina's 2017 Strengthening Opioid Misuse Prevention (STOP) Act on opioid overdose deaths. Methods. We used quarterly data from the North Carolina Opioid Dashboard to conduct an interrupted time series analysis ranging from 2010 to 2018. Results were stratified by heroin-fentanyl deaths and other opioid deaths. Results. After the STOP Act, there was an initial rate increase of 0.60 opioid deaths per 100 000 population (95% confidence interval [CI] = 0.04, 1.15) and a decrease of 0.42 (95% CI= -0.56, -0.29) every quarter thereafter. Results differed by stratification. Conclusions. Our results suggest that North Carolina's STOP Act was associated with a reduction in opioid deaths in the year following enactment. The changes in opioid overdose death trends coinciding with the STOP Act were similar to outcomes seen with previous opioid policies. Public Health Implications. Future policies designed to reduce the availability of opioids may benefit from encouraging and increasing the availability of evidence-based treatment of opioid use disorder.

FULL TEXT

Headnote

Objectives. To examine the impact of North Carolina's 2017 Strengthening Opioid Misuse Prevention (STOP) Act on opioid overdose deaths.

Methods. We used quarterly data from the North Carolina Opioid Dashboard to conduct an interrupted time series analysis ranging from 2010 to 2018.

Results were stratified by heroin-fentanyl deaths and other opioid deaths. Results. After the STOP Act, there was an initial rate increase of 0.60 opioid deaths per 100 000 population (95% confidence interval [CI] = 0.04, 1.15) and a decrease of 0.42 (95% CI= -0.56, -0.29) every quarter thereafter. Results differed by stratification.

Conclusions. Our results suggest that North Carolina's STOP Act was associated with a reduction in opioid deaths in the year following enactment. The changes in opioid overdose death trends coinciding with the STOP Act were similar to outcomes seen with previous opioid policies.

Public Health Implications. Future policies designed to reduce the availability of opioids may benefit from encouraging and increasing the availability of evidence-based treatment of opioid use disorder. (Am J Public Health. 2020;110:1573-1577. doi:10.2105/ AJPH.2020.305748)

In North Carolina, the ongoing impact of opioids resulted in more than 13 000 deaths between 1999 and 2017.1,2 In response, the Strengthening Opioid Misuse Prevention (STOP) Act passed the North Carolina General Assembly unanimously and was signed into law in June 2017, implementing rolling changes to regulations through 2020.3 The first 2 waves of policy changes were enacted in the third quarter of 2017 (July and September, respectively). These initial 2 waves implemented regulations that required physician assistants and nurse practitioners in pain clinics to consult with the supervising physician for any opioid prescription ofmore than 30 days, as well as every 90 days that the prescription remained active (wave 1).

In addition, pharmacies were required to report opioid prescriptions to the Controlled Substance Reporting System (North Carolinas version of a prescription drug monitoring program) no more than 1 day after they were dispensed, with potential monetary penalties assessed by the North Carolina Department of Health and Human Services (DHHS) ifreports were found to be missing or incomplete (wave 2). Finally, the STOP Act sought to increase access to naloxone at the community level in a number of ways. For example, it lifted a state ban on the use of local funds for syringe access programs (although it did not provide such funding; wave 1). Also, it expanded North Carolinas Good Samaritan Law4 by allowing providers to facilitate government and nonprofit organizations ability to obtain and distribute naloxone via a standing order and by providing those organizations with limited immunity otherwise previously offered only to individuals (wave 1).

Research has demonstrated inconsistencies regarding the efficacy of opioid policies in reducing overdose deaths, including some unintended outcomes. Policies intending to restrict the accessibility of prescription opioids have been effective in reducing prescription opioid overdose deaths, but they have also been associated with increased deaths from heroin and fentanyl. Conversely, policies focused on treating substance use disorders are typically effective in reducing all opioid overdose deaths.5-8 Given that the effects of the STOP Act were unknown, we explored the impact ofthe first 2 waves of the act on opioid-related deaths.

METHODS

We used publicly available data from the North Carolina Opioid Dashboard to assess the impact of the STOP Act on opioid-related deaths.9 This dashboard, constructed and maintained by the North Carolina Department ofHealth and Human Services as part of the states opioid action plan,10 tracks several opioid-related metrics on a quarterly basis. Data relating to opioid deaths were derived from North Carolina DHHS death certificate information; this information, tracked by the agencys Vital Statistics Office, represents the official count for the state.9 The dashboard was updated with new quarterly data beginning in 2017, with prior years of DHHS data being included for most factors going back to 2010, resulting in a total possible sample of36 quarters over 9 years (2010-2018). Data from 2010 through 2018 were obtained in December 2019.

Opioid-Related Deaths

Opioid-related deaths, measured as a count of all unintentional opioid-related deaths among North Carolina residents as defined by International Classification of Diseases, 10th Revision (ICD-10; World Health Organization. Geneva, Switzerland), codes X40 to X44 (with T codes of 40.0 to 40.4 or 40.6). were available quarterly from 20İ0 to 2018 (n = 36).9 Opioid-related deaths were stratified into heroin- and fentanyl-related deaths and nonheroin- and nonfentanyl-related deaths for our subanalwes. We created these strata by multiplying the total opioid-related death count by the percentage of all opioidrelated deaths that specifically involved heroin. fentanyl. or fentanyl analogs (acetyl fentanyl. butryfentanyl. fiuranvfentanvl. fluort fentanyl. acrvlfentanyl. fluoroisobutrlfentanyl. betahydroxythiofentanyl, carfentanil).9

Data on percentages of deaths involving heroin. fentanyl. or fentanyl analogs were available yearly from 20 10 to 2016 and quarterly from 2016 to 2018. We filled in quarterly percentages for 20 10 to 20İ6 by applying the yearly percentage to each quarter within the year. For example. the 2015 annual percentage of'46.8% resulted in each quarter in 2015 having a value of 46.8%'. We converted all3 measures of death to unadjusted rates per İ00 000 using the annual population estimates available through the North Carolina Opioid Dashboard.

STOP Act

A binary indicator variable was created that coded each quarter as being either before or after implementation of the STOP Act. with quarter 3 of20l7 (July-September) marked as the first time period for implementation. We selected quarter3 because the resultingchanges to state-level prescribing guidelines that took effect in July 2017 have been cited as motivating many physicians in North Carolina to immediately and abruptly stop prescribing opioids entirely. including for chronic pain.11

With previous evidence suggesting that such a decrease or discontinuation of opioid prescribing can contribute to an increase in heroin use. including a warning issued by the US Food and Drug Administration. we sought to capture any initial increases in heroin deaths that may have been associated with the first wave of the STOP Act.1" 15 However. several portions of the act may require a "phase-in" period (e.g.. effects of changes to the Good Samaritan Law). To examine this possibility. we conducted a sensitivity analysis in which quarter 3 of 2017 was suppressed and quarter 4 served as the first postimplementation period.

Data Analysis

Interrupted time series analysis. a quasi-experimental method. was used to estimate the impact of the STOP Act on opioid-related deaths.16 We used the full 36 quarters of data to generate the most accurate estimate of the underlying temporal trends before implementation of the act. The model contained 2 time components to account for these underlying temporal trends: a continuous time variable from 1 to 36 marking each of the quarters from 20 10 to 20 18 to model linear temporal trends and a time squared component to accommodate nonlinear temporal trends. The binary variable representing STOP Act implementation (coded as 0 before implementation and 1 after implementation) was included in the model. as was a variable for time after STOP Act implementation (coded as 0 before the STOP Act and as a continuous variable |1 -5| for the quarters after implementation). This allowed us to estimate both the immediate impact of the STOP Act (using the coefficient ofthe binary STOP Act variable) and the change in temporal trends after implementation (using the time after implementation variable) while accounting for preexisting temporal trends.

We conducted our analysis using PROC AUTOREG in SAS version 9.4 (SAS Institute Inc. Cary. NC) to accommodate the autocorrelation that can exist in time series data. As our data were quarterly. we tested for autocorrelation using Durbin-Watson statistics for orders 1 through 5. To identify the most parsimonious model while still accounting for autocorrelation. we used a stepwise autoregression for the overall analysis and each ofthe stratified analyses. This technique incorporates backward parameter selection to identify the order ofthe autoregression.17 20 A maximum order of 5 was allowed. and nonsignificant autoregressive parameters were deleted until only significant (P <.05) parameters remained.

RESULTS

In the analysis ofthe overall opioid death rate. no autoregressive parameters were significant at a P level of less than .05. and therefore no adjustments were made to the model to address autocorrelation. The model results indicate that. after adjustment for time trends. there was an initial increase of 0.60 deaths per 100 000 population in the total opioid-related mortality rate (95% confidence interval |CI| = 0.04. 1.15) during the quarter the STOP Act took effect and a decrease of 0.42 in the quarterly estimated temporal trend after implementation (95% CI = -0.56. -0.29; Figure 1). In our sensitivity analysis assessing the overall opioid death rate (in which data from quarter 3 of'2017 were suppressed and quarter 4 served as the first postimplementation period). the STOP Act was not associated with an initial increase (-0.06; 95% CI = -0.50. 0.37). although the quarterly decrease remained (-0.35; 95% CI = -0.48. -0.22; Appendix A. available as a supplement to the online version of this article at http:/ www.ajph.org).

In the stratified analysis. the nonheroinnonfentairnl model differed in that the STOP Act was associated with an initial decrease in the nonheroin-nonfentanyl death rate (-0.28 per 100 000 population; 95% CI = -0.48. -0.08); however. there was not a significant reduction in the quarterly temporal trend (-0.04. 95% CI = -0.09. 0.02; Figure 2). The model for heroin-fentanyl deaths was similar to that in the unstratified analysis. showing that the STOP Act was associated with an initial increase of 1.07 per 100000 population in the heroin-fentanyl death rate (95% CI = 0.65. 1.48). After the initial spike. there was a reduction off 1.42 in the quarterly temporal trend (95% CI = -0.54. -0.30; Figure 3). (Table 1 presents estimates and confidence intervals.) The sensitivity analysis for stratified overdose deaths yielded similar patterns in terms of both significance and directionality (sensitivity analysis graphs are provided in Appendices B and C. and sensitivity analysis estimates. confidence intervals. and associated P values are provided in Appendix D. available as supplements to the online version of this article at http://www.ajph.org).

DISCUSSION

We modeled the effects ofthe STOP Act on opioid-related deaths in North Carolina. Our results provide some evidence that the STOP Act was associated with an initial increase in the death rate followed by a steady decline. This suggests that the impact of the policy is a successful reduction in the rate of opioid-related deaths, although future studies should examine the policy's practical implementation and long-term effects.

The results of a sensitivity analysis allowing for a quarter-long implementation period did not reveal an initial increase in the death rate; however, this more conservative analysis did yield a quarterly rate decrease consistent with the full analysis. After stratification into heroin-fentanyl deaths and nonheroin-nonfentanyl deaths, it seems that the STOP Act may have affected these 2 types of deaths differently. In the case of heroin-fentanyl deaths, the STOP Act was associated with an initial increase in the death rate followed by a decrease over time. Conversely, the nonheroin-nonfentanyl death rate declined in the period immediately following the STOP Act, although it did not exhibit a decrease in the quarterly trend. This lack of a trend decrease may have been a result of the rate of nonheroin-nonfentanyl deaths already being noticeably lower than the overall death rate and the heroin-fentanyl rate. The more conservative estimates of the stratified effects calculated in the sensitivity analysis were consistent with both the initial and quarterly trend estimates of the full analysis.

These early changes in overdose deaths associated with the STOP Act appear to be consistent with the results of other opioid policies in several ways. Supply side policies, such as the increased prescribing regulations in the STOP Act, have been conjectured to lead to fewer deaths from prescription opioids at the expense of increases in heroin-fentanyl j ., 7,8,21-25 deaths.

A 2018 survey conducted by the North Carolina Medical Society revealed that more than 600 providers in North Carolina had stopped prescribing opioids, with some citing the STOP Act as the reason.11 This reduction in providers prescribing opioids, whether specifically a result of the STOP Act or to increased general awareness associated with the passing of the act, could have led to an increase in new or relapsed users of heroin- fentanyl as well as a possible increase in the number of people with opioid use disorder not receiving treatment, which carries an increased risk of overdose.26 Conversely, demand-side policies, such as the standing order for naloxone included in the STOP Act, have been associated with decreases in both prescription opioid overdose deaths and heroin-fentanyl overdose deaths.6,8,26,27 The STOP Act, accordingly, was associated with an initial decrease in prescription deaths and decreases in all opioid overdose deaths over time.

It is possible that the initial increase in opioid deaths shown in our results was not related to the STOP Act but, rather, attributable to other extraneous factors. The elevated heroin- and fentanyl-related death rate for quarter 3 of 2017 may have been a natural continuation of the exponential growth seen in previous quarters. Furthermore, it appears that there were regional trends during the observation period. VivoloKantor et al. found that emergency department visits for suspected opioid overdoses spiked between quarters 2 and 3 of 2017 in the southeastern United States, following a pattern similar to that seen in our analysis and possibly accounting for some of the increase.28 Future studies should examine patient and provider experiences relating to the implementation of the STOP Act, the opioid prescribing guidelines of the Centers for Disease Control and Prevention (CDC), and related policies in an attempt to better understand the effects on opioid-related overdoses and deaths. Future studies should also examine the long-term effects of the STOP Act.

Limitations

Our study had several limitations. In particular, although the quasi-experimental nature of interrupted time series analysis is robust, our use of observational data precludes us from truly assessing causality. As a result of the urgency of opioid overdose trends and ongoing efforts to address them, there is the potential for history effects in our study resulting from national and local initiatives. For example, during the time frame in which our data were collected and prior to the STOP Act, the CDC issued national guidelines on opioid prescribing.29

There is also the potential for confounding in this study owing to heightening general awareness regarding opioid overdose risks. It is possible that an increase in public awareness contributed to fewer deaths as more people became aware of effective treatment options for opioid use disorder, as well as overdose reversal medication (naloxone), and more people accessed relevant services earlier. Although we cannot entirely rule out the possibility of such history effects, there is some evidence that history effects may be minimal. Tennessee and South Carolina, neighboring states similar to North Carolina in not expanding Medicaid, saw an increase in opioid deaths in 20 1 8.30,31

Our outcome measure was based on state-compiled death certificate data, which are not collected for research purposes. Death certificates are known to involve inaccuracies in reporting, especially as it relates to overdose deaths, which may have affected our results.32-34 In addition, the percentage of opioid overdose deaths attributable to heroin and fentanyl was reported annually from 2010 to 2016, which may have obscured some quarterly variation within those years. However, it is worth noting that the quarterly percentages available appeared tightly clustered around the annual percentage. The use of state-level data also limited our ability to make inferences about specific regions within the state.

Finally, we did not consider the effects of local factors, such as socioeconomic status, urbanicity, regional variations in policy compliance and implementation, and local policies or service availability (such as syringe access programs that distribute naloxone), that may have further affected overdose death rates. An example is the potential for shifting trends in substances of misuse. There is evidence to suggest that other substances are rising in use. For example, 1 study showed that methamphetamine and opioid co-use doubled between 2011 and 2017.35

Public Health Implications

Our results suggest that there were decreases in opioid deaths associated with implementation of the STOP Act. This is consistent with previous literature in that it offers support for the efficacy of multifaceted state-level opioid policies. However, also consistent with previous literature was the initial increase in heroin-fentanyl deaths. We propose that future opioid deprescribing policies incorporate additional components encouraging and increasing access to evidence-based treatment of opioid use disorder. >4jPI-l

CONTRIBUTORS

P. Hughes, S. Denslow, and C. Tak developed the study concept. P. Hughes and S. Denslow conducted the analysiswithinputfromC. Tak. B. Ostrach, C. Fusco, and C. Tak helped interpret the findings. P. Hughes and S.

Denslow wrote the article with significant input from B. Ostrach, C. Fusco, and C. Tak.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this study because no human participants were involved.

Sidebar

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Document 36 of 61

Sow the Wind, Reap the Whirlwind: Katrina 15 Years After

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ABSTRACT (ENGLISH)

The historical and empirical evidence presented in this special section highlights the lessons learned that can be directly useful for public health policy, intervention, and practice to mitigate the dire consequences ofhurricanes, wildfires, and other natural disasters. Previous AJPH editorials, "Public Health Disasters: Be Prepared," which outlines the dilemma public health emergency preparedness professionals and societies face in paying the price for preparedness,1 and "Medical Countermeasures: A Stitch in Time Saves Nine,"2 which notes the competing choices to be made among priorities, help our thinking with respect to preventing untoward things from occurring in the first place (primary prevention) and preventing things that do occur from becoming even more serious (secondary prevention). "SOWING THE WIND" Perhaps, in the broadest view-and especially cogent in the light of the current level of raised awareness of the systemic racism still highly prevalent in the United States-the sowing ofthe wind of systemic racism reaped the whirlwind of much of the destruction caused by Hurricane Katrina in terms ofloss oflife and property that disproportionally affected Blacks (even considering their large percentage of the population), who were living in poorer areas at high risk for flooding, had less opportunities for early evacuation to areas of safety, and had higher levels of preexisting medical conditions that made them more vulnerable to the trauma and stress of Katrina.

FULL TEXT

See also the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

"For they have sown the wind, and they shall reap the whirlwind" (Hosea 8:7) warns us that we should anticipate suffering serious consequences as the outcome of our own bad actions or negligence. However, there is also the parable of the positive aspect of sowing, whereby good acts can lead to betterment: "For whatever a man sows, this he will also reap" (Galatians 6:7). Both parables have something to offer in the "lessons learned" from that fateful August in 2005 when Hurricane Katrina devastated areas of Louisiana and Mississippi and now, some 15 years after, when natural disasters have become the "new normal" in public health.

"KATRINA 15 YEARS AFTER" SPECIAL SECTION

This special section of the AJPH, "Katrina 15 Years After," provides manifold examples of actions (or inactions) that led to amplification of the natural disaster as well as good acts that have led to increased resilience and preparedness. The historical and empirical evidence presented in this special section highlights the lessons learned that can be directly useful for public health policy, intervention, and practice to mitigate the dire consequences ofhurricanes, wildfires, and other natural disasters.

Previous AJPH editorials, "Public Health Disasters: Be Prepared," which outlines the dilemma public health emergency preparedness professionals and societies face in paying the price for preparedness,1 and "Medical Countermeasures: A Stitch in Time Saves Nine,"2 which notes the competing choices to be made among priorities, help our thinking with respect to preventing untoward things from occurring in the first place (primary prevention) and preventing things that do occur from becoming even more serious (secondary prevention).

"SOWING THE WIND"

Perhaps, in the broadest view-and especially cogent in the light of the current level of raised awareness of the systemic racism still highly prevalent in the United States-the sowing ofthe wind of systemic racism reaped the whirlwind of much of the destruction caused by Hurricane Katrina in terms ofloss oflife and property that disproportionally affected Blacks (even considering their large percentage of the population), who were living in poorer areas at high risk for flooding, had less opportunities for early evacuation to areas of safety, and had higher levels of preexisting medical conditions that made them more vulnerable to the trauma and stress of Katrina.

Former president Barack Obama, when he was a US senator from Illinois, noted this point:

When he declared on the Senate floor that the poor response to Katrina was not "evidence of active malice," but merely the result of"a continuation ofpassive indifference." These structural exclusions matter very much for one's total life opportunities, including crucially one's economic opportunities . . . and thus greatly affect one's opportunities to, say, escape from deadly hurricanes.3

Katrina gives us a unique lens through which we can see that racism is "not just a matter of the psychology of hatred but is instead also a matter of the racial structure of political and economic inclusion and exclusion."3 Now, some 15 years after, we need to take a deep look into whether the lessons learned from Katrina are actually being translated into actions-or have they become "lessons forgot," as this next public health disaster of COVID-19 sweeps through our most vulnerable communities.

"THIS HE WILL ALSO REAP"

Another side of the coin operative during Hurricane Katrina is that, contrary to what was often reported by the media and went viral, there was the demonstration of human kindness: "That whole week newspapers were filled with accounts of rapes and shootings across New Orleans" and "There were terrifying reports of roving gangs, lootings and of a sniper taking aim at rescue helicopters.... The chief ofpolice said the city was slipping into anarchy, and the governor of Louisiana feared the same. 'What angers me the most,' she said, 'is that disasters like this often bring out the worst in people.'"4(p18) This narrative playing out in the media was reinforcing the myth ofthe veneer theory coined by Frans de Waal, which posits:

Civilization is nothing more than a thin veneer that will crack at the merest provocation. In actuality, the opposite is true. It's when crisis hits-when the bombs fall or the floodwaters rise-that we humans become our best selves.4(p17)

It wasn't until months later, and reported out of the media spotlight of the immediate disaster, that:

Researchers from the Disaster Research Center (DRC) at the University of Delaware concluded that "the overwhelming majority ofthe emergent activity was prosocial in nature." A veritable armada ofboats from as far away as Texas came to save people from the rising waters. Hundreds of civilians formed rescue squads, like the self-styled Robin Hood Looters-a group of eleven friends who went around looking for food, clothing and medicine and then handing it out to those in need. Katrina, in short, didn't see New Orleans overrun with self-interest and anarchy. Rather, the city was inundated with courage and charity.4(p18)

This sowing ofa spontaneous response and support for others can result in a bountiful harvest that we also reap in strengthening community resilience and saving lives. Katrina essentially reconfirmed the scientific evidence on how communities react to public health emergencies. The Disaster Research Center

has established that, in nearly seven hundred field studies since 1963, there'snevertotalmayhem. It's never every man for himself. Crime-murder, burglary, rape- usually drops. People don't go into shock, they stay calm and spring into action. "Whatever the extent ofthe looting," a disaster researcher points out, "it always pales in significance to the widespread altruism that leads to free and massive giving and sharing ofgoods and services."4(p18-19)

CONCLUSIONS

Hurricane Katrina, viewed from the perspective of 15 years later, teaches us that we cannot afford to neglect the winds of racism that we are still sowing such that the same disproportionality in impact on lives that affected communities of color during the whirlwind of Katrina is again being reaped in the whirlwind of greater attack, hospitalization, and mortality rates in the current pandemic of COVID-19.

As communities, states, and the nation, we must rise to our higher selves and sow new seeds through changing hearts and protecting the most vulnerable among us to reap the benefits for all of us to be in a society living in racial harmony where everyone has the opportunity to flourish-as well as being fully prepared for, and ready to respond to, the future public health emergencies such as Katrina and COVID-19 that will inevitably arise.

We need to reap the oneness of humanity, a oneness of the human race that "is no mere outburst of ignorant emotionalism, or an expression of vague and pious hope" but a oneness that "must bind us all ... as members of one human family" through "an organic change in the structure of present-day society" that "calls for no less than the reconstruction . . . of the whole civilized world-a world organically unified . . . and yet infinite in the diversity."5 >4jPI-l

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CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

Sidebar

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Document 37 of 61

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ABSTRACT (ENGLISH)

In the midterm, researchers should study the evolution of the virus as it enters new geographic regions, and the effectiveness of mitigation strategies across gender, age, and socioeconomic status. Expectant Mother Vaccine Beliefs in Italy Bert et al. initiated a cross-sectional study in response to emerging vaccination hesitancy and declining vaccine coverage rates in Italy. Resident doctors conducted face-to-face interviews with 1820 pregnant women from hospital waiting rooms in 14 Italian cities to assess vaccine knowledge, beliefs, and misconceptions based on socioeconomic status, medical information sources, and trust in the health care system.

FULL TEXT

A Feasible Alternative: Increased Testing Rate for SARS-CoV-2 in South Africa via SelfCollected Swabs Developing countries, such as South Africa, are currently unable to determine the true number of COVID-19-infected citizens as a result of low SARSCoV-2 testing rates. Adeniji conducted a literature review of various upper respiratory tract specimen collection methods to assess the efficacy of each testing modality for use during the current epidemic. The author concluded that self-collected swabs were similar to those collected by public health and medical professionals, as long as the individual followed the proper process of collection. This is critical for developing countries, where it is more feasible for properly trained citizens to submit their own nasal swabs for testing than to have medically trained personnel test all potentially infected citizens.

Citation. Adeniji AA. "Self-collected upper respiratory tract swabs for COVID-19 test: a feasible way to increase overall testing rate and conserve resources in South Africa. Afr J Prim Health Care Fam Med. 2020;12(1):e1-e4.

Opportunities for COVID-19 Research in Panama

With the second most populous capital in Central America and one of the highest COVID-19 testing rates in the region, the Republic of Panama is uniquely positioned to contribute to COVID-19 research. Loaiza et al. adapted the World Health Organization's Global Research Roadmap to the Panamanian context and propose research priorities for the country. In the short term, random active surveillance will shed light on differential consequences across demographic groups. In the midterm, researchers should study the evolution of the virus as it enters new geographic regions, and the effectiveness of mitigation strategies across gender, age, and socioeconomic status. Long-term research should focus on understanding community spread. Insight into COVID-19's effects on vulnerable populations in Panama can inform pandemic response in other Latin American countries.

Citation. Loaiza JR, Rao K, Eskildsen GA, et al. COVID-19 pandemic in Panama: lessons of the unique risks and research opportunities for Latin America. Rev Panam Salud Publica. 2020;44:e86.

The Need for Improved Risk Communication Following the Fukushima Disaster

The Fukushima disaster in 2011 resulted in major public health problems during and after its occurrence. The severe nuclear powerplant accident caused numerous long-term posttraumatic effects among its residents, including high levels of psychological distress, decline in subjective well-being, exacerbation of physical illnesses, and anxiety and distrust of the government and experts. The Fukushima disaster also highlighted the pressing need for effective risk communication to educate residents about the associated health risks and consequences of such disasters. A systematic evaluation of ongoing risk communication practices would help in applying impactful approaches to Fukushima recovery efforts and improve future community preparedness efforts.

Citation. Murakami M, Sato A, Matsui S, et al. Communicating with residents about risks following the Fukushima nuclear accident. Asia Pac J Public Health. 2017;29(2 suppl):74S-89S.

Expectant Mother Vaccine Beliefs in Italy

Bert et al. initiated a cross-sectional study in response to emerging vaccination hesitancy and declining vaccine coverage rates in Italy. Resident doctors conducted face-to-face interviews with 1820 pregnant women from hospital waiting rooms in 14 Italian cities to assess vaccine knowledge, beliefs, and misconceptions based on socioeconomic status, medical information sources, and trust in the health care system. Of surveyed women, 20% did not believe that vaccines prevent potentially deadly diseases, and 30% did not believe that vaccination benefits outweigh their risks. Women who obtained information from their general practitioner or medical institution Web sites were less likely to respond with misconceptions. This study informs targeted intervention strategies to increase trust in immunizations and may have added value for the deployment of a future COVID-19 vaccine.

Citation. Bert F, Olivero E, Rossello P, et al. Knowledge and beliefs on vaccines among a sample of Italian pregnant women: results from the NAVIDAD study. Eur J Public Health. 2020;30(2):286-292.

Sidebar

Correspondence should be sent to the AJPH Global News team at vk2316@cumc.columbia.edu.

DETAILS

Subject:	Socioeconomic status; Socioeconomic factors; Womens health; Viruses; Vaccines; Information sources; Mitigation; Immunization; Pregnancy; Waiting rooms; Socioeconomics; Vaccination; Physicians; COVID-19; COVID-19 vaccines; Severe acute respiratory syndrome coronavirus 2; Communication; Developing countries--LDCs; COVID-19 diagnostic tests; Pandemics; Medical research; Public health; Disasters; Coronaviruses; Disease transmission; Health care; Regions
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Water and Sanitation in Urban America, 2017–2019

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ProQuest document link

ABSTRACT (ENGLISH)

Objectives. To estimate the population lacking at least basic water and sanitation access in the urban United States. Methods. We compared national estimates of water and sanitation access from the World Health Organization/United Nations Children's Fund Joint Monitoring Program with estimates from the US Department of Housing and Urban Development on homelessness and the American Community Survey on household water and sanitation facilities. Results. Weestimated that at least 930 000 persons in US cities lackedsustained access to at least basic sanitation and 610 000 to at least basic water access, as defined by the United Nations. Conclusions. After accounting for those experiencing homelessness and substandard housing, our estimate of people lacking at least basic water equaled current estimates (n = 610 000)-without considering water quality-and greatly exceeded estimates of sanitation access (n = 28 000). Public Health Implications. Methods to estimate water and sanitation access in the United States should include people experiencing homelessness and other low-income groups, and specific policies are needed to reduce disparities in urban sanitation. We recommend similar estimation efforts for other high-income countries currently reported as having near universal sanitation access.

FULL TEXT

Headnote

Objectives. To estimate the population lacking at least basic water and sanitation access in the urban United States. Methods. We compared national estimates of water and sanitation access from the World Health Organization/United Nations Children's Fund Joint Monitoring Program with estimates from the US Department of Housing and Urban Development on homelessness and the American Community Survey on household water and sanitation facilities.
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Methods to estimate water and sanitation access in the United States should include people experiencing homelessness and other low-income groups, and specific policies are needed to reduce disparities in urban sanitation. We recommend similar estimation efforts for other high-income countries currently reported as having near universal sanitation access. (Am J Public Health. 2020;110:1567- 1572. doi:10.2105/AJPH.2020.305833)

eople experiencing homelessness and housing instability in towns and cities in the United States may have limited or no access to safe water and sanitation. Water and sanitation are important to prevent infection by fecal-oral pathogens via well-understood pathways of transmission1; are necessary for handwashing, which may limit the spread of SARS-CoV-2; and are critical for maintaining public health. The number of people experiencing homelessness increased from 2016 to 2019,2 but decreased investment in urban sanitation infrastructure has resulted in lower access to public toilets.3 Limited sanitation access for people experiencing homelessness was linked to a nationwide outbreak of hepatitis A from 2017 to 2018.4 People living in emergency shelters and transitional housing share sanitation facilities with others,5 and people in unsheltered locations may not have sustained access to water and sanitation facilities, causing some in both groups to resort to open defecation.6,7 Work by Desmond et al. on low-income housing and the eviction crisis suggested that functioning water and sanitation facilities are not universal in low-income urban housing units in the United States,8,9 in contrast to international statistics reporting universal or 10,11 near-universal access.

The United Nations Sustainable Development Goal 6 calls for adequate and equitable sanitation, hygiene, and safe and affordable drinking water for all by 2030.12 Under Sustainable Development Goal 6, "safely managed" sanitation is defined as the "use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite." Basic sanitation is defined as "use of improved facilities that are not shared with other households." Improved facilities include "flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs."10 Safely managed drinking water is defined as "drinking water from an improved water source that is located on premises, available when needed and free from fecal and priority chemical contamination."10

The World Health Organization and United Nations Children's Fund (WHO/ UNICEF) Joint Monitoring Program (JMP) collects and reports national-scale data on water and sanitation across countries,10,11 but estimates are limited by the data shared by individual countries. The JMP uses the American Housing Survey (AHS) to estimate national water and sanitation access and the US Environmental Protection Agency's Safe Drinking Water Information System to assess drinking water quality.11,13,14 These data sources exclude people experiencing homelessness, estimated to have been 570 000 in 2019, and so national statistics overestimate access to water and sanitation in the United States.

To further examine published estimates of universal or near-universal (> 99%) access to safely managed water and sanitation in urban areas of the United States,10,11 we conducted a scoping study to (1) identify sources of nationally representative data on access to water and sanitation in the United States and (2) estimate the number of people without access to basic water and sanitation in the United States, inclusive of housing instability.

METHODS

We accessed publicly available data representing people living in urban areas of the United States who may have insufficient access to water and sanitation facilities compiled by representative agencies through downloadable Excel (Microsoft, Redmond, WA) files and interactive online tables.

The 2017 AHS produced nationally representative estimates that included a question regarding sanitation access (question: public sewer), but only reported data for the 15 largest metropolitan areas (representing 39% of the total urban population) and select states.15,16

Inaugurated in 2005, the American Community Survey (ACS) is an annual survey by the US Census Bureau with a typical participation of 3.5 million households per year.17 The ACS is mailed to specific addresses, and participants can choose to respond via a paper form or the Internet. The ACS contains 1 question about the presence of a complete bathroom, which it defines as the presence ofhot and cold running water, a flush toilet, and a bathtub or shower. In addition, it asks about the presence of a complete kitchen, which it defines as the presence ofan installed sink with tap water, a mechanical refrigerator, and a stove or range oven with built-in burners. The 2013 to 2017 ACS 5-year estimates included data for all 382 US metropolitan areas17 (urban clusters with populations ‡50 000) representing an additional 150 million urban US residents compared with the 15 largest metropolitan areas assessed by the AHS; therefore, we used the more comprehensive ACS to estimate urban water and sanitation 17 access.

The ACS relies on a ratio estimation procedure to transform survey response data into nationally representative estimates. Weights are assigned to each sample person record (to produce person estimates) or to each housing unit record (to producing housing unit estimates), and are used to compensate for differences in sampling rates across areas, between the full sample and the interviewed sample, and between the sample and independent estimates of basic demographic characteristics.18 We accessed the ACS 2017 5-year estimates public-use microdata set by using the Integrated Public Use Microdata Series,19 filtering out responses not in a metropolitan area or if the metropolitan status could not be assessed, and used the ACS "person weight" option to access national population estimates.20 To account for the high nonresponse rate (42%) to the ACS question on the presence ofa flush toilet, we applied the same response distribution from people who did respond to those who did not respond. The nonresponse rate for other questions was small (< 3%), and no adjustment was used.

We accessed publicly available data21 on homelessness from the 2019 Department of Housing and Urban Development's (HUD's) Point-in-Time (PIT) count.2 The PIT count is an annual survey conducted each January in which volunteers physically count people experiencing homelessness in housed and unhoused locations across the United States.2 The 2019 PIT count was conducted in 397 Continuums of Care across all 50 states; Washington, DC; and US territories.21 Counted persons are categorized as living in an unsheltered or a sheltered location. Unsheltered locations are considered unsuitable for human habitation, such as under an overpass, or in a car or abandoned building, or urban camping. Sheltered locations may include emergency shelters or transitional housing programs. The PIT count represents a conservative estimate of homelessness; it is cross-sectional, and volunteers only count people physically located during the count.22 We matched estimates from ACS 2017 with PIT count data by state to generate national estimates of water and sanitation access (Tables A and B, available as supplements to the online version of this article at http://www.ajph.org).

RESULTS

In the 2019 WHO/UNICEF JMP report, basic sanitation access for urban persons in the United States was estimated to be greater than 99%, while limited sanitation, unimproved sanitation, and open defecation were each less than 1%.10 Data available online from the JMP estimated that 96% (n = 250 000 000) of urban persons in the United States used safely managed sanitation, 4.5% (12 000 000) used basic sanitation, and less than 0.01% (n = 28 000) used unimproved sanitation in 2017.11 Limited sanitation and open defecation were reported as nonexistent.11 Analyzed by facility type, the JMP reported 93% (n = 250 000 000) of urban persons in the United States had a sewer connection, 6.5% (n = 17 000 000) relied on a septic tank, and no urban persons in the United States used a latrine or other form of sanitation.11

The ACS estimated that in 2017 there were 100 000 000 occupied housing units in the 382 metropolitan areas ofthe US Census, totaling 250 000 000 housed urban people.17 A small proportion (0.30%; n = 750 000) of housed urban residents lacked a complete bathroom, defined as hot and cold running water, a bathtub or shower, and a flush toilet.17 Hot and cold running water was most commonly absent from incomplete bathrooms (0.21%; n = 540000), followed by lack of a flush toilet (0.19%; n = 470 000)-which we adjusted for nonresponses-and the absence of a bathtub or shower (0.18%; n = 460 000).17

Very-low-income households were most likely to report lack ofaccess to a flush toilet; 0.37% (n = 150 000) of people in households with incomes less than 100% of the national poverty threshold, as defined by the Social Security Administration, lacked a flush toilet, compared with 0.21% (n = 90 000) of households with incomes between 100% and 200% of the poverty threshold, and 0.14% (n = 235 000) of households with incomes above 200% of the poverty threshold (Table C, available as a supplement to the online version of this article at http://www.ajph.org). In addition, a greater prevalence of people in renting households (0.26%; n = 220 000) lacked a flush toilet than respondents who reported owning their unit (0.14%; n = 230 000; Table C).17 The ACS did not capture the number of flush toilets per household or what alternatives existed in the absence of a flush toilet.

Water

The data reported by the ACS and JMP are not directly comparable because of methodological limitations. To generate national estimates of water access, the JMP used data on water access and water quality, but the ACS only included data on water access.

The 2019 JMP report estimated that more than 99% of urban persons in the United States had safely managed piped drinking water into their home, and less than 1% had nonpiped water access.10 Data from 2017 estimated that more than 99% (n = 270000000) of urban persons in the United States had a safely managed drinking water service, 0.11% (n = 280 000) had basic service, 0.24% (n = 610 000) had unimproved drinking water, and limited service or use of surface water was nonexistent.11 By facility type, JMP estimated that greater than 99% (n = 270 000 000) of urban persons in the United States had access to improved piped water, and 0.18% (n = 460 000) had access to improved nonpiped water, with no other service types reported.11

According to the ACS, a similar number of urban persons in the United States lacked a sink with tap water (0.18%; n = 440 000) compared with those lacking a flush toilet. The lowest-income households were most likely to lack an installed sink with tap; 0.29% (n = 120 000) of people in households making less than 100% of the federal poverty threshold did not have a tap, decreasing to 0.23% (n = 97 000) ofpeople in households at 100% to 200% of the poverty threshold, and an estimated 0.14% (n = 230 000) ofpeople in households with incomes greater than 200% of the poverty threshold.17 In addition, the lack of a tap was more prevalent among renters (0.26%; n = 240 000) compared with homeowners (0.13%; n = 210 000; Table D, available as a supplement to the online version of this article at http://www.ajph.org).17 The ACS did not capture what households used for drinking water in the absence of a sink with a tap.

Homelessness

On a single night in January 2019, the PIT count recorded 570 000 people in the United States as experiencing homelessness.2 Most (n = 330 000) persons in the United States experiencing homelessness were counted in urban areas; almost two thirds (n = 210 000) in urban areas were counted in sheltered locations, and the remaining one third were counted in unsheltered locations (n = 120 000).2 In addition, about one quarter (140 000) ofpeople experiencing homelessness were counted in suburban areas, which included people up to 10 miles from urbanized areas.2 Similarly, two thirds (n = 89000) of the suburban homeless were counted in sheltered locations and one third (n = 46 000) in unsheltered locations.2 The 2019 PIT count did not capture data on water and sanitation access for people experiencing homelessness.

Combined Data

Because people experiencing homelessness in unsheltered urban locations do not have a bathroom when and where it is needed,6,16 and those in sheltered locations generally use shared sanitation,5 we estimated that at least 0.29% of residents (n = 930 000) lacked access to at least basic sanitation in the urban United States. This estimate is substantially greater than the 0.01% of urban persons in the United States (n = 28 000) that JMP reported as having limited sanitation, having unimproved sanitation, or resorting to open defecation (Table 1).

Assuming people experiencing homelessness in sheltered urban locations have access to drinking water from an improved source for which the collection time is 30 minutes or less, then those in sheltered locations should be considered to have basic drinking water access. Those experiencing homelessness in unsheltered locations, however, may not have consistent access to an improved water source or their collection time may exceed 30 minutes; people experiencing homelessness and residing in unsheltered locations should therefore be considered to have limited or worse access to drinking water. When we combined data on homelessness with ACS data, we estimated that 610000 (0.24%) of urban persons in the United States lacked basic water access, without considering water quality.

The combined ACS and PIT count estimated that urban residents did not have access to at least basic water and sanitation in every state except Wyoming (Table 2; Figures A and B, available as supplements to the online version of this article at http://www.ajph.org). Half of estimated urban residents without at least basic water (56%; n = 340 000) and sanitation (50%; n = 470 000) resided in 4 states: California, Florida, New York, and Texas. Although California comprises 12% of the total US population, 19% of all urban residents without at least basic water and 23% without at least basic sanitation resided in California.

DISCUSSION

Access to water and sanitation is reported as near universal in the urban United States, but the human rights to water,23 sanitation,23 and housing24 remain unmet for people experiencing homelessness and those living in homes without adequate water and sanitation. The JMP reports that 28 000 people in the urban United States lack access to at least basic sanitation; however, when we accounted for residents experiencing homelessness and residents in substandard housing, we found that at least 630 000 are without sustained access to a flush toilet and a further 300 000 rely on shared sanitation. The 930 000 people without access to at least basic sanitation services in the urban United States -while a low overall percentage-is a large absolute number in a high-income country where resources exist to address the issue.

In the urban United States, the human right to improved water and sanitation may be best advanced through the lens of adequate housing as a human right24; universal water and sanitation likely will only be achieved when universal affordable housing and rapid rehousing exist. Investments in public sanitation are crucial forpublic health-especially given the reduction in public sanitation in recent decades3-and public sanitation is used by both housed and unhoused people. However, affordable and adequate housing is likely the best option to end open defecation and improve water and sanitation access in the urban United States. Acknowledging that the US Census, ACS, and AHS consistently undercount people experiencing homelessness, the US Census Bureau could incorporate PIT count data to improve national estimates of water and sanitation access, which are subsequently shared with the JMP.

The 2013 AHS-which asked about household sewage disposal-estimated that a very small proportion (0.0037%) of the urban population in the largest US metro areas did not have public sewer access or use a septic tank, cesspool, or chemical toilet.15 This suggests that most urban persons in the United States who reported the absence of a flush toilet in the 2017 5-year ACS likely relied on an outhouse or did not have sustained access to a functioning flush toilet at home. If safely covered and abandoned, or emptied and treated, outhouses can constitute safely managed sanitation. Without sustained access to a flush toilet, some households may use a neighbor's facilities orpublic facilities (e.g., at work or at a gym), or may resort to open defecation.6,7

The WHO/UNICEF JMP estimates of water access are not directly comparable to ACS and HUD data. JMP data consider the use of a water source and the quality of the water, and allow for communal water facilities to be considered a basic drinking water service. However, data from the ACS and HUD only consider the presence of a water source. Therefore, the HUD and ACS estimate ofpeople without a tap is a conservative baseline of drinking water access in the urban United States and suggests that the WHO/ UNICEF estimate of people with limited water or worse is likely insufficient. Wellpublicized lead contamination of drinking water in Flint, Michigan, and Newark, New Jersey, are examples that piped water into the home does not necessarily guarantee safety. The US government could report water quality data along with HUD housing data to theJMP to improve future estimates of urban safe drinking water access.

Some households may have piped water and a flush toilet, but these facilities may fall into disrepair, and landlords may take weeks or months to provide the necessary repairs.9 Intermittent water supply-prevalent in lowand middle-income countries-has been linked to elevated risk of waterborne illness.25 Strengthening laws that protect tenants may be helpful to empower renters to obtain necessary repairs. For low-income homeowners, increasing awareness about and expanding funds disbursed by government housing repair programs (e.g., the Very Low-Income Housing Repair Program) may be useful to achieve universal access.

The JMP is limited by what official government data it receives and the need to apply a consistent methodology across countries. Some countries have explicitly included transient groups such as refugees (e.g., Palestinian and Syrian refugees in Lebanon) or nomadic groups (e.g., in Ethiopia) in survey data collection.14 However, people experiencing homelessness are undercounted in national surveys based on household units and not explicitly included in any national estimate of water and sanitation access. Without housing, it is likely impossible to have consistent access to a flush toilet and piped water when and where they are needed.16,26 More than 90% of open defecation sites in urban Atlanta, Georgia, were less than 400 meters from shelters and soup kitchens.6 UN Special Rapporteurs to water, sanitation, and housing have repeatedly compared the squalid living conditions for people experiencing homelessness in the United States to some of the worst settlements in low-income countries.27,28 Analogous to people experiencing homelessness in the United States, residents of informal urban settlements globally may also be excluded from data reported to the JMP.29

Without sustained access, people experiencing homelessness in unsheltered locations should be classified as "unimproved" on the JMP service ladder for drinking water and "open defecation" for sanitation. Because of the shared nature of water and sanitation facilities in emergency shelters and transitional housing, water for people experiencing homelessness in sheltered locations should be considered "basic" and sanitation considered "limited." Safely managed sanitation also requires adequate treatment of fecal wastes. In some rural US communities, direct discharge of raw sewage into the household yard- referred to as "straight-pipe"-is common.30 In urban and rural areas, failing septic tanks and sewer overflows are common.31 The US Environmental Protection Agency estimates that 850 billion gallons of untreated wastewater and stormwater are released as combined sewer overflows each year.31 Adequate access to sanitation accompanied by sequestration and treatment of fecal wastes remain important to achieving universal safely managed sanitation across the United States.

Access to relatively worse water and sanitation facilities was more prevalent among low-income households. More detailed data about water and sanitation facilities would be useful but overlap significantly with housing status; future ACS surveys will not include the question on flush toilets because of the high nonresponse rate and its perception as invasive.32 Our results suggest that the ACS should reintroduce the question regarding the presence of a flush toilet. Without comprehensive data on flush toilets, other metrics may also be useful.

Nearly 1 million households were evicted in the United States in 2016,9 leaving their short-term access to water, sanitation, and housing unclear. After an eviction, some may experience homelessness such as doubling up with friends or family, staying in an emergency shelter, or sleeping in an unsheltered location.9 More than half a million people were counted in the PIT count, but the count did not attempt an annual estimate of homelessness. The methods used excluded people staying with friends or family and those in hospitals or jails.22 In 2017, after considering people in county jails who had experienced homelessness at the time of their arrest, Houston, Texas, estimated their actual number of people experiencing homelessness was 57% greater than they reported in the PIT count (from 3605 to 5651).33 A 2001 study estimated that annual rates ofhomelessness in the United States are 2.5 to 10.2 times greater than the cross-sectional PIT count estimate.34 In high-income countries where housing instability and homelessness are drivers of inadequate water and sanitation conditions, national estimates derived from household data are insufficient to accurately estimate water and sanitation access. Future estimates could consider or be reported alongside housing data (e.g., evictions or worst-case housing)2,9,35 to ensure low-income households and people experiencing homelessness are accounted for.

Limitations

Our analysis had several limitations. Embarrassment may have caused households lacking a flush toilet to respond less often about their sanitation status than households with a flush toilet, suggesting that our estimates may be biased downward. Water and sanitation access for people experiencing homelessness in sheltered locations varies depending on accommodation: some may share facilities with others, may lack access to the facilities during daytime hours, may lose access temporarily as a punishment, or may have consistent private access in some cases. The heterogeneity in access may bias our estimate of people sharing sanitation.

Current data received by the JMP from the US government exclude large groups in the urban United States because of methodological limitations and data availability. The absence of a question regarding flush toilets in future ACS surveys suggests that the JMP should continue using the AHS, include HUD data on people experiencing homelessness, and consider other metrics of housing instability as proxies for water and sanitation access in the United States. Including people experiencing homelessness, a group often invisible to policymakers, in the data reported to the JMP will enable the United States to improve national estimates of water and sanitation, increase awareness of the issue, and allocate funding for investments in public toilets, which could come from existing programs to improve stormwater quality.

Public Health Implications

Access to safely managed water and sanitation are human rights,23 and, without these basic services, people are at increased risk of infection by fecal-oral pathogens and SARSCoV-2.1 The absolute number of people excluded from basic water and sanitation access is higher than available international statistics suggest. Estimates that account for housing instability reveal disparities that require action. Our methods for estimating water and sanitation access may be applicable to other high-income countries.

CONTRIBUTORS

D. Capone andJ. Brown originated the study. D. Capone wrote the first draft. All authors contributed to data analysis and drafting the final article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

Human participant protection was not required because no human participants were involved in this study.

Sidebar

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DETAILS

Subject:	Low income groups; Public health; Homelessness; Urban development; Shelters; Severe acute respiratory syndrome coronavirus 2; Sanitation; Estimates; Childrens health; Water quality; Housing; Drinking water; Metropolitan areas; Access; Urban areas; Plumbing fixtures; Federal agencies; Sanitation facilities; Income; Toilet facilities; Affordable housing; Homeless people; Households; Sustainable development; Defecation; Water supply; Polls &surveys
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Document 39 of 61

Confronting American Misery: Learning From the Streets

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ABSTRACT (ENGLISH)

Five years ago, we were confronted by the reality that "deaths of despair"-from suicide, drug overdose, and alcohol use, mainly in White working-class Americans-were claiming so many lives that total US population longevity was decreasing, something not seen in a wealthy country since the 1918 pandemic.1 Now, amid another pandemic and a markedly uncivil society with increasing acrimony and inequity, the videoed death of George Floyd, yet another Black man killed by police, has mobilized the social justice movement toward a national reckoning on the inhuman race relations codified in our founding "reasonable compact" and its compromise with slaveholders, including George Washington. Health system commentary on American distress has largely focused on the need either for enhanced response to the opioid epidemic, including better access to effective substance use treatment in the health care system, or for large-scale social and economic policy changes that are beyond the scope of health care, such as changing tax laws to promote economic mobility or increasing federal support for education.3 One cannot argue with either. In surveying the life experience of enrollees in Oregon's largest Medicaid health plan, we found that those who had the most complex high-risk health conditions, as well as the highest acute care use and costs,

had endured lives with the greatest sequential distresses: 56% had highly troubled early childhoods; 46% had run away from home; 54% had parents with substance abuse; 63% had substance use histories themselves, 40% starting in childhood; 62% had been homeless; and 52% had been in jail.

FULL TEXT

See also Blanchflower and Oswald, p. 1538.

"The establishment of our new Government seemed to be the last great experiment, for promoting human happiness, by reasonable compact, in civil Society."

-George Washington to Catharine Sawbridge Macaulay Graham, January 9, 1790

The American experiment is producing new troubling results, particularly troubling for a grand experiment to promote human happiness. Five years ago, we were confronted by the reality that "deaths of despair"-from suicide, drug overdose, and alcohol use, mainly in White working-class Americans-were claiming so many lives that total US population longevity was decreasing, something not seen in a wealthy country since the 1918 pandemic.1 Now, amid another pandemic and a markedly uncivil society with increasing acrimony and inequity, the videoed death of George Floyd, yet another Black man killed by police, has mobilized the social justice movement toward a national reckoning on the inhuman race relations codified in our founding "reasonable compact" and its compromise with slaveholders, including George Washington. Calls for structural change fill the streets.

In this issue of AJPH, Blanchflower and Oswald (p. 1538) document a related troubling reality: the increasing percentage of Americans reporting "extreme distress. " Examining data from 8.1 million respondents to the Behavioral Risk Factor Surveillance System between 1993 and 2018, they identified individuals who reported that during every day of the last 30 days their mental health "which includes stress, depression and problems with emotions" was "not good." They found that the percentage of the American population effectively reporting that "every day of my life is a bad day" grew from 3.6% in 1993 to 6.4% in 2019; forthose without college education, it increased from 4.5% to 8.6%; for middle-aged White Americans without college education, it more than doubled, from 4.8% to 11.5%.

The authors place their results in the context of multiple other studies using different measures that similarly find increasing American distress, despair, or mental health problems. Much remains to be learned. There is evidence that increasing despair affects all racial/ethnic groups. Furthermore, it is speculated that because ofsystemic racism, Black Americans expect much less from society than more recently disenfranchised Whites, with Blacks consequently having lower rates of reported extreme distress and associated deaths despite suffering the greatest inequities.2

But it is no longer a matter of speculation that because of racism, inequity, and economic marginalization growing segments of the population experience a dystopian America and not a society "promoting human happiness." This was true even before the economic disruptions from the COVID-19 pandemic and a predicted surge in mental health morbidity added to our collective distress.

Health system commentary on American distress has largely focused on the need either for enhanced response to the opioid epidemic, including better access to effective substance use treatment in the health care system, or for large-scale social and economic policy changes that are beyond the scope of health care, such as changing tax laws to promote economic mobility or increasing federal support for education.3 One cannot argue with either.

The most hopeful response, however, is the racial justice movement to restructure community policing now drawing broad support in the streets and in public opinion. It suggests that the most powerful and effective counter to American misery will come from change at the local level. Yes, there is an urgent demand for state and national policy changes regulating policing and police conduct. But the call to "defund the police" is about shifting what local governments do to keep people safe "to entities that are better equipped to meet the need."4 Starting with addressing systemic racism, it is about changing community and neighborhood programs and policies that address people in mental health or substance use crisis, or those living on the streets, or those involved in family and personal conflicts, or children in trouble at school. It is about community structural change and investment to make the response to those in distress "fairer and safer" and to mitigate that need.4 It is about what a Minneapolis, Minnesota, can do, or a New York City, or any community, most effectively as part of a national movement.

We have known for decades about established societal pathways undermining vulnerable communities, including those that start in early childhood. A "preschool-to-prison pipeline,"5 predominantly for low-income children of color, sequentially increases a child's risk of later incarceration, initially with preschool suspension and expulsion and then through continuing school behavior and performance issues, truancy, dropping out, and not finishing high school. Black children, mostly boys, account for 42% of preschool suspensions but make up only 18% of enrollment. They face not only racism and families stressed by economic insecurity but also punitive rather than restorative school policies, inadequate school funding, insufficient workforce diversity and training, scarce access to in-school and home-based behavioral health supports, and lack of family and community engagement.5

The preschool to prison pipeline runs through health care as well as education and criminal justice: in prenatal care that fails to address parental behavioral health and parenting risks; in early child screenings insufficiently focused on social and emotional development; in overdiagnosing attentiondeficit/hyperactivity disorder for early school behaviors related to family stress; in adolescent visits that do not screen for depression, substance use, or suicidality; in providing poor access to behavioral health services for both children and adults; in system barriers that limit care delivery where it is needed, such as in schools and jails; and generally in delivery models that are too narrowly medical and do not engage with individuals in their family, social, and community contexts. Health care systems, too, need to rethink community wellbeing and safety.

We would be better for it. In surveying the life experience of enrollees in Oregon's largest Medicaid health plan, we found that those who had the most complex high-risk health conditions, as well as the highest acute care use and costs, had endured lives with the greatest sequential distresses: 56% had highly troubled early childhoods; 46% had run away from home; 54% had parents with substance abuse; 63% had substance use histories themselves, 40% starting in childhood; 62% had been homeless; and 52% had been in jail. Their average yearly medical costs were $48 876.6

How can health systems improve health and control costs without similarly dismantling the pipelines between childhood adversity, school failure, substance use, homelessness, incarceration, and complex health morbidity, and their infrastructures of racism and inequity? The turning points that contribute to those outcomes are many and frequent over the life course and involve multiple sectors. Joining with communities to unravel and realign the tangle of policies and programs that produce those pipelines is the work of health care as well.

The national racial justice movement is forcing us to confront whether our community institutions harm us, drive us to despair, or help us thrive. Health systems should fully engage with this challenge. Truly addressing the broad distress rising in America will certainly take large-scale social and economic national policy changes, in effect a new reasonable contract for civil society. Hopefully, a national movement of community-focused change will provide the opportunity not only to understand how to construct the next version of the American experiment but also to create the new alliances and political consensus that will get us there. /4JPUI

David Labby, MD, PhD

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DETAILS

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Document 40 of 61

The Environmental Health and Emergency Preparedness Impacts of Hurricane Katrina

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ABSTRACT (ENGLISH)

Fifteen years ago, Hurricane Katrina made landfall as a powerful category 3 storm in southeast Louisiana, bringing record storm surges exceeding 27 feet in Mississippi and approaching 20 feet in New Orleans, Louisiana. The surge into Lake Pontchartrain battered the citys outflow canals, leading to failure and the eventual technological disaster that poured over New Orleans. We reflect on Katrinas impacts on environmental public health and the emergency preparedness landscape. Katrinas effects on environmental health from a chemical and heavy metal perspective were substantial. Storms of this magnitude coupled with floodwater inundation reveal how complex the sources and types of chemical and elemental hazards can be, hazards that include pollutants mobilized from hazardous waste sites, oil spills, and formaldehyde off-gassing in temporary housing units.Adverse respiratory outcomes associated with both acute and chronic exposures to particulate matter, including biological and chemical hazards, were prevalent in Katrina disaster victims, first responders, and the workforce, including transient volunteers, who are typically involved in remediation, demolition, and cleanup of affected residential and industrial areas.2 Noise

exposure and heat stress associated with heavy equipment use and physical labor during summer months in hurricane-prone regions are consistent sources of disaster-related injury.

FULL TEXT

See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

Fifteen years ago, Hurricane Katrina made landfall as a powerful category 3 storm in southeast Louisiana, bringing record storm surges exceeding 27 feet in Mississippi and approaching 20 feet in New Orleans, Louisiana. The surge into Lake Pontchartrain battered the citys outflow canals, leading to failure and the eventual technological disaster that poured over New Orleans. We reflect on Katrinas impacts on environmental public health and the emergency preparedness landscape.

Katrinas effects on environmental health from a chemical and heavy metal perspective were substantial. Storms of this magnitude coupled with floodwater inundation reveal how complex the sources and types of chemical and elemental hazards can be, hazards that include pollutants mobilized from hazardous waste sites, oil spills, and formaldehyde off-gassing in temporary housing units.1

Adverse respiratory outcomes associated with both acute and chronic exposures to particulate matter, including biological and chemical hazards, were prevalent in Katrina disaster victims, first responders, and the workforce, including transient volunteers, who are typically involved in remediation, demolition, and cleanup of affected residential and industrial areas.2 Noise exposure and heat stress associated with heavy equipment use and physical labor during summer months in hurricane-prone regions are consistent sources of disaster-related injury.

Care must be taken in assigning many health effects to the myriad environmental exposures caused by Katrina. Duration and frequency of exposures must be considered in addition to the levels or concentrations of the pollutants. Because proper and accurate exposure assessments were and continue to be poorly documented before and after disasters, it remains a public health challenge to clearly associate exposures with particular chemicals or toxins with adverse health outcomes.

Significant effects on microbial water quality and increased risks associated with exposure to pathogens in contaminated urban floodwaters are challenges induced by hurricanes and other severe weather disasters. Decreased population and increased use of low-flow plumbing devices following Katrina led to less water being consumed and a proliferation of opportunistic pathogens, including Naegleria fowleri,3 in the drinking water systems ofSt. Bernard Parish, part of the Greater New Orleans region. Four of 16 water distribution system samples collected by the Centers for Disease Control in 2013 tested positive for N. fowleri. Contributing factors included no detectable total chlorine residual and a water temperature greater than 30 degrees centigrade at three of the four positive sampling locations,3 indicating opportunistic environments for pathogens of concern years after Katrina.

Excessive standing floodwaters, flooded swimming pools, and warmer temperatures after Katrina provided optimal conditions for mosquito larvae, including the vector of West Nile virus; cases of West Nile fever nearly doubled compared with previous years but have since stabilized to average ranges.4 The crowding of infected and susceptible hosts, interruptions of ongoing control programs, and a weakened public health infrastructure further increased risk factors for the transmission of vector-borne diseases.

Katrinas impact initiated significant changes in emergency preparedness. Practitioners in coastal jurisdictions were forced to rethink prestorm evacuation strategies for people with and without individual means to do so and to consider rostering individuals with access and functional needs. Coordination, collaboration, and communication across multiple sectors and stakeholders needed strengthening to assist with a more robust common operating picture, threat visibility, and situational awareness of the disaster from an emergency operations center perspective-all of which were provided as local and state areas of improvement after Katrina.

Foundational to preparedness is identifying hazards or threats facing a jurisdiction, especially those posing the greatest risk. However, viewing these threats and hazards-such as those identified during and after Katrina-through an environmental and public health lens is often less common. Complex exposure risks caused by Katrina became a focal point for local and state public health officials during and following the storm. Questions related to exposure, toxicity, and risk were consistently posed to, and by, local health officials throughout the response to and recovery from Katrina.5

The current Threat and Hazard Identification Risk Assessment, conceptualized in 2012, is an example of a structured methodology formalized after Katrina; this assessment standardizes the process used by state, local, tribal, and territorial authorities to effectively address area-specific risks. The preparedness capabilities and gaps for each of these risks are aligned to one or more of the five core mission areas of the national preparedness goal: prevention, protection, mitigation, response, and recovery. Further specificity is accomplished by aligning these areas to the 32 core capabilities, which provides jurisdictions a roadmap on how to optimize capabilities and bridge gaps.

Although the Threat and Hazard Identification Risk Assessment process often remains generically public safety-centric, it continues to show hurricanes as a prioritized natural hazard in areas close to the Atlantic Hurricane Basin. Risk assessments associated with environmental exposure, including associated risk communications, may not be adequately incorporated into Threat and Hazard Identification Risk Assessments; this is evidenced by hurricanes Sandy, Harvey, and Florence, which all had complex environmental health concerns similar to Katrina's. Examples of such complexities include environmental health threats, such as oil spills and other mobilized pollutants from an industrial, agricultural, or previously contaminated site; many of these remain extremely vulnerable to climate change, presenting significant future challenges to local jurisdictions.

Of the 1571 nonfederal sites on the National Priorities List, 713 are currently located in areas with 1% or higher annual chance of flooding and 187 are at risk for major hurricane-related storm surges.6 Exposure risk posed by the combination of an active hurricane season, congregate evacuation-related sheltering strategies, and COVID-19 adds further complexity to hurricane threats. Despite the increasing frequency of major hurricanes and large preparedness advancements made explicitly in emergency management and the public health sector (which serves as colead for Emergency Support Function 8 in the National Response Framework in support of the national preparedness goal7), experts in exposure assessment or applied environmental health are not commonly integrated into state, local, tribal, and territorial comprehensive planning processes or teams.

Emergency Support Function 8 extensively engages in preparedness-this cannot be denied or argued-and the reality of experiencing a complex environmental health disaster can result in advanced Emergency Support Function 8 integration. In post-Katrina New Orleans, significant efforts related to integrating public health into overall public safety have occurred as a result of the experiences the Gulf Coast has endured. We argue, however, that nationwide gaps continue to persist in comprehensively integrating environmental and public health expertise into the preparedness system, including the Threat and Hazard Identification Risk Assessment process. A literacy gap persists on both sides between the disciplines of environmental and public health and that of emergency management. The disciplines should no longer be ships passing in the night, but rather the same ship advancing preparedness, response, and resilience.

The 2019 Pandemic and AllHazards Preparedness and Advancing Innovation Act is a step in the right direction and explicitly suggests integrating environmental health into situational awareness and biosurveillance, strengthening response to environmental hazards, advancing the consultation of environmental health agencies during crises, and infusing environmental health as major expertise in zoonotic disease transmission and investigation.

In a time of elevated, complex threats, state, local, tribal, and territorial actions should expand to include the identification of environmental health experts, researchers, and practitioners and their integration into task forces or strike teams to bolster preparedness, incident management, and situational awareness. Policy supports this; however, successful implementation, challenges, and barriers remain unknown. ÂfPU

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M.J. Wilson led the writing. S. A. Murphy led the revision. All authors contributed equally to this editorial.

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Sidebar

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Food Access 3.0: Insights From Post-Katrina New Orleans on an Evolving Approach to Food Inequities

Rose, Donald, PhD; O'Malley, Keelia, PhD

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ABSTRACT (ENGLISH)

Racial and economic disparities in access to healthy food have been well documented in urban areas throughout the United States. Inadequate food access is a socialjustice issue, an indefensible inequity, especially in a land of abundance. It also contributes to poor-quality diets-typically low in fruits and vegetables and high in sugar, salt, and saturated fats- which can increase the prevalence of various chronic diseases. Large-scale efforts to address this access problem, such as the original Food Stamp Program, initially focused on increasing purchasing power, because inadequate household income was viewed as the cause of this problem.1 We refer to this problem definition and response as Food Access 1.0.

The second wave of food access interventions, or Food Access 2.0, focused on expanding groceries in underserved areas across the country.2 Distant grocery stores make shopping for healthy foods difficult because of added costs and inconvenience, especially in cities with a poor transportation infrastructure and a low rate of car ownership.3,4 In New Orleans, Louisiana, food access disparities worsened in the aftermath of Hurricane Katrina,5 heightening awareness of the problem and precipitating a multistakeholder response that helped lead this wave. The issue is a problem in urban and rural areas throughout the country, but the disaster in New Orleans demonstrated stark racial disparities. Federal disaster funds were eventually used to support the first locally directed, healthy food retail incentive program.

FULL TEXT

Racial and economic disparities in access to healthy food have been well documented in urban areas throughout the United States. Inadequate food access is a socialjustice issue, an indefensible inequity, especially in a land of abundance. It also contributes to poor-quality diets-typically low in fruits and vegetables and high in sugar, salt, and saturated fats- which can increase the prevalence of various chronic diseases.

Large-scale efforts to address this access problem, such as the original Food Stamp Program, initially focused on increasing purchasing power, because inadequate household income was viewed as the cause of this problem.1 We refer to this problem definition and response as Food Access 1.0.

The second wave of food access interventions, or Food Access 2.0, focused on expanding groceries in underserved areas across the country.2 Distant grocery stores make shopping for healthy foods difficult because of added costs and inconvenience, especially in cities with a poor transportation infrastructure and a low rate of car ownership.3,4 In New Orleans, Louisiana, food access disparities worsened in the aftermath of Hurricane Katrina,5 heightening awareness of the problem and precipitating a multistakeholder response that helped lead this wave. The issue is a problem in urban and rural areas throughout the country, but the disaster in New Orleans demonstrated stark racial disparities. Federal disaster funds were eventually used to support the first locally directed, healthy food retail incentive program.6

Perhaps because of the existential nature ofthe disaster or the delayed and muted federal response, rebuilding after Hurricane Katrina generated an unprecedented degree of citizen involvement. With it came a tremendous surge of social innovation in all sectors, particularly in food and nutrition (https://bit.ly/NOLA-foodnutrition-resources). This led to a third wave of interventions, Food Access 3.0, which sees the problem as structural in nature, originating in socially determined inequities (Table 1). The response is based on innovative, multidimensional, cross-sectoral participatory interventions that promote agency in those affected and address underlying systemic influences. These interventions address disparities in healthy food access in terms of both social justice and health outcomes.

Grow Dat Youth Farm is one example of this type of innovative intervention in New Orleans. It is simultaneously an urban agriculture, youth development, and community food-supplying organization. It improves food access, and it educates high schoolers about a sustainable food systems approach, building leadership skills through mentoring and afterschool employment. The Sankofa Community Development Corporation runs fresh produce markets, including a mobile market stop in the Lower Ninth Ward, as well as healthy cooking and gardening classes. Liberty's Kitchen employs local youths in the food sector, focusing on food preparation and service skills. Demonstrating the multidimensional aspect of this new wave of interventions, it runs a restaurant, has catered healthy school meals to local schools, and has supplied warehousing facilities to a local corner store initiative.

Top Box Foods supplies preordered boxes of discounted foods to low-income individuals for pickup at local churches and other drop spots. It also serves as a distributor to a new city-funded project to stock corner stores with fresh produce and healthy snacks. That corner store project is run by Propeller: A Force for Social Innovation, a local incubator and accelerator that promotes equitable outcomes in the food, health, education, and water sectors. The project educates and equips store owners to sell fresh produce, and it supports community education, including in-store cooking demonstrations.

These and many other innovative organizations all use the food system as an entry point, but they cut across various sectors- education, employment, community development, business development, agriculture, environment, and health. They are based on local needs and participation and often focus on youth leadership development. They are all multidimensional, operating at various points in the food system, with a perspective rooted in past structural inequities that provides a holistic response to the problem. They often collaborate with other mission-driven organizations for synergy in achieving common goals.

Many of these organizations are part of a growing local culture of social innovation, which seeks "a novel solution to a social problem that is more effective, efficient, sustainable or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals."7(p36) The hybrid organizations span private and public sectors. They attack complex social problems with entrepreneurial and systems-thinking skills, coupled with the commitment of motivated individuals living these problems. They start small, experiment, learn from mistakes, and adapt without growing too large, too soon. This approach contrasts with large bureaucracies (like governments and some corporations) whose top-down structures discourage the experimentation needed in our complex reality.

This third wave is not new or unique to New Orleans. Rather, it is a resurgence of activities that have been around for decades and exist throughout the country. The Freedom Farms Cooperative, started in the late 1960s by Fannie Lou Hamer, was an agricultural cooperative that focused on economic development using various strategies to support the needs of African American sharecroppers and tenant farmers in Mississippi. The Edible Schoolyard began in Berkeley, California, in the mid-1990s as an effort to transform children's connection to food. Also focused on mentoring youths as well as alternative agriculture and food provisioning, Growing Power began in Milwaukee, Wisconsin, in 1993.

The Urban Growers Collective brings healthy locally grown food to Chicago's communities through mobile farmers markets run on converted city buses. It also runs youth job training and urban farmer development programs. Started in Los Angeles, California, the Good Food Purchasing Program encourages large institutions, such as school districts, to orient their purchasing toward core values, such as supporting local economies, environmental sustainability, and nutrition. Coalitions, such as the Detroit Black Community Food Security Network and the National Black Food and Justice Alliance, use food system entry points to build community, transform structural inequities, and promote food and social justice (for references, see the Appendix [available as a supplement to the online version of this article at http://www. ajph.°rg]).

These and other local organizations that form the vanguard of this new movement may be strong, but they are not invincible. There is a significant turnover in grassroots food organizations. The federal government has funded some efforts to increase the self-reliance of communities in providing the food needs of its citizens. For example, the Community Food Projects Competitive Grants Program, run by the US Department of Agriculture, provides funds that promote comprehensive responses to local food access, farm, and nutrition issues. But the grants require a 100% match, and the entire program is funded at a level less than a hundredth of a percent of the Supplemental Nutrition Assistance Program. As creative as locally led efforts are in developing resources to support their activities, external, institutionalized, and substantial support will be important in their sustainability and scale-up. Comprehensive evaluations will also be important for understanding and promoting best practices.

The New Orleans experience can provide insights to communities throughout the country that suffer nutritional inequities, face increasing risks from natural disasters, and respond to the current food security crisis resulting from the COVID-19 pandemic. The communitydriven response, focused on socially innovative approaches to food access problems and their underlying determinants, holds promise for reducing food and social system inequities. To be sure, this approach is not a panacea, nor is it a replacement for the resource supports that are the foundation for Food Access 1.0 and 2.0 interventions. Adequate income to purchase food and geographic access to healthy food at reasonable prices are necessary -although not sufficient-conditions for an adequate diet. All three-effective demand, adequate supply, and a participatory gumbo that strengthens individuals, communities, and local institutions through education and action on pressure points in the local food system-are needed to make inroads on the food access problem and the underlying structures that create it.

CONTRIBUTORS

D. Rose developed the ideas underlying the editorial and led the writing of it. K. O'Malley contributed to the concepts and writing of the editorial.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

Sidebar

IMII See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

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DETAILS

Subject:	Hurricanes; Food stamps; Disasters; Nutrition; Groceries; Funds; Retail stores; Transportation engineering; Food security; COVID-19; Social justice; Food; Ownership; Health care; Low income groups; Sustainability; Public health; Education; School districts; Grocery stores; Community development corporations; Agricultural management; Editorials; Agriculture; Federal agencies; Purchasing; Farms; Urban areas; Purchasing power; Chronic illnesses; Nutrient deficiency; Rural areas; Agricultural cooperatives; Social innovation; Racial inequality; Grocery industry
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Document 42 of 61

Colonial Neglect and the Right to Health in Puerto Rico After Hurricane Maria

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ProQuest document link

ABSTRACT (ENGLISH)

The humanitarian crisis revealed as a result of Hurricane Maria in Puerto Rico demonstrates a long history of US colonial neglect and human rights violations. This reality has made it especially difficult for the people of Puerto Rico to achieve their right to the highest attainable standard of health. The impacts are pervasive, resulting in disparities in Puerto Rican health, including water access and quality; wealth, including economic loss and disinvestment; and sustainability of the island's resources. As a result of failed governmental protection and support, public health issues related to access to care, a failing infrastructure, and discrimination all contributed to crisis on the island. A human rights framework is necessary to assess the ongoing human rights violations of the quality of life to support millions of American citizens on the island. This essay utilizes a rightsbased approach to reveal historical disenfranchisement of Puerto Rico before the storms, identifies the specific human rights violations that resulted from the US government's lack of emergency preparedness and responsiveness, and demands rebuilding the island to reconcile all that has been lost. (Am J Public Health. 2020;110:1 5121518. doi:10.2105/AJPH.2020. 305814)

FULL TEXT

Headnote

The humanitarian crisis revealed as a result of Hurricane Maria in Puerto Rico demonstrates a long history of US colonial neglect and human rights violations. This reality has made it especially difficult for the people of Puerto Rico to achieve their right to the highest attainable standard of health. The impacts are pervasive, resulting in disparities in Puerto Rican health, including water access and quality; wealth, including economic loss and disinvestment; and sustainability of the island's resources. As a result of failed governmental protection and support, public health issues related to access to care, a failing infrastructure, and discrimination all contributed to crisis on the island. A human rights framework is necessary to assess the ongoing human rights violations of the quality of life to support millions of American citizens on the island. This essay utilizes a rightsbased approach to reveal historical disenfranchisement of Puerto Rico before the storms, identifies the specific human rights violations that resulted from the US government's lack of emergency preparedness and responsiveness, and demands rebuilding the island to reconcile all that has been lost. (Am J Public Health. 2020;110:1 5121518. doi:10.2105/AJPH.2020. 305814)

On September 20, 2017, Puerto Rico was struck by Hurricane Maria, a category 4 storm that pummeled the island for more than 30 hours with reported wind speeds up to 155 miles per hour, precipitating one of the worst humanitarian disasters ever documented in a US territory. This megastorm made landfall just 2 weeks after Hurricane Irma, devastating the already fragile infrastructure of Puerto Rico, making Puerto Rican people even more vulnerable to numerous human rights violations. Before the storms, there were major inadequacies in physical infrastructures, and Puerto Ricans on the island had poorer health outcomes than US residents on the mainland, reflecting the effects of the persistent colonialist policies that scar the health and wellbeing of the people of Puerto Rico. A UN report confirmed that the human rights of Puerto Ricans on the island have been undermined for decades before these storms because of the economic and financial crises perpetuated by austerity policies. This UN report states that such policies and violations affect the rights to health, education, and social security as well as basic needs such as food, housing, and water.1

We utilized a human rights- based approach2 that calls on international covenants rooted in the Universal Declaration of Human Rights (UDHR) to demonstrate how historical and ongoing systematic neglect ofthe rights of Puerto Rican people by the US government causes multiple public health challenges. A human rights-based approach pulls focus away from individuals and health care systems and places greater scrutiny on governmental systems that have exacerbated inequality and discrimination. In short, it identifies a framework to ensure government accountability for respecting, protecting, and fulfilling human rights, and to help build opportunities for people's political participation and social action. Our human rights-based approach includes an assessment of the obligations of the United States (as a dutybearing state) and the decisionmaking capacity of the Puerto Rican people (the rights holders) to dismantle structural inequities, promote health and well-being, and create equitable preparedness and disaster response processes.

This essay begins with an account ofthe historical events that led to Puerto Rico becoming an unincorporated US territory, the differences between statehood and territory status, and the ramifications of those differences for Puerto Rico's residents. We then describe how the systemic disadvantages of Puerto Rico's territorial status have resulted in political and economic crises that exacerbate its vulnerability to poor health and reveal gaping inequities between Puerto Rico residents and individuals in the mainland United States. Through highlighting a variety of human rights violations, especially those of nondiscrimination and right to water, electricity, and health care access, we identify a rights-based approach to address these violations and rebuild the island so that the Puerto Rican people can achieve their right to the highest attainable standard of health. The highest attainable standard of health includes the right to health care and to the necessary underlying conditions such as the right to safe drinking water, food, and housing. This right also entitles people to a system of health protection with equal opportunity and without discrimination, in which all related goods and services must be made available, accessible, acceptable, and of good quality.3

SLAVERY AND COLONIALISM IN PUERTO RICO

In the late 15th century, the Spaniards colonized and enslaved the indigenous Taino and Carib people of Puerto Rico and established San Juan as an essential military post. After the Spanish-American War in 1898, Puerto Rico was acquired by the United States and, soon after, established as an unincorporated territory.4 The Territory Clause of the US Constitution5 authorizes unequal treatment of US territories compared with US states as long as there is a "rational basis" for such differential treatment by government bodies including Congress.6 This "rational" differential treatment contributes to disparities between treatment of US territories, such as Puerto Rico, and states.7

The relationship between the United States and Puerto Rico highlights decades of human rights violations against the Puerto Rican people that has left the island suffering from economic, social, and political crises. The dichotomy of being both American citizens and colonial subjects has situated Puerto Ricans in a political purgatory and makes them particularly vulnerable to exploitation of their land and resources by the United States.8 This history is in direct violation of the 1969 International Convention on the Elimination of All Forms of Racial Discrimination (ICERD),9 which asserts that colonialism and all practices of segregation and discrimination based on race and ethnicity must end. As an example, as residents of a US territory, Puerto Ricans cannot fully benefit from the protections and rights of the US Constitution and are therefore subject to unequal treatment. Despite being US citizens, residents ofPuerto Rico do not have full representation in Congress, they cannot vote in national presidential elections, and in all areas of governance, US federal mandates supersede local policies and legislation,8 violating the right of Puerto Ricans to equal participation in political affairs.10 These unjust policies were already in place before the storms, setting a precedent of unfair, state-sanctioned discriminatory treatment of island residents during the response and recovery efforts after Hurricane Maria.

POLITICAL AND ECONOMIC CRISES IN PUERTO RICO

The constant economic crisis on the island is perpetuated by rights violations and systems of disadvantage built by the US government that include extremely high taxes to import goods into Puerto Rico and wages consistently lower than the federal minimum wage requirement.11 The 2013-2017 American Community Survey estimates that 41% of all Puerto Ricans have incomes below the federal poverty level. For families with children younger than 18 years, the poverty rate is even higher, at 52.4% as compared with the national average of 16.7%.12 The lack of affordable education and employment opportunities has forced constant migration of Puerto Ricans to the mainland in search for higher paying jobs, dwindling the Puerto Ricanlaborforce.11 Years of economic hardship attributable in part to historical corporate tax breaks and the migration of corporations off the island led to a severe economic recession in 2006. Before the megastorms, the Puerto Rican government had $74 billion of debt owed to investors, loans to utility agencies, and pension-related debt meant to sustain the island.11

As an example of long-term and widespread injustices enacted by the US government against Puerto Rico, the Merchant Marine Act of 1920 continues to strangle Puerto Rico's economy by requiring that maritime waters and ports be controlled by US agencies, rather than local authorities. This leads to higher-cost consumer goods compared with costs on the mainland United States, and prevents foreign countries from trading directly with Puerto Rico.8 In addition, it prevents foreign governments from supplying the island with goods in times of crisis.

In May of 2017, Puerto Rico declared bankruptcy in an effort to seek federal assistance in escaping debt, a financial situation that would only be made worse in the aftermath of destruction in the upcoming hurricane season. The US response to the bankruptcy declaration was to establish the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA). This act allowed Congress to appoint a fiscal control board to begin the dismantling of Puerto Rico's debt crisis. The board has primarily consisted of politicians and financial industry executives.11 Following political and economic scandals involving alleged mismanagement of relief funds and leaked messages from the former governor, PROMESA's representative of the Puerto Rican government resigned.

HEALTH AND HEALTH CARE APARTHEID IN PUERTO RICO

In July 2016, there were approximately 3.41 million Puerto Rican residents living on the island,13 many of whom were experiencing negative health outcomes and limited access to health services. Table 1 demonstrates the disparities relevant to poverty and unemployment for those living in Puerto Rico compared with Latinos living in the mainland United States and the general US population. Because in part of the high rates of poverty and unemployment, a substantial proportion of Puerto Rico's residents utilize public programs to meet their health care needs. For instance, almost half (49%) of residents in Puerto Rico are covered by Medicaid,14 and only 35% have access to employer-sponsored insurance.14 This inequity in financing of health care costs has been associated with key health disparities, including Puerto Rico residents reporting poorer general health and being more likely to report having a disability than mainland US residents (Table 1).

A few key indicators of the substantial health disparities between Puerto Rico and the mainland United States include the fourth-highest premature birthrate of any US state or territory as of2016,8,15 a high diagnosis rate ofHIV at 15.1 per 100 000 as of 2015,8,16 a 50% greater prevalence of diabetes, and a diabetes mortality rate 3 times higher than the rest of the United States.13,17 Before Hurricane Maria, Puerto Rico was also still recovering from the 2015 Zika epidemic.8 The combination of state-sanctioned discrimination and capped health care spending in Puerto Rico has led to stark inequities in health and health care for island residents. When Maria made landfall, these inequities were exacerbated by inadequate support for disaster response and recovery.

MANIFESTATION OF COLONIAL NEGLECT ON INFRASTRUCTURE

The vulnerability of the power and water infrastructure before, during, and after the storm highlights the importance ofrebuilding these utilities to the highest possible quality standard, rather than simply to the inadequate quality level that was present before Maria.

Access to Electricity and Potable Water

Much has been written about the effects of Hurricane Maria on the electricity infrastructure in Puerto Rico, as well as the extended period that many residents were without power and potable water following the hurricane. However, even before the storm, these service infrastructures were not adequate for the health of the residents of Puerto Rico. In 2015, virtually all Puerto Ricans living on the island (99.5%) were being served by water supplies that were in violation ofthe Safe Drinking Water Act.18 In addition, almost 70% of people's water supply was in violation ofhealth-based standards, with high levels of coliform bacteria and volatile organic compounds, and 97.2% of all Puerto Rican residents had water in violation of the Lead and Copper Rule.18

The status of the island's power supply was similarly in poor repair. A 2016 audit of the Puerto Rico Electric Power Authority referred to the system as being "in a state of crisis. "19(p26) This report references how the transmission and distribution systems were "cracking, corroding, and collapsing."19(p18) In addition to being in poor shape, Puerto Rico's energy supplies existed almost entirely from nonrenewable sources. Before Maria, only 3.3% ofPuerto Rico's power was generated from renewable energy sources, such as wind and solar, despite high potential for each ofthese.20 In 2010, targets related to the proportion of energy sourced from renewables have been set, but not met.20

The storms left approximately half of the population (1.7 million) without drinking water21 and more than 1.5 million residents on the island without power.20 By comparison, 280 000 were without power in Texas following Hurricane Harvey, which made landfall on August 25, 2017, as a category 4 hurricane.22 Puerto Rican households were on average without electricity for 84 days and without water for 68 days, with 83% of remote households without power for nearly 3 months.23 In the days following the storms, the Puerto Rico Department of Health, the Puerto Rico Aqueduct and Sewer Authority, the Environmental Protection Agency, and the Centers for Disease Control and Prevention each informed residents to boil or add chlorine to their water after service had been restored.24 Despite the Federal Emergency Management Agency (FEMA) declaring that 95% ofPuerto Rico had potable water 60 days after the hurricane, this water had not been tested for safety by the Environmental Protection Agency,23 placing people at risk for contracting disease. Communications regarding water supply safety were contradictory, and the timing of the repairs to the system varied across the island.24

Despite the larger number of US citizens affected by Maria, disaster response in Puerto Rico was significantly slower and overall provided less relief than the disaster response to hurricanes Harvey in Texas and Irma in Florida.25 For example, within 9 days after landfall, survivors of Hurricane Maria in Puerto Rico received $6.2 million dollars of direct FEMA aid, whereas Harvey survivors received $141.8 million dollars.25 In addition, Puerto Ricans waited 2 months longer than survivors of Harvey for less than one fourth of the total federal aid allocation for disaster relief. Given these disparities, the response to Hurricane Maria has been deemed a "resounding failure"26 and is evidence of discrimination and oppression ofPuerto Rican citizens.

Access to Quality Health Care

Before Hurricane Maria, there were approximately 70 formal hospitals providing health care in Puerto Rico.7 Because of the high rates of Medicaid coverage, many residents received their care from 1 ofthe 20 federally funded community health centers, which offer primary and preventive care services at 93 sites across the island.7,27 Fifty-three percent of community health centers primarily relied on Medicaid funding.13,27 Reports indicate that before the storms there was a sufficient supply of providers including 7 nurses per 1000 people and 2.5 physicians per 1000 people in Puerto Rico.28,29 However, access was limited as these providers were unevenly distributed throughout the island, with the highest concentration in the San Juan metropolitan area. Even before the storm, remote rural areas experienced significant shortages in health care providers,28,29 and 72 of the 78 municipalities were designated as medically underserved areas by the US Health Resources and Services Administration.28

In the days following Hurricane Maria, only 3 of 70 previously existing hospitals were operational.13 One of the most significant impacts on the island was that most hospitals were left without grid electricity and had limited access to generators with fuel.13 Two months after Hurricane Maria, 40% of the hospitals were still running on generators, which proved to be an unreliable power source as generators ran out of fuel resulting in intermittent outages.13 Community health center structures were also severely damaged during the hurricane, with 10 out of the 93 sites still closed as of October 2017.13 By March 2018, all health centers were reported to be opened and serving the community, but lack of gridbase electricity remained an issue for many sites.27 Given the high burden ofdiabetes on the island, dialysis centers are a critical part of the health care system for Puerto Rico. A majority of the island's 47 dialysis centers lost power during the hurricane and experienced issues with power failures in the following months, which sometimes required transporting patients to other centers throughout Puerto Rico and the mainland United States.13,30 Previous issues with the uneven distribution of health care provider access were only exacerbated by the regional displacement and continued migration of providers to the mainland United States that occurred following the storm.7,28 In 2017, the US Health Resources and Services Administration estimated that almost half of the current population of Puerto Rico was living in a designated Health Provider Shortage Area, meeting less than 2% of the need for health care provider services on the island.13,31

HUMAN RIGHTS VIOLATIONS BY THE US GOVERNMENT

A rights-based approach utilizes the United Nations' international covenants and treaties to shape understanding ofproblems and solutions necessary for people's security, dignity, and wellbeing. It also identifies ways in which nation states are meant to be held accountable to respect, protect, and fulfill the fundamental human rights of their people. The approach demands that states pay special attention to groups who are made more vulnerable through discrimination, colonialism, apartheid, and other forms ofpolitical, economic, social, and cultural oppression.2 Although the United States has not ratified all the international treaties relevant to the right to the highest attainable standard of health for the people of Puerto Rico, the US government is legally accountable for principles enshrined in 2 relevant covenants: the ICCPR32 (signed in 1977, ratified in 1992) and the ICERD9 (signed in 1966, ratified in 1992). As a result of ratification, these covenants' principles now have status equal to US federal law. While the United States signed but did not ratify the International Covenant on Economic, Social, and Cultural Rights (ICESCR) in 1977,33 this document still helps to identify multiple rights violations and opportunities for remedy. Several UN documents, principles, and rights violations against the people of Puerto Rico are outlined in Table 2 and described in the next section.

Unequal Treatment

Article 1 of the UDHR stresses the equality of all human beings in regard to one's right to dignity and equal rights.34 The US Constitution, which allows for a "rational basis" of differential treatment of territories and US states, violates this by granting rights differently depending on where an individual may live. This unequal treatment is discriminatory along racial and ethnic lines, which violates Article 2 of the UDHR34 and the ICERD,9 which enshrines the right to freedom from discrimination based on race, language, and jurisdiction. The US government response to the hurricanes was far more comprehensive and immediate for communities in the continental United States than it was for the people of Puerto Rico.25 This unequal treatment is perpetuated by a politics of disinvestment and neglect from US government regarding Puerto Rico as a colony and the heightened anti-Latinx sentiment demonstrated by the current administration.

Self-Determination and Economic Justice

The US oppression of Puerto Rico demonstrates a sociopolitical violation of Article 1 of the ICCPR, which states: "All peoples have the right of self-determination. By virtue of that right, people are meant to freely determine their political status and freely pursue their economic, social, and cultural development."32 As US citizens, Puerto Ricans are entitled to the same protections as mainland citizens, and any difference in the treatment of Puerto Ricans is in clear violation of both treaties. Article 5 of the ICERD supports that Puerto Ricans should not be denied rights because of their Puerto Rican identity or region, and clearly demonstrates that the United States is responsible for protecting and promoting the political (Article 5c) and civil rights (Article 5d) of the Puerto Rican people.9

Although signature without ratification does not hold the United States accountable to the ICESCR, signature does demonstrate that the United States endorses those basic principles and reifies the international norm that all rights are indivisible and interdependent. Therefore, the right to the highest attainable standard of health of ICESCR's Article 1233 and of General Comment 1435 help to demonstrate principles for government action and accountability in areas that have direct relevance to Article 1 of the ICCPR,32 which asserts that people should be able to freely pursue their economic, social, and cultural development. It is impossible to achieve good health and well-being without economic stability and the ability to meet basic needs. Poverty causes poor health outcomes by both reducing access to health care services and simultaneously increasing vulnerability attributable to lack of access to safe water and utilities necessary to meet basic needs.36

Basic Needs of Waterand Electricity

Water is essential for life and is important for all dimensions of good health. General Comment 15 of the ICESCR demonstrates that the right to clean, potable water is related to many other human rights obligations,37 specifically that people are entitled to a "minimum amount of safe drinking water" and to participating in water-related decision-making.37 That drinking water was at such poor quality before the hurricane demonstrates the US failure to respect, protect, and fulfill this human right. In addition, the lack of effective response after the hurricanes on the part of the US government to secure basic needs, including potable water and electricity, violates the right to the highest attainable standard ofhealth. It is likely that a portion of the 4645 estimated excess deaths that occurred in the 3 and half months following the storms38 are directly or indirectly attributable to the lack of basic utilities of electricity and water. Indeed, one third of these deaths were found to be the result of delayed or interrupted health care,38 which may be in part attributable to health care institutions not having power with which to operate. The failure of the United States to fulfill the right to health by providing a swift and sufficient response to the storms is a violation of multiple international human rights standards and to US federal law. The US government must progressively act toward meeting its rights obligations.

RIGHTS-BASED APPROACH TO HEALTH EQUITY

The political and economic oppression of Puerto Rico is a highly complex and controversial topic, and the notion of colonial status versus independence can often derail our attention from the larger issues ofhuman rights abuses that have deeply affected the health and well-being ofthe people of Puerto Rico. Regardless of Puerto Rico's status, the United States has a responsibility because of internationally agreed-upon covenants and their own federal laws to not directly violate the human rights oftheir citizens. A human rights framework can guide the rebuilding and restructuring of Puerto Rico. Following the UN guidelines for recovery and reparations for chronic and acute harms suffered,39 immediate restitution from the US government is owed to the citizens of Puerto Rico. To achieve this ambitious goal, we recommend a multipronged human rights-based approach to promote truth and acknowledgment ofpast injustices and advocate a process ofpeace building, unification, and reconciliation.

Recommendations for Equitable Response

The central pillar of actualizing a human rights-based approach is to hold governments accountable for their violations of human rights and ensure opportunities for meaningful public participation in the process. The process should be informed by and require participation of Puerto Rican representatives such that they contribute to the decision-making and implementation. Puerto Rico's physical infrastructure must be improved to adequately meet all people's basic and health care needs while also being capable of withstanding and quickly recovering from megastorms. Investment in adequate and sustainable infrastructure that benefits from scientific advancement, such as solar and wind power options, as well as advanced agricultural renewal strategies, will contribute to economic development. The Puerto Rican and US federal governments should review and enhance the disaster response plan activities, such as communication and preparedness procedures to ensure fulfillment of the right to information as it is essential to achieving the highest attainable standard of health.

Recommendations for Reducing Vulnerabilities

More than a century ofpolitical disenfranchisement, economic depression, and deliberate disinvestment in the infrastructure and stability of the island are crimes against the Puerto Rican people. Meaningful compensation for lost opportunities related to Hurricane Maria must be addressed. This includes loss of employment, education, and social benefits that may have been arrested or restricted during the crisis. With tremendous debt lingering above Puerto Rico, extreme poverty will remain, and restorative justice will not be feasible. To address this, a debt relief or stimulus plan could be developed and implemented to bolster the economy and give Puerto Rican civic, government, and business leaders the financial resources necessary to improve the quality of life for Puerto Rico's residents. Finally, a permanent repeal of unjust austerity policies and banishment of any fiscal control boards will allow for local government and civic leaders to determine and promote economic development on their own.

CONCLUSION

Hurricane Maria represents one of the most damaging and costly storm-related disasters ever documented in the United States.40 The historical colonial relationship between the mainland United States and Puerto Rico led to inadequate electric, power, and health care infrastructures before the storms.

These inadequacies were only exacerbated in the aftermath of the storm, continuing to violate numerous human rights and inhibit Puerto Rico's ability to provide for its residents and promote the highest attainable standard of health.

To prepare for changing weather and storm patterns that continue to increase in both frequency and severity because ofthe climate crisis, Puerto Rico needs to develop a political and civil infrastructure that can be sustained throughout such natural disasters. However, this cannot be achieved until the structural and systemic neglect brought on by the US government and appointed officials comes to light and the damage is repaired and restored so that Puerto Ricans can meet their basic needs so necessary for their health and well-being for generations to come.

CONTRIBUTORS

AH authors contributed significantly to the conceptualization of the article, interpretation of the literature, and development, revision, and approval of the final version.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

No human participants were involved. Therefore, institutional review board approval was not needed.

Sidebar

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DETAILS

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Document 43 of 61

COVID-19 Threatens Access to Oral Health

Warnick, Aaron

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FULL TEXT

Dentistry is a messy job. From scraping plaque to removing cavities, procedures send saliva, contaminated water, and bacteria from patient mouths into the air. And during the COVID-19 pandemic, those routine practices can make dental care a high-risk situation.

To protect both workers and patients, dental offices have made sweeping changes, following guidance from professional organizations and industry experts. They have altered the kinds of protective gear they use, limited the number of patients they see per day, and, in some offices, invested heavily in specialty equipment to make offices safer.

Fewer operating dental offices and longer wait times threaten access to care, thus endangering the health of patients. Going without needed dental care can be not only painful but also life threatening if it leads to infection. Regular dental care prevents tooth loss and gum disease and screens for oral cancers. In 2018, 36% of Americans reported that they had not seen a dentist in the past year, with minorities, people with low incomes, and the elderly more likely to not receive care. The fallout from COVID-19 has the potential to increase those disparities even more.

-Aaron Warnick

Read the full story on The Nation's Health Web site at http://thenationshealth.aphapublications.org/ content/50/6/1.2.

DETAILS

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Document 44 of 61

Hurricane Katrina at 15: Introduction to the Special Section

Davis, Shelina[1]; Rose-Davison, Knesha[2]; Smith, Dean G[3] [1] Louisiana Public Health Institute, New Orleans [2] AgriSafe Network, Inc., Covington, LA [3] Louisiana State University Health Sciences Center, School of Public Health, New Orleans

ProQuest document link

ABSTRACT (ENGLISH)

Hurricane Katrina was a social and public health disaster.1 From the perspectives of health care systems, the environment, community health, and everything in between, Katrina devastated New Orleans, Louisiana, and the Gulf Coast. In the 15 years since the storm, we have learned much about how devastating natural disasters can be for a community and how many ways public health can be involved in creating opportunities for recovery and preparing for the next disaster. Some of the lessons that we learned and that we need to learn are touched on in this special section. Hurricane Katrina devastated the public health and health care systems across the US Gulf Coast and exposed the health and racial inequities that have persisted among this community for decades. As Kim-Farley notes (p. 1448), we are reaping what we sow. Individuals and families were affected emotionally, physically, and spiritually because of this disaster. Hurricane Katrina exacerbated the community's health problems and exposed the fragmentation in care. Despite this, individuals in the community came together to mobilize and organize and to identify solutions to transform how health care was delivered to the community while ensuring health and racial equity. Over time, social norms evolved-shifting from residents accessing care in emergency departments to residents going to community-based health care provider organizations that offered comprehensive and holistic health and wellness services, including mental health and substance abuse disorder treatment.

FULL TEXT

Hurricane Katrina was a social and public health disaster.1 From the perspectives of health care systems, the environment, community health, and everything in between, Katrina devastated New Orleans, Louisiana, and the Gulf Coast. In the 15 years since the storm, we have learned much about how devastating natural disasters can be for a community and how many ways public health can be involved in creating opportunities for recovery and preparing for the next disaster. Some of the lessons that we learned and that we need to learn are touched on in this special section.

Hurricane Katrina devastated the public health and health care systems across the US Gulf Coast and exposed the health and racial inequities that have persisted among this community for decades. As Kim-Farley notes (p. 1448), we are reaping what we sow. Individuals and families were affected emotionally, physically, and spiritually because of this disaster. Hurricane Katrina exacerbated the community's health problems and exposed the fragmentation in care. Despite this, individuals in the community came together to mobilize and organize and to identify solutions to transform how health care was delivered to the community while ensuring health and racial equity. Over time, social norms evolved-shifting from residents accessing care in emergency departments to residents going to community-based health care provider organizations that offered comprehensive and holistic health and wellness services, including mental health and substance abuse disorder treatment.

HEALTH AND HEALTH CARE SYSTEMS

Three contributions to this special section discuss the impact of Hurricane Katrina on individuals' health and on health care systems. "Hurricane Katrina beat us. We lost the ability to communicate, transport by land and air, and provide health care for the population," writes Honore (p. 1463). In this piece, Honore highlights the inequities that were exposed and lessons from his experience as the commander of Joint Task Force-Katrina. Honore provides a timely invitation to readers to confront injustices and improve preparedness and response to natural disasters amid COVID-19.

Harville et al. (p. 1466) explore the trends in pregnancy outcomes in women residing in the US Gulf States after Hurricane Katrina and consider whether women had an increase in adverse pregnancy outcomes because of the disaster. Katrina put a spotlight on the need for a major transformation of public health and health care system infrastructure to support the holistic needs of individuals.

Davis et al. (p. 1472) discuss the $100 million federal Primary Care Access and Stabilization Grant program, which paved the way for innovative and sustained public health and health care transformation across Greater New Orleans. This infrastructure offered community residents easily accessible, higher quality holistic care and acted as a catalyst for sustained funding for community-based health care organizations.

ENVIRONMENTAL HEALTH

Four contributions to this special section address the environmental health issues raised and affected by Katrina. Hurricane Katrina was a natural event that had disastrous results because ofthe storm itself and the infrastructure and human failings that led to widespread flooding and power outages. Some of the failings were owing to being unprepared for a natural event of this magnitude. Wilson et al. (p. 1476) argue that we are still unprepared and that there remains work to be done to integrate environmental and public health expertise into a preparedness system. The 2019 Pandemic and All-Hazards Preparedness and Advancing Innovation Act is a recent policylevel action to raise environmental health preparedness. Of course, the outcome of this act will depend on our ability to implement its provisions and address any challenges.

Even when we are prepared for environmental events, the responses are not always quick enough to address the most serious concerns or to understand the full nature of the events. Lichtveld and Birnbaum (p. 1478) comment that we often focus our attention and resources on the immediate response phase and devote insufficient attention to any prolonged recovery. The longer-term problems brought on by Katrina made the environmental health community aware of and responsive to assessment and recovery after the Deepwater Horizon disaster (2010). Having the National Institutes of Health's Disaster Research Response Program in place may facilitate immediate and longer term responses to future disasters.

Many authors have examined Katrina's major environmental effects on New Orleans and their endurance. Diaz et al. (p. 1480) review this extensive literature and provide a summary of work related to floods, wastes, land losses, and other environmental consequences of Katrina. The numbers are staggering: 400 billion gallons of floodwaters, 120 million cubic yards of storm debris, and six times the usual annual land loss. Katrina led to the design and construction of the Hurricane Storm Damage Risk Reduction System, which we hope will help to protect New Orleans, at least in the near term.

In addition to the loss of homes and land, Katrina compromised the interiors of thousands of homes. Lichtveld et al. (p. 1485) comment on the mold infestation of homes and the resulting exacerbations of childhood asthma. Community-based participatory research addresses environmental asthma in a manner that can serve as a model for other communities. This model is particularly relevant today, as we come to grips with the full understanding of environmental health threats, disasters, and health disparities.

PUBLIC HEALTH RESPONSE

Hurricane Katrina, coined "the worst natural disaster of the century," exposed the essential need for a multifaceted crosssector public health response. This disaster featured a lack of city, state, and federal coordination. According to the Centers for Disease Control and Prevention, approximately 1800 people from Louisiana, Mississippi, Florida, Alabama, and Georgia lost their lives in Hurricane Katrina.2 Five contributions to this special section look at promising community health practices that encourage predisaster planning and crosssector coordination. In true Louisiana form, these contributions are a bit of a gumbo, looking at a variety oftopics that affected community health, including public safety, cascading events, food access inequity, and community health workers as well as promising practices in pet evacuation and public health infrastructure.

Murphy et al. (p. 1490) examine the need for public health to integrate with public safety in predisaster planning as opposed to the commonplace postdisaster preparedness strategies. Murphy et al. note that lessons from Hurricane Katrina are vital for creating "a pathway to improve proactive cross-disciplinary integration and all-hazards preparedness."(p1490) There remains a need to learn from the gaps impeding an integrated response, the federal evaluation of the Department of Homeland Security and Exercise and Evaluation Program, and the local response from the New Orleans City Assisted Evacuation framework.

Greenberg (p. 1493) urges hazard mitigation planning that includes cascading effects as a way to think beyond the natural disaster into certain "trigger events," which can lead to deadly consequences. Greenberg highlights the need to systematically analyze how a single disaster event can cascade into multiple failures that substantially multiply severe consequences. Including cascading effects is another tool for coordinating public health and emergency response. Greenberg also looks at existing policy to coordinate these efforts through the Stafford Act.

Food access inequities were vastly expanded after Katrina. Rose and O'Malley (p. 1495) compare national programs and their food access approach, along with giving a historical perspective of programming to address the spectrum offood access issues in US metropolitan areas. Food Access 3.0 offers communitydriven and socially innovative solutions to the decades-long issue of sustainable and healthy food access for families.

Haywood et al. (p. 1498) provide an account ofresponding to community needs and organization around community health workers during postKatrina recovery. In the varied history of the use and acceptance of community health workers in the United States, Wennerstrom et al. describe how this necessary brigade of community liaisons organized to fill a devastating public health void in New Orleans. They state that community health workers "not only supported recovery from the devastation but also learned important lessons through organizing themselves into a professional association to support their growing workforce and influence policy. "(p1498)

Hurricane Katrina had a lasting impact on many policies in emergency preparedness and disaster response for pet safety. Babcock and Smith (p. 1500) review the critical work of disaster planning and pet safety and the lasting aftermath that changed public health policy and disaster response after Katrina. The Pets Evacuation and Transportation Standards Act of2006, one of the early wins from dismal outcomes in New Orleans, was established with lessons learned following Hurricanes Gustav and Harvey. The need to train city, public health, and community members is key in any preparedness plan. New Orleans has shown innovation in offering training, both live and virtual, to prepare for future events.

Just as health and environmental systems have learned and evolved, so too has the public health system. As Gee (p. 1502) notes, the data systems and other critical public health infrastructure developed after Katrina have enabled more effective responses to the Baton Rouge floods and now COVID-19 than would have previously been possible. With each storm, public health systems improve to address the next one. /4JPI-I

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CONTRIBUTORS

All authors contributed equally to this editorial.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

Sidebar

See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

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DETAILS

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Document 45 of 61

Policy Views and Negative Beliefs About Vaccines in the United States, 2019

Stecula, Dominik A, PhD [1] ; Kuru, Ozan, PhD [1] ; Albarracin, Dolores, PhD [2] ; Jamieson, Kathleen Hall, PhD [1] [1] Annenberg Public Policy Center, University of Pennsylvania, Philadelphia [2] Department of Psychology, University of Illinois, Urbana-Champaign

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ABSTRACT (ENGLISH)

Objectives. To determine whether holding vaccine misconceptions, in the form of negative beliefs about vaccines, correlates with opposing governmental action at all levels designed to increase vaccination (e.g., removing personal belief and religious vaccine exemptions). Methods. Drawing on data from a nationally representative survey of 1938 US adults, we assessed the relation between negative beliefs about vaccines and provaccination policies. Results. Beyond sociodemographic and policy-relevant variables, such as gender and partisan affiliation, questionable negative beliefs about vaccines are the strongest predictor of opposition to policies designed to increase vaccination. Conclusions. Negative beliefs about vaccines in the general population may thwart the passage or implementation of policies designed to increase vaccination. Implementing strategies that reduce these negative beliefs should be a priority of educators and public health officials.

FULL TEXT

Headnote

Objectives. To determine whether holding vaccine misconceptions, in the form of negative beliefs about vaccines, correlates with opposing governmental action at all levels designed to increase vaccination (e.g., removing personal belief and religious vaccine exemptions).

Methods. Drawing on data from a nationally representative survey of 1938 US adults, we assessed the relation between negative beliefs about vaccines and provaccination policies.

Results. Beyond sociodemographic and policy-relevant variables, such as gender and partisan affiliation, questionable negative beliefs about vaccines are the strongest predictor of opposition to policies designed to increase vaccination.

Conclusions. Negative beliefs about vaccines in the general population may thwart the passage or implementation of policies designed to increase vaccination. Implementing strategies that reduce these negative beliefs should be a priority of educators and public health officials. (Am J Public Health. 2020;110:1561-1563. doi:10.2105/AJPH.2020. 305828)

In 2019, the United States experienced one of the worst measles outbreaks in a quarter century.1 Four years before, in response to the Disneyland outbreak, the state of California increased vaccination coverage by removing nonmedical (personal belief and religious) vaccine exemptions.2 Since then, several states have attempted to tighten their own vaccine laws, but in some cases, most recently New Jersey, a vocal antivaccine lobby successfully opposed the state's efforts.3 At a time when the world is fighting the COVID-19 pandemic while awaiting a vaccine, understanding the implications of vaccine misconceptions is critically important to public health.

Vaccine misconceptions, in the form of questionable negative beliefs about vaccines, is a potential determinant of the mixedlevel of public support forprovaccine policies. During the 2019 US measles outbreak, between 15% and 20% of US adults accepted at least 1 widely circulated antivaccination claim.4 Although embrace ofsuch claims is known to correlate with a reduced likelihood of vaccination,5,6 scholars have not answered this question: do negative beliefs about vaccines also affect the level of public support for provaccination policy, and if so, to what extent?

METHODS

We conducted this study during the 2019 measles outbreak in the United States, drawing on a large, nationally representative panel study of US adults to examine associations between vaccine misconceptions and support for provaccine policies. We controlled for sociodemographic status, partisan affiliation, media consumption, trust in the Centers for Disease Control and Prevention (CDC), religiosity, and whether there was a young child in the home, considering that parents might be more opposed to eliminating vaccine exemptions than are people without young children.4

Specifically, our research relied on responses from 1938 randomly drawn respondents collected in a longitudinal panel study focused on perceptions of infectious diseases and vaccination predictors conducted in 2018 through 2019, when the United States was in the midst ofa measles outbreak. The National Opinion Research Center at the University of Chicago gathered the data as part of their AmeriSpeak panel, a probability-based, nationally representative sample of US adults.7 We primarily focused on wave 4 (administered February 28-March 25, 2019) for predictor variables and wave 6 (September 13-October 2, 2019) for policy support variables.

Three dependent variables focused on support or opposition for 3 provaccine policies: (1) support for mandatory childhood vaccinations, (2) opposition to religious vaccine exemptions, and (3) opposition to personal beliefand philosophical exemptions. We measured each with a 5-point scale (1 = strongly oppose; 5 = strongly support) with items 2 and 3 reversed so that the higher scores in each ofthe 3 items indicated support for the provaccine policy. Our key independent variable was vaccine misconceptions in the form ofnegative beliefs about vaccines, measured using 4 items.

These items gauged support for common antivaccination claims,8 including that (1) vaccines cause autism, (2) vaccines are full of toxins, (3) delaying vaccinations and altering the vaccine schedule is not harmful, and (4) developing natural immunity by catching the disease is superior to getting vaccinated. Responses were measured on a 4-point scale: "very inaccurate" (0) to "very accurate" (3). We averaged the responses to each item into a continuous index (ranging from 0 to 3) and then divided by 3 to rescale it into 0 to 1 for ease of interpretation. The Cronbach a for the index was 0.79.

Our analysis controlled for theoretically relevant variables that could reasonably shape policy views about vaccines, which included the sociodemographic variables of gender, education, income, and age. We also controlled for self-described religiosity, partisanship (standard strength of party affiliation, ranging from strong republican [1] to strong democrat [5]) the presence of a young child (younger than 6 years) in the household (1 = yes; 0 = no), and trust in the CDC (0 = very little trust at all; 3 = a great deal of trust). Since the study took place during a major measles outbreak, we also controlled for recent exposure to measles and measles, mumps, and rubella (MMR) news in traditional media (e.g., newspapers, magazines, radio, television) and on social media (e.g., Facebook, Twitter, YouTube, Instagram). We combined the questions about MMR and measles, for which response options ranged from "never" (0) to "often" (3), into simple additive indices, for which the Cronbach alphas were 0.94 for traditional media and 0.95 for social media.

Given that our dependent variables were ordinal, we regressed policy support on the predictors using multivariate ordered probit models. Details about question wording and the data used to produce Table 1 appear in the appendices (available as a supplement to the online version of this article at http://www.ajph.org).

RESULTS

We found broad support for provaccination policies in the US population: 72% of US adults strongly or somewhat supported mandatory childhood vaccination, 60% strongly or somewhat opposed religious exemptions for vaccines, and 66% strongly or somewhat opposed personal belief exemptions in their states.

Among the factors that we observed, negative vaccine beliefs were the strongest negative predictor of support for provaccination policies. In the presence of controls, moving from the least (0) to the most (1) negative beliefs about vaccines reduced the probability ofstrongly supporting mandatory childhood vaccines by 70%, the probability of strongly opposing religious exemptions by 66%, and the probability ofstrongly opposing personal belief exemptions by 79%. The introduction ofnegative beliefs accounted for a substantial increase in the variance explained by the model, a conclusion documented by the pseudo R2 changes between the models displayed in Table 1.

Furthermore, we found that exposure to news about measles and MMR played a role in policy considerations during an outbreak. Moreover, the source of the news mattered, in that traditional news was associated with more provaccine policy views, whereas exposure to news on social media was associated with less provaccine policy views. We found that trust in the CDC, religiosity, and, in some cases, presence of a young child in the household and partisanship also correlated with policy views, but these correlations were smaller in magnitude.

DISCUSSION

Negative vaccine views are the primary driver of reservations about provaccination policy, showing us how misperceptions can have the potential to shape policy decisions in this context.

Consistently with previous work, we also show that factors such as the news media and trust in experts shape vaccine considerations.4 Furthermore, at a time characterized by high levels of partisan polarization in the United States, many policy preferences are driven by one's partisan attachments.9 However, our results show that, although partisanship plays a role, negative vaccine views matter more than political affiliation.

PUBLIC HEALTH IMPLICATIONS

These results are relevant to the COVID-19 pandemic. Once a safe and effective vaccine is developed, misinformation, in the form of negative views about vaccines, could increase opposition to policies designed to increase vaccination rates. As a result, the nation and individual states could have difficulty achieving the levels of community immunity needed to minimize transmission of SARS-CoV-2. Because reservations about possible requirements to vaccinate against SARS-CoV-2 are already evident,10 educators and public health professionals should intensify their efforts to reduce misconceptions about vaccines. ÂfPU

CONTRIBUTORS

D. A. Stecula analyzed the data.D. A. Stecula and O. Kuru wrote the brief. All authors edited and revised the briefand were part of the team that designed the study.

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CONFLICTS OF INTEREST

All authors declare no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

The University of Pennsylvania institutional review board approved and deemed exempt the research protocol employed in this study.

Sidebar

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DETAILS

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Document 46 of 61

Public Health Integration Into Public Safety in Post-Katrina New Orleans

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ProQuest document link

ABSTRACT (ENGLISH)

Hurricane Katrina's impact reshaped national preparedness doctrine. The ensuing catastrophe, including acute and chronic environmental exposures, complex population movements, and patient management crises, highlighted the need to improve integration between the public health, medical, and traditional public safety disciplines. Recent crises, including the COVID-19 pandemic, unfortunately continue to exemplify the need for this proactive system approach to optimizing preparedness. Against this backdrop, we examine current practice, specific successes, and areas of improvement that remain, all of which may help propel the preparedness enterprise toward an optimized state ofintegration. As leaders in New Orleans, Louisiana, emergency response agencies (2006-2018), we posit that post-Katrina preparedness strategies provide a pathway to improve proactive crossdisciplinary integration and all-hazards preparedness. Public health and emergency management agencies use a "lessons-learned" approach to generate corrective action following an incident or exercise. Following the guidance provided by the Department ofHomeland Security's (DHS's) Homeland Security Exercise and Evaluation Program, lessons are captured in a standardized process titled afteraction reports,1 which in turn inform the improvement and corrective action plans. In addition to lacking an integrated systems approach, numerous improvement areas were documented by public sector officials and other stakeholders (see the box on page 1491) in state and federal after-action reports, including, but not limited to, comprehensive evacuation planning, emergency operations center coordination and situational awareness to include public health and medical response, leadership training on plans and incident management systems, and tactical communications interoperability.

FULL TEXT

Hurricane Katrina's impact reshaped national preparedness doctrine. The ensuing catastrophe, including acute and chronic environmental exposures, complex population movements, and patient management crises, highlighted the need to improve integration between the public health, medical, and traditional public safety disciplines. Recent crises, including the COVID-19 pandemic, unfortunately continue to exemplify the need for this proactive system approach to optimizing preparedness. Against this backdrop, we examine current practice, specific successes, and areas of improvement that remain, all of which may help propel the preparedness enterprise toward an optimized state ofintegration. As leaders in New Orleans, Louisiana, emergency response agencies (2006-2018), we posit that post-Katrina preparedness strategies provide a pathway to improve proactive crossdisciplinary integration and all-hazards preparedness.

Public health and emergency management agencies use a "lessons-learned" approach to generate corrective action following an incident or exercise. Following the guidance provided by the Department ofHomeland Security's (DHS's) Homeland Security Exercise and Evaluation Program, lessons are captured in a standardized process titled afteraction reports,1 which in turn inform the improvement and corrective action plans. In addition to lacking an integrated systems approach, numerous improvement areas were documented by public sector officials and other stakeholders (see the box on page 1491) in state and federal after-action reports, including, but not limited to, comprehensive evacuation planning, emergency operations center coordination and situational awareness to include public health and medical response, leadership training on plans and incident management systems, and tactical communications interoperability.2

The inadequate evacuation planning before Hurricane Katrina necessitated a new strategy: the city-assisted evacuation (CAE) framework. Critical to the framework is its flexibility to shift quickly based on hurricane trajectory and intensity and resource constraints. Being continuously updated, the CAE framework accounts for current and future changes in population density, urban mobility, access and functional needs, pet and animal evacuation, and specific resource requirements, including mental health services. Thus, a successful CAE framework requires an intimate understanding of the area's population and how best to align and mobilize resources to collective and individual needs. For example, advances in health care delivery, life-sustaining technologies, and a generally aging population (often with serious chronic conditions) results in increased resource requirements to identify, evacuate, and provide for individuals with access and functional needs.3

The New Orleans Access and Functional Needs database, initially created in a partnership between the city's Office of Homeland Security and Emergency Preparedness, emergency medical services, and the health department, addresses these aspects and remains a cornerstone of the CAE framework. What began as a way to anticipate medical transportation requirements has matured into a program that includes site visits by city and state public health officials to health care and medical facilities, senior living centers, and even private homes to assess specific resource requirements. These include specialized transportation assets, medical apparatus, pharmaceuticals, and types of shelter space. These local data are routinely cross-walked with federally available data; one recent exercise resulted in the positive identification of 93% of electrically dependent New Orleanians using a home oxygen concentrator or ventilator, making the New Orleans Access and Functional Needs database an accurate, reliable preparedness tool.3 Although execution of the CAE framework has occurred only once (Hurricane Gustav, 2008), it remains a nationally recognized program.

The success of the CAE framework is linked to systemslevel integration of public health preparedness efforts and improved multisector coordination. In the National Response Framework, Public Health and Medical Services are categorized as Emergency Support Function8. After Katrina, local Emergency Support Function-8 authorities became (and remained) engaged across a range ofreadiness activities -from weekly citywide preparedness meetings with public safety agencies to comprehensive inclusion in event and incident action plans for mass gatherings (e.g., Mardi Gras celebrations). State-level Emergency Support Function-8-specific strategies included establishing a designated regional coordinator for hospitals and emergency medical services for each of the state's nine preparedness regions. Designated regional coordinators coordinate and share sector-specific situational awareness, resource requirements, and operational strategies with emergency operations centers.

Since Katrina, designated regional coordinators and hospitals maintain radio interoperability- the ability to communicate on a single system-with emergency operation centers and all ofpublic safety on Louisiana's network, which is the largest state interoperable radio system in the United States.4 The influences of the integrated designated regional coordinators are amplified by the federal Hospital Preparedness Program's health care coalitions. Further, an elaborate, wellrehearsed timeline was developed to coordinate the simultaneous evacuation of otherwise distinct groups: the general population, those with access and functional needs, and hospital-based patient census.5 Situational awareness platforms in the emergency operations center now integrate hospital response, the New Orleans Access and Functional Needs database, transportation, and sheltering dashboards.

Our industrialized built environment often exacerbates natural disaster impacts. Katrina caused environmental contaminations, including oil spills and toxic industrial chemical releases; thus, an organic collaboration emerged between officials strategically planning for hurricanes and hazardous materials (hazmat) incidents, exemplifying multisector, all-hazard integration. From 2014 through 2017, New Orleans partnered with the DHS Office of Health Affairs (reorganized as the Countering Weapons of Mass Destruction Office) to conduct the Chemical Defense Demonstration Project. This project improved knowledge of the risk of chemical exposure and led to targeted response system enhancements (e.g., advanced hazmat training for emergency medical services and public health personnel, increased decontamination capability, specific medical countermeasure investments aligned to the greatest threats, and adaptation ofevacuation and family reunification plans originally developed for hurricanes). Further, the New Orleans Access and Functional Needs database has the potential to inform the hazmat response of specialized resource requirements based on the prevalence of pulmonary illnesses and other potential health concerns that may compound the impact of a hazmat incident.

Katrina strengthened public-private sector relationships, especially through the creation of a tiered reentry protocol used during mandatory evacuations.5 Following mandatory evacuations, this tiered system prioritizes reentry of critical infrastructure and supporting agencies (e.g., water, power, hospitals, medical clinics, pharmacies, grocery stores, banks). Subsequently, the general population returns to a safer, functioning community. Public engagement detailing the reentry protocol and registration requirements dovetailed to other all-hazards initiatives. The city harnessed hurricane threat momentum to create an extensive occupational and residential closed point of distribution network within the Cities Readiness Initiative, which serves as the local planning initiative for medical countermeasure distribution of the Strategic National Stockpile.5 During responses to certain biological threats (e.g., Anthrax, the 2009 H1N1 influenza pandemic), these confidential partnerships, which also include hospitals, would operate in concert with city-operated public distribution points to accelerate the distribution of the Strategic National Stockpile medical countermeasure to the population at risk. Annual exercises further strengthen these partnerships.

A deliberate focus should remain on conceptualizing and sustaining an integrated systems approach while strengthening and further integrating threatspecific subject matter expertise into the preparedness and response infrastructure, including environmental health and exposure assessment strike teams.6,7 The COVID-19 pandemic, documenting the first time all states and territories are under simultaneous major disaster declarations, continues to test the system, which is better tuned to natural disasters such as hurricanes, and highlights the need to improve systematic integration across sectors for full threat and response visibility. For example, much of the modeling and scientific data used to inform nonpharmaceutical interventions and other decision making is generated by academia and public health professionals. Yet, many of these entities were not fully integrated into preparedness systems before, thereby requiring them to pivot into this role in the middle of disaster. Louisiana's response to COVID-19 has used the gains made since 2005, using academia, designated regional coordinators, and established partnerships to improve situational awareness, medical surge, and resource allocation.

Despite significant emergencyrelated improvements aimed at enhancing collaboration and coordination between public health, medical, and public safety disciplines, nationwide gaps persist in terms of public health preparedness being adequately funded and integrated into the public safety enterprise. This is the optimal time to transition a reactive system into one that is truly proactive.

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CONTRIBUTORS

S.A. Murphy led the drafting and conceptualizing of the editorial. The authors contributed equally to the content and revisions.

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

Sidebar

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DETAILS

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Document 47 of 61

Leisure Activity Engagement Among the Oldest Old in China, 1998–2018

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ProQuest document link

ABSTRACT (ENGLISH)

Objectives. To examine the trends of leisure activity engagement among the oldest old in China for the past 2 decades. Methods. Our panel data came from the Chinese Longitudinal Healthy Longevity Survey, which systematically asked respondents about their current participation in leisure activities overa 20-year period.The final sample contained 66 789 interviews from 1998 to 2018. We applied generalized estimating equations regression models in our analysis. Results. Compared with 1998, odds ratios of television watching among Chinese oldest old individuals increased by about 2 to 3 times in 2018. Meanwhile, the odds ratio of exercise declined by 24%, mostly in men;playing cards and mah-jongg declined by about 30% for men. Results also showed that reading became less popular in the oldest old, and Chinese women tended to do more housework than before. Conclusions. Our findings indicated that Chinese oldest old persons have become more sedentary and solitary in the past 2 decades. The negative trend in leisure activity engagement among the elderly Chinese population warrants policy attention, and the urgent development of public health interventions is required to reverse such trends. (Am J Public Health. 2020;1 1 0:1535-1537. doi:10.2105/AJPH.2020.305798)

FULL TEXT

Headnote

Objectives. To examine the trends of leisure activity engagement among the oldest old in China for the past 2 decades. Methods. Our panel data came from the Chinese Longitudinal Healthy Longevity Survey, which systematically asked respondents about their current participation in leisure activities overa 20-year period.The final sample contained 66 789 interviews from 1998 to 2018. We applied generalized estimating equations regression models in our analysis. Results. Compared with 1998, odds ratios of television watching among Chinese oldest old individuals increased by about 2 to 3 times in 2018. Meanwhile, the odds ratio of exercise declined by 24%, mostly in men;playing cards and mah-jongg declined by about 30% for men. Results also showed that reading became less popular in the oldest old, and Chinese women tended to do more housework than before. Conclusions. Our findings indicated that Chinese oldest old persons have become more sedentary and solitary in the past 2 decades. The negative trend in leisure activity engagement among the elderly Chinese population warrants policy attention, and the urgent development of public health interventions is required to reverse such trends. (Am J Public Health. 2020;1 1 0:1535-1537. doi:10.2105/AJPH.2020.305798)

Leisure time makes up a major part of ones later life. Engagement in leisure activities, defined as preferred and enjoyable activities that an individual participates in during his or her free time,1 has long been considered an important aspect of healthy and active aging. Meaningful and purposeful leisure activities are often found to be associated with a wide range of positive outcomes for older adults, including physical, mental, and social well-being, as well as reduced risks of mortality.2

Surveillance ofthe trends ofleisure activities, especially leisure-time physical activity, has made substantial progress in the last 2 decades because of the importance of physical activity for preventive medicine.3 Yet existing studies have focused mostly on children and adolescents. With the worlds population aging at a rapid pace, monitoring the level and trend of leisure activity engagement among older adults is increasingly becoming an urgent priority. Previous studies have mostly documented positive leisure-time physical activity trends among older adults in Western countries. For example, the proportion of older Americans reporting no leisure-time physical activity engagement declined gradually from the 1990s to the 2010s.4 Similar findings were reported in other Western societies.5 By contrast, studies conducted among elderly populations in Asia suggested that older adults are becoming increasingly more sedentary overtime.6 To the best of our knowledge, no studies have specifically examined leisure activity engagement in the oldest old (80 years or older), the fastest-growing segment within the population of older adults. This is unfortunate because the association of leisure activities with quality of life tends to increase with age, and the oldest old are likely to have the greatest potential to benefit from leisure-targeted interventions.7 Our study fills the literature gap by examining the trends in leisure activity engagement among the oldest old in China over a 20-year period.

METHODS

Our data were from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which contains one of the largest data sets of oldest old cohorts in the world; a complete description of the CLHLS is given elsewhere.8 CLHLS features a panel design, and surviving respondents are reinterviewed each wave. Accordingly, we pooled observations across all 8 survey waves-namely, 1998, 2000, 2002, 2005, 2008, 2011, 2014, and 2018-and the final sample included 66 789 interviews.

The CLHLS systematically asked respondents about their current participation in 11 leisure activities: watching television, reading, exercising, engaging in outdoor activity, taking part in tourism, playing cards or mahjongg, raising flowers or birds, gardening, doing housework, engaging in social activity, and participating in religious activity. A 5-level response category was used (almost every day, at least once a week, at least once a month, less than once a month, and never), except for exercising, which was coded as a yes-or-no variable. We collapsed the first 4 responses into the "yes" category and contrasted it with the "no" category.

We applied generalized estimating equations regression models to examine each leisure activity, with year as the key independent variable (1998 as reference), controlling for gender, age, rural or urban residence, activities of daily living, cognitive impairment, education, number of children alive, marital status, and region (for more details, see

Table A, available as a supplement to the online version of this article at http:// www.ajph.org). The generalized estimating equations models also accounted for repeated measures of the same individuals across waves through the exchangeable correlation structure.

RESULTS

Among the 11 leisure activities, we observed consistent temporal trends over 5 major activities-namely, watching television, reading, exercising, playing cards or mah-jongg, and doing housework (Table 1). Overall, the results suggested that the Chinese oldest old have become more sedentary and solitary over the past 2 decades.

Of most interest is the rising popularity of watching television, odds ratios of which increased by about 2 to 3 times over the past 2 decades. Meanwhile, the Chinese oldest old exercised less: the odds ratio declined by 24% from 1998 to 2018, mostly in men. Similarly, playing cards or mah-jongg declined by about 30% for men in both rural and urban areas. Results also showed that reading became less popular in the oldest old, and Chinese women tended to do more housework than before.

DISCUSSION

Leisure-time physical and social activities are effective in promoting health, well-being, and life satisfaction of Chinese older adults9; however, our study found that the oldest old in China have become more sedentary and solitary over the past 20 years. Although our measurements of these leisure activities were limited without detailed information on their frequency, intensity, and duration, the patterns as shown are evidently worrisome and alarming. Prolonged television watching not only is a low-demand cognitive activity but also leads to physical inactivity and thus increases the risk for type 2 diabetes, cardiovascular disease, and all-cause mortality.10 The uprising trend oftelevision watching as observed also should be partially responsible for the declines in reading and exercising among the Chinese oldest old, both of which promote mental and physical health in old age. We speculate that this negative trend was embedded in the larger social transformations of China taking place in recent decades. As a marker of modernization, television ownership increased significantly in China with economic development since the 1980s. More Chinese people chose to spend leisure time watching television, especially older persons. Interventions toward better health behaviors in later life were not prioritized in the public agenda until the 2010s, when a national system of social security was finally completed to cover all older people for basic medical insurance and pensions. Additionally, the lack of age-friendly public space and the ambient air pollution, caused by the rapid urbanization during this period, also helped trap many seniors indoors.

The decline of social gaming and the increase in doing housework also mirror social transformations in China. The market reform in the 1980s individualized the social life of Chinese adults, and now it is quite common that many Chinese are not familiar with their next-door neighbors. For older adults, this may lead to a higher risk for social isolation and depression. A recent meta-analysis showed that the loneliness of Chinese older adults increased significantly from 1995 to 2011.11 The rising trend of housework among elderly Chinese women may be attributable to grandparenting responsibilities even though they do not live with their adult children, particularly so for rural elderly whose adult children have migrated to cities.

PUBLIC HEALTH IMPLICATIONS

Western societies have made good progress in helping adults meet the national recommendations for leisure-time physical activity.12 We advocate to strengthen the monitoring of leisure activity engagement of older adults, the oldest old in particular, and call for more research in developing countries such as China, where the negative trends of leisure activities could be worrisome, as shown in this study.

Our study suggests that after the completion of the national social security system for older adults, the Chinese government needs to shift focus to develop effective lifestyle interventions for the oldest old, especially to promote their engagement in leisure-time physical and social activities. In the rapidly aging China, reversing the trend toward a more sedentary and solitary lifestyle among the oldest old could be a cost-effective way to promote their healthy aging and quality of life.

CONTRIBUTORS

Q. Feng and W. Zhang initiated the research. Q. Feng, J. H. Fong, and H. Chen analyzed and interpreted the data.

Q. Feng, J. H. Fong, and W. Zhang drafted and revised the article. C. Liu and H. Chen provided critical comments.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

Data from the Chinese Longitudinal Healthy Longevity Survey already had obtained ethical approval and informed consent and were approved by the research ethics committees ofDuke University and Peking University (IRB00001052-13074).

Sidebar

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DETAILS

Subject:	Exercise; Public health; Leisure; Trends; Regression analysis; Regression models; Economic development; Outdoor air quality; Older people; Television viewing; Quality of life; Panel data; Playing cards; Age; Outdoor activities; Housework; Health care; Aging; Respondents; Recreation; Population policy; Reading; Adults; Television; Adult children; Oldest old people
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Document 48 of 61

Frequent Cannabis Use and Cessation of Injection of Opioids, Vancouver, Canada, 2005–2018

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ProQuest document link

ABSTRACT (ENGLISH)

Objectives. To evaluate the impact of frequent cannabis use on injection cessation and injection relapse among people who inject drugs (PWID). Methods. Three prospective cohorts of PWID from Vancouver, Canada, provided the data for these analyses. We used extended Cox regression analysis with time-updated covariates to analyze the association between cannabis use and injection cessation and injection relapse. Results. Between 2005 and 2018, at-least-daily cannabis use was associated with swifter rates of injection cessation (adjusted hazard ratio [AHR] = 1.16; 95% confidence interval [CI] = 1.03,1.30). A subanalysis revealed that this association was only significant foropioid injection cessation (AHR= 1.26; 95% CI = 1.12,1.41). At-least-daily cannabis use was not significantly associated with injection relapse (AHR= 1.08;95% CI = 0.95, 1.23). Conclusions. We observed that at-least-daily cannabis use was associated with a 16% increase in the hazard rate of injection cessation, and this effect was restricted to the cessation of injection opioids. This finding is encouraging given the uncertainty surrounding the impact of cannabis policies on PWID during the ongoing opioid overdose crisis in many settings in the United States and Canada.

FULL TEXT

Headnote

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Conclusions. We observed that at-least-daily cannabis use was associated with a 16% increase in the hazard rate of injection cessation, and this effect was restricted to the cessation of injection opioids. This finding is encouraging given the uncertainty surrounding the impact of cannabis policies on PWID during the ongoing opioid overdose crisis in many settings in the United States and Canada. (Am J Public Health. 2020;110: 1553-1560. doi:10.2105/AJPH.2020.305825)

In the past decade, many jurisdictions throughout the United States and Canada have legalized nonmedical (recreational) cannabis use by adults.1 These reforms have proceeded despite arguments from some experts that cannabis has not been subjected to the same rigorous scientific evaluation typically applied to other drugs undergoing significant changes in legalization and regulation.1 For example, the potential effects of cannabis legalization or nonmedical cannabis use among members of vulnerable groups, including people living with mental illness or those of lower socioeconomic status, have not been fully investigated.2

One longstanding concern regarding cannabis is how its use might influence the use of other psychoactive substances and the progression to other forms of high-risk substance use such as injection drug use.3,4 The potential for cannabis to exert so-called gateway effects has been questioned by recent evidence indicating that trajectories to high-risk forms of substance use are largely driven by environmental, psychosocial, and genetic risk factors.3,4 At the same time, some preliminary studies have linked cannabis use or cannabis legalization to a number of positive effects related to substance use behaviors and health outcomes associated with substance use. For example, an interrupted time-series analysis of populationlevel data from Colorado found that recreational cannabis legalization was associated with a 6.5% decrease in opioid-related deaths (b = -0.68; 95% confidence interval [CI] = -1.34, -0.03). These results appear to represent a reversal of the increases in opioid-related deaths that occurred over a 14-year period preceding recreational cannabis legalization.5

At the individual level among higher-risk people who use drugs, such as people who use illicit and injection drugs, cannabis use has been associated with decreased drug-seeking behavior and reduced use of substances such as crack cocaine, decreased exposure to highrisk opioids such as fentanyl, and retention in opioid agonist therapy.6,7 In our setting, we recently reported that frequent cannabis use was associated with lower rates of injection initiation among street-involved youths and documented the intentional use of cannabis by them to mitigate drug-related harms.7 9

Given the serious harms associated with injection drug use and the outstanding questions surrounding cannabis and other forms of substance use, there is a need to better understand the relationship between cannabis and high-risk drug use, including injection drug use. Thus, the 2 objectives of the present study were to evaluate the impact offrequent cannabis use on cessation ofinjection drug use and to evaluate the impact of frequent cannabis use on injection relapse among 3 prospective cohorts of people who use illicit drugs in Vancouver, Canada, during a period of de facto cannabis decriminalization.

METHODS

We derived the data for these analyses from 3 community-recruited open prospective cohort studies ofpeople who use illicit drugs: the At-Risk Youth Study (ARYS), the Vancouver Injection Drug Users Study (VIDUS), and the AIDS Care Cohort to Evaluate Exposure to Survival Services (ACCESS). These studies apply harmonized recruitment, follow-up, and data collection procedures and have been described in detail previously.10,11 As a brief overview, participants were recruited through extensive street outreach and self-referral in the Downtown Eastside and Downtown South neighborhoods of Vancouver, Canada. These areas experience high levels of drug-related harms, including overdose and HIV transmission, as well as marginalization and criminalization.12

The City ofVancouver has also been a site of de facto decriminalization of nonmedical cannabis use, with the Vancouver Police Department exercising their discretion to not pursue charges ofpersonal cannabis possession or use without a complaint since 2006.13 Beginning in 2015, the City of Vancouver allowed the establishment and operation of retail cannabis stores, and recreational cannabis use was legalized federally in October 2018.14

Eligibility in each ofthese cohort studies is contingent on using illicit drugs other than or in addition to cannabis in the previous month, residing in the Greater Vancouver Regional District, and providing written informed consent. ARYS includes street-involved youths (defined as being without stable housing or having accessed street-based youth services in the past 6 months) aged 14 to 16 years; VIDUS includes adults who have injected illicit drugs in the month preceding enrollment and tested seronegative for HIV at the time of enrollment; ACCESS includes HIV-positive adults. Participants in the VIDUS cohort who seroconverted to HIVpositive during follow-up were transferred to the ACCESS cohort. At baseline and semiannually over follow up, participants completed an interviewer-administered questionnaire that collected data including sociodemographic information, substance use patterns, HIV risk behaviors, and engagement with health and social services. Participants also provided blood samples for HIV and hepatitis C serological analysis. Participants are remunerated CA $40 for their time at each study visit.

The analytical sample for the first objective (i.e., evaluate the impact of frequent cannabis use on injection cessation) was restricted to all ARYS, VIDUS, and ACCESS participants who were aged 18 years or older, reported injection drug use at baseline or over follow-up, and completed at least 1 study visit between September 2005 and November 2018. The outcome of interest was time to injection cessation, defined as a period of6 months without any injection drug use. This outcome is consistent with previous studies and defined as responding "No" to the item, "In the last six months, have you used a needle to chip, fix, or muscle even once?"15 The analytical sample for the second objective (i.e., evaluate the impact of frequent cannabis use on injection relapse) was restricted to all ARYS, VIDUS, and ACCESS participants who were aged 18 years or older; provided a report of injection drug use at baseline or over follow-up, which was followed by a 6-month period of no injection drug use (injection cessation); and completed at least 1 study visit between September 2005 and November 2018. The second outcome of interest was time to relapse of injection drug use. This outcome was defined as any injection drug use in the past 6 months that occurred after a period of injection cessation (i.e., a 6-month period with no injection drug use). Both outcomes (injection cessation and injection relapse) were defined as the midpoint between the first interview during which the outcome was reported and the preceding interview before the outcome was reported.

The primary explanatory variable of interest was frequent cannabis use in the past 6 months (‡ daily vs <daily). Cannabis use was measured on the basis of the item, "In the last six months, how often have you used marijuana?" The response options were "0 = less than once a month"; "1 = 1-3 times per month"; "2 = about once per week"; "3 = 2- 3 times per week"; and "4 = at least daily." These categories were collapsed to at least daily versus less than daily because of the low prevalence of occasional users (e.g., "less than once a month" and "1-3 times per month"), and analyzing these as individual categories can produce unstable estimates of effect size. Previous investigations of this sample have also found that there are significant differences in the reasons for use between at-least-daily users and less-than-daily users. At-least-daily users appear to use cannabis for a specific therapeutic purpose and were significantly more likely than less-than-daily users to report using cannabis to reduce pain, insomnia, stress, andnausea or loss of appetite.16 For these reasons, we opted to combine the less-than-daily categories and create the lessthan-daily versus at-least-daily variable.

On the basis ofprevious studies ofinjection cessation and relapse, we selected a range of sociodemographic, substance use, and drug treatment variables hypothesized to confound the association between cannabis use and injection cessation and injection relapse.17,18 These variables were sex (male vs female); age (per year older); race/ethnicity (White vs non-White); being in a relationship (i.e., legally married, common-law, orregular partner vs others); recent incarceration (yes vs no); licit employment (i.e., having a regular, temporary, or self-employed work vs none); enrollment in opioid agonist therapy (yes vs no); engagement with alcohol or drug treatment other than opioid agonist therapy (yes vs no); homelessness (yes vs no); binge drug use, defined as a period of using drugs more often than usual (yes vs no); noninjection heroin use (‡ daily vs <daily); noninjection cocaine use (‡ daily vs <daily); noninjection crack-cocaine use (‡ daily vs <daily); noninjection crystal methamphetamine use (‡ daily vs <daily); involvement in drug dealing (yes vs no); having tried but been unable to access addiction treatment services (yes vs no or never tried); and cohort designation (i.e., ACCESS vs VIDUS, ARYS vs VIDUS).

Additional covariates included in the analysis ofinjection relapse were experiencing barriers to accessing alcohol or drug treatment (yes vs no), involvement in sex work (yes vs no), any history of childhood sexual abuse (yes vs no), and experiencing physical or sexual violence (yes vs no). The primary explanatory variable, the outcome variables, and each of the time-varying secondary covariates were assessed at baseline and every 6 months thereafter via the interviewer-administered questionnaire completed. We treated all of these variables as time-varying covariates with the exception of sex, race/ethnicity, and history of childhood sexual abuse, which were assessed at baseline only. These variable definitions were consistent with previous studies and each behavioral variable referred to the previous 6-month period.11

We analyzed the characteristics of the study sample at baseline, stratified by cannabis use, using the %2 test for binary variables and the Wilcoxon rank sum test for continuous variables. We calculated the incidence density and the 95% CI of each outcome (injection cessation and injection relapse) based on the Poisson distribution. We applied Kaplan-Meier methods to calculate the cumulative hazard of the first injection cessation and relapse event, stratified by daily cannabis use at baseline. We used extended Cox regression models to estimate the unadjusted and adjusted relative hazards and 95% CIs for variables associated with injection cessation and injection relapse. We applied an a priori multivariable model building protocol to an extended Cox regression model for recurrent events to fit the adjusted models. First, we constructed a full multivariable model that included all explanatory variables. In a manual stepwise manner, we removed covariates that produced the smallest relative change in the cannabis use coefficient 1 at a time. We discontinued this process once the minimum change in the cannabis use coefficient exceeded 5%. We selected a 5% threshold because simulation studies have shown that confounder-selection strategies using the "change in estimate" approach provided the least-biased effect estimates when lower thresholds were selected.19 This method has been used in several previous studies as a confounder-selection . . 20,21 strategy.

This method is designed to retain covariates that represent the most significant confounders of the association between cannabis use and injection cessation and relapse.19 Given that cannabis use has produced distinct effects on opioid and stimulant use in previous studies, we also performed subanalyses on the cessation of injection opioids versus stimulants, and relapse of injection opioids versus stimulants.1,8 Because each of the variables in the analysis were timeupdated every 6 months and a very low proportion of values was missing during the study period (< 2%), we excluded missing observations from the analysis. Participants were right censored iftheir last study visit was conducted more than 3 years before the end of the study period. The distribution of the censored data is provided in Appendix A, Table A (available as a supplement to the online version of this article at http://www.ajph.org).

Injection opioid use comprised heroin, fentanyl, and prescription opioids, and injection stimulant use comprised cocaine, crack cocaine, and crystal methamphetamine. These subanalyses followed the same model building protocol described previously for the whole-sample analysis. We used SAS version 9.4 (SAS Institute, Cary, NC) to perform all statistical analyses. All P values were 2-sided with a significance threshold of .025 (.05/2) because we tested 2 independent hypotheses (the association between cannabis use and injection cessation and the association between cannabis use and injection relapse).

RESULTS

From September 2005 to November 2018, a total of2459 people who inject drugs (PWID) were enrolled and completed at least 1 follow-up interview in the ARYS (n = 570; 23.2%), VIDUS (n = 1152; 46.8%), or ACCESS (n = 737; 30.0%) studies during the study period and were included in the analysis of injection cessation. Of this sample, 2110 participants were included in the analysis of injection relapse from the ARYS (n = 836; 39.6%), VIDUS (n = 715; 33.9%), or ACCESS (n = 559; 26.5%) studies. The baseline characteristics of the study sample (n = 2459) are presented in Table 1 and Appendix A, Tables B, C, and D. At baseline, the median age of the participants was 36.8 years (interquartile range [IQR] = 25.9-45.7), 863 (35.1%) were female, and 1466 (59.6%) were White. At-least-daily cannabis use was reported by 666 (27.0%) of the study sample at the time of enrollment. The median follow-up time per participant was 49.8 months (IQR= 18.2-109.8). During the 12-year study period, 1371 (55.8%) participants reported at least 1 injection cessation event, resulting in an incidence density of 17.9 events per 100 person-years

(95% CI = 17.1, 18.7). From study enrollment, the median time to the first report of injection cessation was 16.4 months (IQR = 5.0-39.9). Among those who reported injection cessation, 1151 (54.6%) participants reported at least 1 injection relapse event over the study period for an incidence density of 25.9 events per 100 person-years (95% CI = 24.2, 27.7). The median time to injection relapse was 8.4 months (IQR = 3.1-21.5).

The adjusted hazard ratios (AHRs) of injection cessation are presented in Table 2. In the adjusted analysis, at-least-daily cannabis use was significantly associated with increased rates of injection cessation (AHR = 1.16; 95% CI = 1.03, 1.30; P = .017). The subanalysis indicated that this association was only significant for opioid injection cessation (AHR =1.26; 95% CI=1.12, 1.41; P <.001); cannabis use was not significantly associated with the cessation of stimulant injecting (AHR = 0.93; 95% CI = 0.83, 1.04; P = .216; Table 3). At-least-daily cannabis use was not significantly associated with time to injection relapse (AHR = 1.08; 95% CI = 0.95, 1.23; P = .236; Table 4). This association was also nonsignificant for opioid injection relapse (AHR = 1.05; 95% CI = 0.92, 1.19; P = .476) and stimulant injection relapse (AHR = 1.00; 95% CI = 0.88, 1.14; P = .969; Table 4). The unadjusted associations between each of the covariates and injection cessation and injection relapse are included in Appendix A, Table E). Substance use trends over follow-up and the Kaplan-Meier analyses of injection cessation and injection relapse are also presented in Appendix A, Figures A through D.

DISCUSSION

In the present study, we observed that atleast-daily cannabis use was associated with a 16% increase in the hazard rate ofinjection cessation, and the subanalysis showed that this effect was restricted to the cessation of injection opioids. We also found that at-leastdaily cannabis use was not significantly associated with relapse to injection drug use, and this association remained nonsignificant in subanalyses of opioid injection relapse and stimulant injection relapse.

Previous studies ofinjection cessation have identified several individual, behavioral, and socio-structural factors associated with injection cessation, including living in stable housing (adjusted odds ratio [AOR] = 1.30; 95% CI = 1.13, 1.48), having formal employment (AOR = 1.12; 95% CI = 1.01, 1.23), social support (AOR= 1.22; 95% CI = 1.10, 1.35), access to health and social services (AOR= 1.21; 95% CI = 1.09, 1.34), younger age (adjusted time ratio [ATR] = 0.79; 95% CI = 0.65, 0.94), and HIV seropositivity (ATR = 0.83; 95% CI = 0.73, 0.96).9'22 Daily injection drug use (ATR = 1.55; 95% CI= 1.35, 1.79), speedball (heroin and cocaine) injection (AOR= 1.39; 95% CI = 1.20, 1.62), homelessness (AOR= 1.36; 95% CI = 1.12, 1.65), illegal income activities (AHR = 0.19; 95% CI = 0.06, 0.61), and history of sexual abuse (AHR = 0.44; 95% CI = 0.27, 0.71) have been negatively associated with injection cessation. Two previous studies observed that injection cessation was often paralleled by increases in cannabis use, although cannabis use was not identified as a predictor of injection cessation.17,25

To our knowledge, this is the first longitudinal study to identify a positive association between cannabis use and cessation of injection drug use. This observation is supported by a recent study showing that frequent cannabis use was associated with decreased illicit opioid use among people who use drugs with chronic pain, a common comorbidity among this population.16 Preliminary trials in humans have reported reduced severity of opioid withdrawal associated with synthetic oral tetrahydrocannabinol (THC) administration (dronabinol), although some mild dose-related side effects were reported in 1 trial.26-28 THC produces feelings of reward by binding to cannabinoid receptortype 1 (CB-iR), which are colocalized with m opioid receptors.1,28,29 Endocannabinoids such as THC have been shown to influence opioid peptide levels and enhance the sensitivity and reward associated with other substances, which may explain the ability of cannabis to moderate opioid withdrawal.1,28

Although cannabidiol (CBD), a nonintoxicating phytocannabinoid, is not rewarding, it has also been implicated in the treatment of substance use disorders and opioid use disorder specifically.1 Animal models and preliminary human studies indicate that CBD attenuated the reward associated with opioids and reduced withdrawal symptoms and cue-induced cravings among heroin-dependent individuals.28,30 In both animal models and human studies, the reduced craving associated with CBD was observed up to 1 week after the final CBD administration.28,30 A randomized clinical trial of CBD use among individuals with heroin use disorder found that CBD administration for 3 consecutive days significantly reduced the drug craving and anxiety associated with salient drug cues compared with placebo.31 These benefits have important implications for substance use disorders given that drug craving increases with the duration of drug abstinence.1 These effects may be attributed to the ability of CBD to normalize opioid-induced impairment of CB1R receptors in the striatum, which plays a central role in the processing of reward, reinforcement, motivation, and decisionmaking.1,30 CBD also decreases activation in the amygdala during the processing of negative emotions, and the amygdala processes conditioned cues associated with substance use that provoke drug-seeking behaviors.1 The neurophysiological effects of THC and CBD and the potential to attenuate opioid withdrawal may account, in part, for our observation that daily cannabis use was associated with the cessation ofinjection opioid use among PWID.

Existing studies of injection relapse have identified several risk factors including younger age, male gender, homelessness, HIV seropositivity, noninjection stimulant use, and incarceration.17,18,22,23,32 Only 2 of these studies analyzed the impact ofcannabis use, and, similar AJPH OPEN-THEMED RESEARCH
to our study, the association between cannabis use and injection relapse was not statistically significant.22,32

Predictors of injection relapse have been understudied relative to injection initiation and injection cessation. Given that substance use dependence is recognized as a chronic condition involving recurring cycles of relapse and recovery, additional research evaluating predictors of injection relapse in the context of an opioid overdose crisis will be important to mitigate the drug-related harm associated with injection drug use.33

Limitations

The limitations of this study included the measurement of drug use behaviors via self-report, although the reliability and validity of self-report measures among PWID have been demonstrated in previous studies.34 Underreporting of stigmatized and criminalized behaviors such as illicit injection drug use may have attenuated the effect sizes observed in the present study. Residual confounding may have also influenced the results as this was an observational design, and these findings may not be generalizable to other groups of PWID as these cohorts do not include random samples. Furthermore, we did not collect data on the types of cannabis used by study participants during the entire study period, including details of the relative concentrations of bioactive molecules (i.e., THC and CBD).

Although cannabis use was positively associatedwith injection cessation, it shouldbe noted that the magnitude of the effect size (AHR = 1.16) was smaller than other than factors including opioid agonist therapy (AHR = 1.32) and alcohol and drug treatment (excluding opioid agonist therapy; AHR = 1.84). Nevertheless, the association between cannabis use and the cessation of opioid injection is important given the recent regulatory changes to nonmedical cannabis use and the ongoing opioid overdose epidemic in North America.

Public Health Implications

In conclusion, we found that at-least-daily cannabis use was associated with an increased rate ofinjection cessation, and this effect was restricted to the cessation of opioid injection. We did not observe a significant association between at-least-daily cannabis use and injection relapse. These observations are encouraging given the uncertainty surrounding the impact of cannabis legalization policies during the ongoing opioid overdose crisis in many settings in the United States and Canada, particularly among PWID who are at increased risk for drug-related harm. The accumulating evidence from preclinical and epidemiological studies linking cannabis use to opioid use behaviors further supports the evaluation ofthe therapeutic benefits ofcannabis and specific cannabinoids (e.g., CBD and THC) for people living with opioid use disorder. Á¡PU

CONTRIBUTORS

H. Reddon and M-J Milloy designed the study. H. Reddon and M-J Milloy drafted the article. H. Dong performed the statistical analysis. All authors contributed substantially to critically reviewing the article for intellectual content and approved the final version.

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Sidebar

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Document 49 of 61

Advances in Environmental Health and Disaster Research 15 Years After Hurricane Katrina

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ABSTRACT (ENGLISH)

In August 2005, when Hurricane Katrina resulted in flooding more than 80% of the city of New Orleans, Louisiana, for more than six weeks, many worried about the environmental health consequences. Of highest concern were mold exposures, especially indoors. A major pediatric asthma study conducted after Katrina, funded by a public-private partnership, could not be implemented until 2007. The Head-offEnvironmental Asthma in Louisiana study, implemented with 182 children with moderate to severe asthma, is illustrative of key disaster research challenges. Health disparities are an influential factor affecting health outcomes (in this case, childhood asthma), and delayed study implementation hampers just-intime environmental assessments; for example, many Head-off Environmental Asthma in Louisiana study participants were living in remediated homes two to three years after the disaster.1 Infrastructure challenges, including some in public health, also resulted in an extended time for participant recruitment. In the context of the disaster management cycle, most resources were invested in the response phase, with dwindling resources available for the prolonged recovery. After Katrina, environmental health action initially focused on worker exposure and community needs assessments. For example, the Worker Training Program ofthe National Institute of Environmental Health Sciences (NIEHS) trained 8000 first responders how to mitigate and prevent environmental exposures. The key lessons learned that hampered postdisaster research were (1) the inability to accurately assess exposures to potential chemical contaminants given the extended lag time between exposure and assessment of those exposures and (2) the lack of investment in longitudinal cohort studies that must be initiated during the immediate response phase.

FULL TEXT

In August 2005, when Hurricane Katrina resulted in flooding more than 80% of the city of New Orleans, Louisiana, for more than six weeks, many worried about the environmental health consequences. Of highest concern were mold exposures, especially indoors. A major pediatric asthma study conducted after Katrina, funded by a public-private partnership, could not be implemented until 2007. The Head-offEnvironmental Asthma in Louisiana study, implemented with 182 children with moderate to severe asthma, is illustrative of key disaster research challenges. Health disparities are an influential factor affecting health outcomes (in this case, childhood asthma), and delayed study implementation hampers just-intime environmental assessments; for example, many Head-off Environmental Asthma in Louisiana study participants were living in remediated homes two to three years after the disaster.1 Infrastructure challenges, including some in public health, also resulted in an extended time for participant recruitment.

In the context of the disaster management cycle, most resources were invested in the response phase, with dwindling resources available for the prolonged recovery. After Katrina, environmental health action initially focused on worker exposure and community needs assessments. For example, the Worker Training Program ofthe National Institute of Environmental Health Sciences (NIEHS) trained 8000 first responders how to mitigate and prevent environmental exposures. The key lessons learned that hampered postdisaster research were (1) the inability to accurately assess exposures to potential chemical contaminants given the extended lag time between exposure and assessment of those exposures and (2) the lack of investment in longitudinal cohort studies that must be initiated during the immediate response phase.

DISASTER RESEARCH AFTER HURRICANE KATRINA

The Institute ofMedicine (now the National Academy of Medicine) convened a special workshop in 2007 to address the key health concerns associated with Hurricane Katrina and develop a research agenda.2 Key research gaps identified by the workshop presenters were conducting exposure assessments at the earliest possible time after the disaster; ascertaining the effect of complex exposure pathways, including exposures to chemical mixtures; characterizing individual susceptibilities; and recognizing the important role of community-engaged environmental epidemiological studies.

Almost five years after Hurricane Katrina, the Gulf Coast experienced a technological disaster of unprecedented proportion: the Deepwater Horizon oil spill. Coastal communities from Louisiana to Florida faced new challenges and expressed heightened concerns about exposure to oil-associated compounds. Research investments disproportionately focused on ecosystem studies assessing the effect of the spill on fauna, flora, and water quality. From a human health perspective and in large part based on the lessons learned from Hurricane Katrina, a more robust and timely allocation of financial and human resources resulted in a strengthened exposure assessment in many oil spill-cleanup workers. A comprehensive and ongoing occupational environmental epidemiological study, the Gulf Long-Term Follow-Up Study, funded by NIEHS, was the largest worker cohort study ever conducted in the aftermath of an oil spill. The study used a comprehensive panel of biomarker data, clinical evaluations, and survey instruments to prospectively examine potential adverse physical and mental health effects associated with the oil spill.3

Community members, many of whom already faced the triple burden of health disparities, disasters, and environmental health threats, were seeking answers to three questions after the oil spill:

1. Is the seafood safe to eat?
2. Is the air safe to breathe?
3. What will happen to the health of our babies born after the spill?

In response to these questions and lessons learned about the pivotal role that communities can play in unraveling these seemingly simple but often interconnected questions, NIEHS, in collaboration with other National Institutes of Health institutes and centers, competitively funded four community- academic partnerships. The consortia had three distinguishing features: a transdisciplinary focus on seafood consumption, a dedicated program addressing community resilience, and a community network advising the four consortia to ensure community engagement in all aspects of the research from design to dissemination. Among the products were a consortia-wide assessment ofseafood safety and a community resilience activation framework.4,5 The collective research endeavors also documented the psychosocial consequences of disasters, both natural and technological.

The most prominent contribution of countering the seemingly intransigent challenges associated with conducting disaster research is the National Institutes of Health's Disaster Research Response Program.6 Miller et al.6 identified four key domains of challenges: (1) research issue identification and prioritization, (2) research process challenges, (3) infrastructure and implementation, and (4) relationships, coordination, and engagement. All the domain-specific challenges can be daunting, both singularly and as a whole, but the most profound contribution of the program has been decreasing the time lag between chemical exposure and research assessing the magnitude of those exposures and potential adverse health outcomes by providing access to "off-the-shelf' research tools, institutional review board- approved protocols and strategies to accelerate the institutional review board process, and the Disaster Research Response Program collection tool repository. The program provides a promising foundation for data linkages enabling queries of environmental, exposure, and health outcome data.

A RESEARCH AGENDA FOR THE FUTURE

In the aftermath of Hurricane Katrina, the frustrations faced by communities and their academic partners alike centered around the difficulty of environmental health and disaster research to determine whether a health symptom or condition was associated with a specific disaster. A promising step to address this concern is to deliberately invest in the continuum of research from bench to clinic to community. Furthermore, this holistic, transdisciplinary approach has a high likelihood of advancing the knowledge base of disaster research by using both upstream and downstream strategies. For example, ascertaining genetic and epigenetic risk factors can better characterize an individual's susceptibility and enable a more precise evaluation of the potential cumulative effect of disaster-related chemical exposures. Similarly, communitybased environmental epidemiological cohort studies can be enriched by pathophysiological assessments through biospecimen banking and biomarker analyses at the clinical level. This holistic approach to disaster research must be accompanied by a commitment to collect exposure and risk factor data, as well as information on social determinants of health, in what is increasingly recognized as the interdisaster period, especially in communities facing frequent disasters such as hurricane, floods, and environmental incidents.

The need for long-term research beyond postdisaster response studies is particularly relevant in the context of strengthening and measuring community resilience.7 Such research should facilitate the systematic collection, analysis, translation, and dissemination of data on exposures to chemical and nonchemical stressors over time. Furthermore, advances in data science will accelerate the pathway from discovery to recovery. Hurricane Katrina made visible the historic burden of health disparities in many Gulf Coast communities. Making disaster research work for our communities requires advancing environmental health literacy. Doing so will not only promote embedding communities in our joint disaster research enterprise but also strengthen the quality of our research. The ultimate goal is to protect those most vulnerable.

Maureen Lichtveld, MD, MPH

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Both authors contributed equally to this editorial.

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Sidebar

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Prescription Drug Monitoring Programs and Overdoses: Advancing the Next Generation of Research

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ABSTRACT (ENGLISH)

Recent research has recognized that states have enacted highly heterogeneous PDMP laws, with some mandating their use and others not doing so, some requiring daily updates and others permitting significant lags, and some requiring that law enforcement have a warrant to access data and others not having this requirement in place.2 This editorial identifies additional select guideposts for future analyses of PDMPs drawing on principles of public health law research developed by Wagenaar and Burris.3 OUTCOME MEASURES With rare exception, studies of PDMPs and overdoses have conceptualized and operationalized their outcomes as some permutation of overdose mortality, probably because vital statistics data enumerating overdose deaths are widely available (although perhaps overdoses are misclassified). Melding implementation science theories and methods to analyze the interface of

PDMPs and prescriber and pharmacist practices is a vital next step, although it will require advancing implementation science so that it more rigorously and comprehensively conceptualizes and measures the external environment and the processes through which it shapes implementation outcomes.4 RISK ENVIRONMENTS The risk environment model posits that laws are part of the broader macro-level political environment and that they may shape the health of people who use drugs by interacting with features of the social, economic, physical, and health care- criminal justice intervention environments that operate at the macro, meso, and micro levels, as well as with other features of the political environment.5,6 PDMP impacts on overdoses may thus depend on these other risk environment features. When overdose mortality is the outcome, investigators should consider whether case fatality rates vary systematically by the victim's social position (e.g., gender, race/ethnicity), perhaps traveling with systematic population-level differences in comorbidities, naloxone access, and willingness to summon EMS personnel and, by extension, the police.

FULL TEXT

Ell See also Hughes et al., p. 1573.

A decade of public health research investigating the impacts of prescription drug monitoring programs (PDMPs) on overdoses has generated a cacophony of divergent findings. PDMPs are databases used to monitor and regulate the prescribing and dispensing of controlled substances and are a policy lever that 49 states and Washington, DC, have implemented to combat opioid-related harms. Several studies-including the Hughes et al. study (p. 1573) appearing in this issue-have shown that PDMPs are associated with a decrease in opioid overdoses, a finding aligned with their purpose; others, however, have reached the opposing conclusion or have revealed no association. If public health is to fulfill its mission of promoting population health by guiding policy, we have provided a mercurial compass for PDMPs thus far. This mission is particularly vital now, as the COVID-19 pandemic threatens to exacerbate vulnerability to overdoses.1

The contradictory findings regarding PDMPs originate, in part, in the challenges of conceptualizing and analyzing laws as social determinants of health. Recent research has recognized that states have enacted highly heterogeneous PDMP laws, with some mandating their use and others not doing so, some requiring daily updates and others permitting significant lags, and some requiring that law enforcement have a warrant to access data and others not having this requirement in place.2 This editorial identifies additional select guideposts for future analyses of PDMPs drawing on principles of public health law research developed by Wagenaar and Burris.3

OUTCOME MEASURES

With rare exception, studies of PDMPs and overdoses have conceptualized and operationalized their outcomes as some permutation of overdose mortality, probably because vital statistics data enumerating overdose deaths are widely available (although perhaps overdoses are misclassified). PDMPs, however, would primarily affect overdose occurrence rather than the fatality rate among overdose victims. Multiple factors influence fatality rates among overdose victims, including the pharmacokinetics of the ingested substances, the victim's physiological responses and comorbidities, the presence of bystanders who are aware of the event, and the capacity of bystanders and emergency medical service (EMS) personnel to respond effectively.

Each of these factors holds multiple possible futures for the victim. If bystanders are present, they may (or may not) have sufficient doses of naloxone to reverse the overdose, and they may (or may not) summon EMS personnel. If summoned, EMS personnel may (or may not) arrive in time and may (or may not) be required to delay care until the police arrive. For the vast majority of overdose victims, these various factors coalesce to form a bridge to survival: before fentanyl saturated the market, it was estimated that more than 95% of overdose victims survived. The low fatality rate among overdose victims, coupled with the number of variable factors linking overdose occurrence to death, obscures relationships between PDMPs and overdose mortality.

Future research on PDMPs and overdose should also expand to encompass nonfatal overdoses as outcomes. Nonfatal overdoses matter in and of themselves; they generate significant suffering, including serious multisystemic sequelae (e.g., cognitive impairment; pulmonary, muscular, and cardiovascular complications; and renal failure) and psychological trauma, and mark vulnerability to a future fatal overdose. The challenge resides in accessing valid data on such outcomes to systematically study the impact of state laws.

IMPLEMENTATION

As Wagenaar and Burris argue,3 the health impacts ofa law "on the books" depend largely on whether and how it is implemented "on the streets." To illustrate, heroin possession has been illegal outside of highly circumscribed instances since 1924. However, the scale up of the war on drugs 60 years later transformed the enforcement of drug-related laws, dramatically increasing arrest and incarceration rates for drug-related offenses and catalyzing racialized mass incarceration. Little research, however, has explored whether and how variations in PDMP implementation shape overdoses.

Future research could examine the nature and consequences of heterogeneities in PDMP implementation, culling data from the laws themselves (some of which explicitly describe enforcement) and associated funding allocations, case law, investigations by relevant state boards (e.g., state medical boards), and surveys of prescribers and pharmacists. Melding implementation science theories and methods to analyze the interface of PDMPs and prescriber and pharmacist practices is a vital next step, although it will require advancing implementation science so that it more rigorously and comprehensively conceptualizes and measures the external environment and the processes through which it shapes implementation outcomes.4

RISK ENVIRONMENTS

The risk environment model posits that laws are part of the broader macro-level political environment and that they may shape the health of people who use drugs by interacting with features of the social, economic, physical, and health care- criminal justice intervention environments that operate at the macro, meso, and micro levels, as well as with other features of the political environment.5,6 PDMP impacts on overdoses may thus depend on these other risk environment features.

To illustrate, the beneficial impacts of North Carolina's PDMP on overdoses reported in this issue may have occurred in part because the state's robust user unions, Good Samaritan Laws, and naloxone access laws helped people living with an opioid use disorder survive any changes in local drug markets that the evolving state PDMP precipitated. These and other variations in risk environments (e.g., spatial access to substance use disorder treatment, Medicaid expansion) might explain heterogeneous past PDMP findings, and they merit future exploration to enhance understanding of the specific contexts in which particular PDMP stipulations harm or advance public health.

HEALTH EQUITY

For more than a century, US drug-related laws have generated health inequities by sustaining White supremacy and other forms of discrimination. A next step for research on PDMPs and overdoses could recognize this potent historical and contemporaneous fact and explore whether and how PDMPs might generate inequities in overdoses, whether by race/ethnicity, gender, rurality, or other socially defined characteristics. This advance will require combining several suggestions from this editorial, including investigating inequalities in the implementation ofspecific PDMP stipulations and in risk environments. When overdose mortality is the outcome, investigators should consider whether case fatality rates vary systematically by the victim's social position (e.g., gender, race/ethnicity), perhaps traveling with systematic population-level differences in comorbidities, naloxone access, and willingness to summon EMS personnel and, by extension, the police.

Drug-related laws are evolving as rapidly as the overdose epidemic itself. Generating a larger body of evidence, including research guided by the recommendations outlined here, to accurately identify stipulations of PDMP laws that promote or damage the public's health is a vital step toward ending drug-related suffering.

Hannah L. F. Cooper, ScD

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DETAILS

Subject:	Environment models; Judicial system; Legislation; Minority &ethnic groups; Public health; Mortality; Implementation; Criminal justice; Ethnicity; Prescription drugs; Risk; Social justice; Environmental impact; Police; Intervention; Narcotics; COVID-19; Overdose; Drug overdose; Vital statistics; Fatalities; Crime; Epidemics; Permutations; Criminal investigations; Research; Law enforcement; Coronaviruses; Naloxone; Imprisonment; Gender; Editorials; Health care; Therapeutic drug monitoring
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Document 51 of 61

The Paradoxical Effects of Hurricane Katrina on Births and Adverse Birth Outcomes

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ABSTRACT (ENGLISH)

Objectives. To review the trends in pregnancy outcomes after Hurricane Katrina and assess effects of the disaster on research and public health related to pregnant women. Methods. We reexamined the 2004-2006 vital statistics data from Alabama, Louisiana, and Mississippi, assessing what the risk of adverse pregnancy outcomes in the population would have been under varying risk scenarios. Results. We saw a reduction in number of births as well as in low birth weight and preterm birth. If the number of births had stayed constant and the relative higher risk in the "missing" births had been between 17% and 100%, the storm would have been associated with an increased risk instead ofa decrease. Because the relative decline in births was larger in Black women, the higher risk in the "missing" births required to create a significant increase associated with the storm was generally not as great as for White women. Conclusions. Higher exposure to Katrina may have produced a reduction in births among high-risk women in the region rather than increasing adverse outcomes among those who did give birth.

FULL TEXT

Headnote

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Methods. We reexamined the 2004-2006 vital statistics data from Alabama, Louisiana, and Mississippi, assessing what the risk of adverse pregnancy outcomes in the population would have been under varying risk scenarios.

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Conclusions. Higher exposure to Katrina may have produced a reduction in births among high-risk women in the region rather than increasing adverse outcomes among those who did give birth. (Am J Public Health. 2020;110:1466-1471. doi:10.2105/AJPH.2020.305769)

Birth outcomes are generally expected to worsen following natural disasters. Trauma may trigger labor.1 Mental illnesses, including posttraumatic stress disorder, anxiety, somatic complaints, alcohol addiction, and depression, rise after natural disasters and are associated with negative birth outcomes.2,3 Maternal psychological distress is also associated with an increased risk of preterm birth (PTB), low birth weight (LBW), and fetal growth restriction.4 Beyond psychosocial factors, other disaster-related exposures such as environmental contaminants can also have a negative impact on birth outcomes.5 Disaster research has generally shown small reductions in birth weight associated with exposure to disaster, while effects on gestational age are more mixed.6 Other complications, such as hypertensive disorders of pregnancy or gestational diabetes, are understudied-while a few studies have indicated increases in their occurrence after disaster,7 9 the literature is limited.

The March ofDimes predicted an increase in preterm births after Katrina.10 Instead, an unexpected improvement of birth outcomes occurred. Hamilton et al. and the National Center for Health Statistics compared affected areas 12 months before and after the disaster11 and found a decline in LBW in all affected areas, which included parts of Louisiana, Mississippi, and Alabama, and a decrease in PTB in Louisiana and Mississippi (however, there was an increase in PTB in Alabama). In Louisiana specifically, for instance, the incidence of very low birth weight (VLBW; <1500 grams) before Hurricane Katrina was 2.3% and it decreased to 1.8% after Katrina, while the rate of very preterm birth (VPTB; <32 weeks) also fell, from 3.2% to 2.4%.11 A more detailed analysis of Louisiana data for 2 years after Katrina similarly found declines in LBW and PTB in the New Orleans region and Orleans Parish specifically.12 In addition, the storm might have been expected to widen racial disparities, with African American women being more vulnerable and, therefore, more affected. However, racial disparities in LBW and PTB did not widen and may even have decreased somewhat; nor did the hurricane have a stronger impact on birth outcomes among African American 12 women.

Smaller studies with more detailed assessment of exposure did not necessarily reflect these population-level statistics, however. Xiong et al. found a graded association between exposure to the hurricane and adverse birth outcomes, with a greater number of severe exposures associated with higher risk of LBW and PTB.13 Similarly, Harville et al., examining birth outcomes in a cohort of Louisiana pregnant women 5 to 7 years after the storm, found that having experienced damage and injury during Katrina was associated with reduced birth weight and gestational age, although current experience of long-term recovery and other indicators of previous exposure were not.14 Other outcomes that might be expected to be associated with adverse birth outcomes, such as lack of prenatal care,11,12 cleft birth defects,15 and eclampsia,16 were reported to rise. In qualitative studies, women reported devastating complications, which they attributed to disaster exposure.17

Pre-post comparisons are complicated because ofthe decline in population and birth rate after Katrina. Katrina caused one of the largest internal migrations in US history, with a million people distributed across the United States in less than 2 weeks.18 There was a 19% decrease in the number of births in the 14 most-affected counties or parishes in the 12 months after Katrina compared with 12 months before.11 Moving can delay fertility until a more secure and permanent residence is established, employment is obtained, and lost assets are rebuilt, leading to a short-term fertility decline.19

The decline in fertility was not uniform: there was a sharper decrease in birth rates in non-Hispanic Black women than in nonHispanic White women and Hispanic women. Return migration after Katrina was slower for Blacks compared with Whites.20 As measured by total fertility rate, Black fertility fell and remained 4% below expected values for at least 5 years after Katrina, whereas White fertility increased by 5%.19 Other demographic changes were also observed: women giving birth in the New Orleans region in the year after Katrina were more likely to be married, to be aged older than 20 years, and to have a college education than in the year before.12 However, no increase or a reduction in risk was found for both LBW and PTB in Orleans Parish and the New Orleans region after controlling for these factors and others (i.e., ethnicity, parity, smoking, interpregnancy interval).

The combination of these trends of lower complications but also lower fertility leads to concerns about live-birth bias in estimating the overall effect of Hurricane Katrina. Restricting a sample to include only live births can lead to an inaccurate estimate of overall exposure effect if the exposure affects both survival and the outcome under study; such a bias has been proposed as a possible explanation for the inverse association between neurodevelopmental outcomes and exposure to environmental pollutants.21 Similar questions arise with respect to natural disaster exposure when only live-birth data are used: many exposed women do not become pregnant, whether intentionally or unintentionally, and other pregnancies do not result in live births because of spontaneous and induced abortion, fetal death, and stillbirth. Zahran et al. reported a higher rate of fetal deaths to be correlated with living in an area with widespread destruction ofhousing stock after Katrina.22 We therefore explored the possible effects of the post-Katrina decline in fertility and whether differential reductions in fertility are possible explanations for the observed decline in adverse birth outcomes. METHODS

We conducted an analysis ofpossible live birth bias following the principles of Liew et al.21 Data included in the 2009 report from the National Vital Statistics System11 provided the number ofbirths and proportion of complications in areas affected by Hurricane Katrina 12 months before the storm and 12 months following the storm. We estimated what the effect of the storm on birth outcomes would have been if the number of births had stayed constant, varying the hypothetical proportions of each birth outcome. We first estimated the number of "missing" births as the difference between the number of births in the 12 months after compared with the 12 months before. We then calculated what the relative risk and confidence intervals (using standard Mantel-Haenszel formulas) would be if varying proportions of the "missing" births resulted in, forinstance, LBW, comparing the probability of LBW occurring after disaster to the probability before the disaster under these hypothetical scenarios.

A schematic for this process is provided in Figure 1. For example, in the 14 most-affected counties orparishes, there were 34 520 births in the 12 months before Katrina and 27 848 in the 12 months after Katrina, for a reduction of6672 births. Before Katrina, the incidence of PTB was 16.7%, or 5765 cases. After Katrina, the incidence of PTB was 16.7%, or 4651 cases. If20% ofthe 6672 births had occurred and had been preterm (n = 1334), the overall incidence of PTB in the 12 months after the storm would have been (4651 + 1334)/34520 = 17.3%, with a relative risk of 1.04 (17.3/16.7; 95% confidence interval = 1.00, 1.07). By varying this percentage, the incidence of PTB under various conditions can be calculated (details in material available as a supplement to the online version of this article at http://www. ajph.org). We used Microsoft Excel's What-If Analysis-Goal Seek (Microsoft, Redmond, WA) to calculate the point at which a statistically significant increase would have occurred.

We repeated similar calculations for VLBW, PTB (< 37 weeks' gestation), and VPTB and stratified by race/ethnicity (nonHispanic White and non-Hispanic Black; the number of Hispanics and other groups was too small to analyze. Results for the overall population are not necessarily the average of the subgroups, both because of the lack of analysis of these smaller race/ethnicity groups and the fact that the baseline risk and the relative decline in births differed by race, creating a situation similar to confounding identifiable in stratified analysis.). We conducted the analysis for the 14 most-affected counties or parishes in the overall Katrinaaffected region as well as Louisiana specifically. It should be noted that our analysis oflive births is a thought experiment, to put bounds on the possible effects of differential changes in fertility and childbearing, rather than a true estimate ofthe hurricane's effects, which would require a much more extensive consideration of uncertainty and variation and more detail on the relevant effect sizes.

RESULTS

If the missing births were to women at high risk, Hurricane Katrina might have been associated with worse outcomes rather than better (Table 1; detailed analysis in Tables A-F, available as supplements to the online version of this article at http://www.ajph.org). Whether the higher risk required to create that association is plausible varies by the association being analyzed. The risk in the missing births that led to a harmful effect of Katrina, rather than a protective one, varied by outcome. For the most affected counties across the region, it would be a 5.7% incidence of VPTB, 19.5% of PTB, 3.7% ofVLBW, and 14.2% for LBW; somewhat higher incidences would be required in Louisiana specifically. This would be between a 17% increase and a doubling ofrisk in the missing group compared with the observed risk.

Because the decline in births was larger in Black women, the higher risk in the "missing" births required to create a significant increase associated with the storm was generally not as great as for White women (Table 2). The reduction of risk noted overall was also stronger in the Black population than the White population, where mostly there was no change or perhaps a small increase. For Black women, the increased risk in the missing births required to create a significant increase after the storm was less than 50% above baseline for the region, up to 80% for VPTB in Louisiana.

DISCUSSION

After Hurricane Katrina, adverse birth outcomes did not rise as expected, and birth rates fell. Our analysis of the possible effects of these changes in population suggests the incidence of adverse outcomes in the "missing births" would have had to be high to create the reduction in adverse birth outcomes that was seen. For many outcomes, the increased risk is plausible: for instance, a 14.3% risk of LBW, 31% higher than baseline, is consistent with overall statistics for non-Hispanic Black women or for other populations worldwide. For others, it is unlikely to be realistic-few exposures cause a doubling or tripling of risk for PTB, so this bias is unlikely to have been the cause ofthe lack ofincrease in VPTB or VLBW in White women, for instance. For livebirth bias to be the cause ofthe lower incidence in the overall population, the women who delivered live births would have to have been, on the contrary, very low risk and apparently not particularly affected by the hurricane. Some of the post-Katrina research that found higher risk of adverse birth outcomes with more

exposure to the hurricane also found a low baseline risk among less-exposed women in the study samples.13

It is also notable that the decline in births was larger and the required increase in risk lower for the Black population than for the White population. A reasonable conclusion might be that, on the whole, Black women were more affected by Katrina but that the consequences of exposure were primarily a reduction in births among vulnerable women rather than increased adverse outcomes among those who did give birth. This reduction in births could be attributable to one or more of the following: selective migration, choosing not to become pregnant or carry to term, biologically lower fertility, or increased pregnancy losses.

Katrina was a major cause of the internal migration.18 Beyond the short-term fertility decline attributable to the complications of moving,19 family size also directly affects the inclination to move after disaster: individuals with smaller families have a higher propensity to move away from the affected region than do larger families. Smaller families tend to have smaller homes, own fewer items, and are easier to house in a new area.23 Return migration after Katrina was slower for Blacks, generally at higher risk for adverse birth outcomes, compared with Whites,20 and this likely accounts for some of the lower overall population risk in the year that followed the storm.

Changes in fertility may be attributable to conscious decisions as well as the biological ability to conceive. Warnings or experiences of natural disasters can prompt families who are already planning on having a child to either conceive earlier or postpone and conceive later, known as the "harvesting effect."24 After severe disasters, mothers or couples may desire to conceive children to replace lives lost, either in response to mortality levels in the broader community or to replace a child lost during the disaster.25 Several disaster-related factors affect reproductive decision-making. Reduced income and economic pressures may lead couples to delay childbearing. Unemployment rates and harsh economic conditions are tied to lower fertility rates via a decline in marriage rates and an increase in divorce rates.2 Marital conflict is also very common following natural disasters and during times of high stress.2 These types of conflicts can interfere with a couple's desire to have children together or lead to decreased sexual activity: 1 study found that women's satisfaction with their sexual life had markedly decreased following an earthquake, with 89.4% of them saying they did not want to become pregnant.26 Access to health care can be limited after disaster, and women may worry about receiving necessary prenatal and obstetrical care. Costs of contraception, abortion, and basic health care can also rise after a disaster, with potential effects in both directions on fertility rates: Kissinger et al. found an increase in unplanned pregnancy after Katrina.27 In addition, access to medically assisted fertility treatment is likely to be limited; however, this affects only a small portion of births. Fertility may also be biologically affected by disaster, because of physical illnesses, mental health and stress, and environmental contaminants. After the 2017 Wenchuan earthquake, women had significantly higher rates of lower genital tract infection, pelvic inflammatory disease, and menstrual disorders than before the earthquake.26 Stress can contribute to infertility through neuroendocrine pathways; for instance, high levels of stress can reduce levels of estrogen and luteinizing hormone,28 leading to a delay in ovulation and follicle maturation.25 A study of men's health after Katrina found significant changes in sperm parameters associated with decreased fertility potential.29 Environmental contaminants that have been associated with disaster include lead after Katrina,16 fecal bacteria after Superstorm Sandy,25,30 and radiation after the Fukushima earthquake and tsunami.25 In addition, lack of electricity after a disaster can expose individuals to dangerous heat or cold.

Similar pressures operate on other outcomes that reduce live births. An increase in spontaneous abortion was reported after flooding in New York State31 and in fetal death associated with proportion of the housing stock destroyed after Katrina.32 In addition, a reduction in the sex ratio in Katrina-affected areas was seen in November 2005 (though not in months before or following); such declines in male births are often hypothesized to indicate a relative vulnerability of male fetuses to external stressors,32 producing differential pregnancy loss. Miscarriage, fetal death, and stillbirth are all associated with chemical and nonchemical stressors, and disaster can lead to increased exposures of both types-for instance, raising the risk of stillbirth attributable to carbon monoxide poisoning from improperly ventilated generators.33

Katrina could also have genuinely improved birth outcomes. The postdisaster period can be a time of communities pulling together, and pregnant women and infants are a concrete sign of renewal. Many people report posttraumatic growth and "silver linings" related to disaster. Even in wartime, increased support to women and children has been associated with improved birth outcomes.34

PUBLIC HEALTH IMPLICATIONS

Several clinical and public health groups provided descriptions of their experience during Hurricane Katrina relevant to pregnant women (see list of references in Appendix A, available as a supplement to the online version of this article at http:// www.ajph.org). Hospitals that sheltered pregnant women reported deliveries by flashlight or generator light. Infants were evacuated by air, often separated from their mothers, and Woman's Hospital in Baton Rouge, Louisiana, received patients from the neonatal intensive care units of several New Orleans hospitals. Those experiencing the disaster stressed the need for flexibility and adaptability as well as infrastructure that can stand up to multiple days without power, and those receiving patients stressed the importance of communication. Both sides expressed the importance ofdisaster planning and qualified coordination. The obstetrics/ gynecology residency program at Louisiana State University suffered short-term loss of trainees and less opportunity for skills training in some areas. However, the disaster and subsequent reaccreditation process allowed for shifts in the program, including a greater use of private-practice sites and obstetric simulators, and ultimately higher numbers of medical students entered obstetrics/ gynecology.

Analysis ofvital statistics data made it clear that some women were not able to access prenatal care after Katrina, with the proportion of women receiving inadequate prenatal care significantly higher in the New Orleans region after Katrina and almost doubling in Orleans Parish.12 This increasing trend was stronger in White than Black women, both in relative and absolute terms, although Black women were still more likely overall to receive inadequate care.11,12 Not only in the Gulf region, Katrina encouraged clinicians to work with patients to develop disaster preparedness plans and be aware of particular postdisaster needs of pregnant women.

The Centers for Disease Control and Prevention (CDC) assessed a number of public health actions taken for reproductive health after Katrina, concluding that future programs need to encourage breastfeeding and provide contraception, and pregnancy-related considerations need to be incorporated into general public health disaster response programs; for instance, some vaccines and antibiotics are contraindicated in pregnant women. Newborn screening was disrupted and a large proportion of neonates did not have valid samples provided to the state laboratory. Health educators at the CDC worked to develop public service announcements and fact sheets targeting pregnant women affected by the hurricane, specifically encouraging seeking care, eating healthily, and taking hygiene precautions. The Organization for Teratology Information Specialists fielded a number of Katrina-related calls to their hotline and provided additional information on topics of special concern, such as mold, Vibrio, and pesticides. In the recovery phase, Healthy Start New Orleans served women who were particularly exposed to the disaster, and those women reported receiving more mental health counseling and prenatal education than women enrolled in traditional prenatal care.

Hurricane Katrina also led to the development of tools to assist with understanding postdisaster reproductive health care needs. Based on the Reproductive Health Assessment for Conflict-Affected Women Toolkit, the Reproductive Health After Disaster toolkit was developed to assess the needs of pregnant, postpartum, and reproductive-aged women35 and includes modules assessing exposure to disaster and service needs for pregnancy, family planning, and social services, with guidance on data entry and analysis. The toolkit was piloted after flooding and tornado disasters, along with sampling strategies to specifically reach the reproductive-aged population. It was also successfully implemented along the Gulf Coast after Hurricane Isaac, including training community health workers and patient navigators to administer it.

Hurricane Katrina's effects on pregnant women provide a number of lessons for disaster planning and response. To begin with, pregnant women and infants must be considered not only by programs that address their needs specifically but also as an important and vulnerable subpopulation for any disaster planning and response group. Second, disasters will almost certainly lead to a reduction in access to prenatal care. For low-risk women, this is likely to be a minor inconvenience, while for high-risk women, this can be a major danger. Third, in the long term, major disasters lead to complicated effects on the birth rate, fertility, and adverse birth outcomes, which cannot necessarily be predicted. >4jPI-l

CONTRIBUTORS

E. W. Harville conceptualized, edited, and developed the article. X. Xiong and P. Buekens assisted in study design and article preparation. M. David performed analysis and wrote sections of the article. All authors revised the article for critical content.

CONFLICTS OF INTEREST

None of the authors have a conflict of interest.

HUMAN PARTICIPANT PROTECTION

Institutional review board approval was not needed as no human participants were involved.

Sidebar

Correspondence should be sent to Emily Harville, Department of Epidemiology, Tulane School of Public Health and Tropical Medicine, 1440 Canal St #8318, New Orleans, LA 70112 (e-mail: harville@tulane.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Document 52 of 61

Hurricane Katrina: A Signature Cascading Risk Event and a Warning

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ABSTRACT (ENGLISH)

Racial and economic disparities in access to healthy food have been well documented in urban areas throughout the United States. Inadequate food access is a socialjustice issue, an indefensible inequity, especially in a land of abundance. It also contributes to poor-quality diets-typically low in fruits and vegetables and high in sugar, salt, and saturated fats- which can increase the prevalence of various chronic diseases. Large-scale efforts to address this access problem, such as the original Food Stamp Program, initially focused on increasing purchasing power, because inadequate household income was viewed as the cause of this problem.1 We refer to this problem definition and response as Food Access 1.0.

The second wave of food access interventions, or Food Access 2.0, focused on expanding groceries in underserved

areas across the country.2 Distant grocery stores make shopping for healthy foods difficult because of added costs and inconvenience, especially in cities with a poor transportation infrastructure and a low rate of car ownership.3,4 In New Orleans, Louisiana, food access disparities worsened in the aftermath of Hurricane Katrina,5 heightening awareness of the problem and precipitating a multistakeholder response that helped lead this wave. The issue is a problem in urban and rural areas throughout the country, but the disaster in New Orleans demonstrated stark racial disparities. Federal disaster funds were eventually used to support the first locally directed, healthy food retail incentive program.

FULL TEXT

Isll See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

On August 29, 2005, Hurricane Katrina triggered failures in engineered systems and human services in New Orleans, Louisiana, and its environs. Water topped the unfinished levees and dikes, found seams between them and infiltrated underneath them. More than 1800 people died, more than 30 000 had to be rescued from the flood waters, thousands relocated, the impact was disproportionately felt by poor predominantly African Americans, and the economic cost of this one event was more than $100 billion.1-3

I make no pretense ofadding to information about the event itself, which has been heavily studied. Instead, I use Katrina to highlight the need to systematically analyze how a single event-a hurricane, wildfire, earthquake, blizzard, or industrial or transportation accident-can cascade into multiple failures that substantially multiply consequences. Katrina was a painful opportunity to learn about cascading events when one hazardous event triggers others, producing even more severe consequences.

TRIGGER EVENTS AND DEADLY CONSEQUENCES

The American Society of Civil Engineers called the flooding of New Orleans "the worst engineering catastrophe in US History. "3 There is no doubting the physical power of Katrina to cause damage, nor ofhurricanes and tropical storms Sandy, Rita, Ike, Irene, Andrew, and Ivan just in the 21st century. Although tropical storms are at the top of the list of events leading to presidential disaster declarations, nor'easters, pandemics and epidemics, tornadoes, chemical spills, transportation accidents, and other hazardous events can cause disastrous cascading consequences. In addition, less noticeable events such as seemingly minor malfunctions in the electrical grid, construction in vulnerable locations, poorly designed and operated control panels, pipeline fires, and explosions can trigger serious multihazard events.

Each cascading event is unique because of geography and trigger event. Yet, some patterns repeat. Typically, tropical storms trigger communication and electricity failures. Fire, police, and other first responders are cut off and not able to effectively respond. The ability of transportation, water, and sewer system operators as well as health care providers are compromised, especially because they lack the ability to communicate and coordinate, all of which occurred during Katrina.

A WARNING AND SOLUTIONS

Pescaroli and Alexander4 urge that we not wait for cascading events to happen. They argue that we need to understand interdependences among systems, the degree ofamplification when a cascading event occurs, and the kinds of secondary disaster that can result. We need to model cascading event progression and prevent the events or build in resilience. This modeling includes engineered systems, human service interactions with each other and with engineered systems, and economic effects, including direct impacts on the surrounding area as well as indirect ones that can occur thousands of miles away as demand and consumption change.

We have good starting points, beginning with the acknowledgment that these events need to be considered. In the United States in regard to climate change, the multiagency US Global Change Research Program Office for Coastal Management5 discusses cascading events in the context of the climate challenge. Increasingly, we have access to more accurate data supported by publicly available software packages that allow planners and health and risk analysts to map local attributes and study their vulnerability. Researchers have developed processes that allow users to uncouple key systems, build models of the systems, and better understand the risks.6 Although we do not know which coupled cascading hazards are the potentially most disastrous in each location, we need to begin with some obvious ones stemming from climate change, freshwater availability, temperature, precipitation, storms, flooding, drought, fire, and water and food security. Science has been embracing the challenge.

Government has been much slower to engage these events in the form of providing resources. There already is a mechanism; we do not need to invent a new process. Changes to the Robert T. Stafford Act of 2000 require states and local governments to prepare and update hazard mitigation plans to be eligible for federal disaster relief funds. The Stafford Act does not preclude consideration of cascading events. Nor, however, does it insist that they be included.

I believe the key is to require each county and city as part of their next required hazard mitigation plan update to explicitly and briefly discuss the potential worst cascading events. An additional two to three pages in a document that often exceeds 250 pages should not be an undue burden. If the county or city is persuaded that one or more cascading events are truly threatening, they should be able to apply for a special competitive grant program that would provide additional funds for a more thorough assessment. This is not a pie-in-the sky idea. The federal government created the competitive Brownfields Program, which provided additional funds.7 Successful studies led the federal government to help these places access federal grants and technical assistance.

I have been documenting coverage of cascading effects in each state and in large cities and metropolitan regions. New Orleans is one of the cities. In 2005, a few months after Katrina struck, the New Orleans hazard mitigation plan focused on establishing a network of cooperative participants. Discussions of cascading events appear in two places in the report and acknowledge the interconnectedness of issues. The 2015 parish document (https://bit.ly/32DSouU) includes 11 mentions or discussions of interconnectedness, including specific examples, such as Katrina's floodwaters causing toxins to flow out of warehouses, stranded or abandoned autos, and homes as well as infrastructure failure, especially electricity. However, the document does not appear to elevate the priority ofany ofthese in its requests for resources. I do not mean to criticize the report. In fact, the 2015 New Orleans parish report seems the norm, that is, regions are more aware of the challenge than their earlier reports show. The reports focus on singular risks. For example, electrical power loss is a focus. The downstream consequences have to be inferred. Portland, Oregon, Los Angeles, California, and New York City wrote a great deal more about cascading events in their most recent reports than did New Orleans.

Overall, progress has been made. Yet I am concerned, as I expect the consequences of cascading events to markedly increase because ofclimate change, globalization, and urbanization. Katrina was an early warning that we have been too slow to heed. My anxiety is high for large US metropolitan areas and even higher for the more than 30 megacities located mostly in Asia, where millions of people live in high-risk areas, for interconnected natural and human hazard events. We need to guard against fatalism and do the unglamorous work of preparing and implementing protective programs that are grounded in resilience principles and detailed in plans crafted long before the event occurs, are periodically practiced, are activated during an event, and follow through to postevent recovery. My contention is that the vast majority of cascading event-related disasters would be less harmful if we accepted them as realities of our globalizing, urbanizing, and climate change- affected world, created scenarios of how a single event could trigger others, and worked seamlessly together to reduce consequences. This requires careful analyses, planning, and prudent decisions, which require the elevation of cascading event challenge to the national level and additional resources, albeit modest resources initially for detailed studies. Perhaps my suggested solution-which is to offer an opportunity to local governments to compete for extra funding that would completely focus on the cascading risk challenge-is too simple. Time will tell if I am overstating the case for this approach. I believe that I am understating the collective risk we face from cascading events. Â1PU

Michael Greenberg, PhD

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Note. The author is solely responsible for the opinions, observations, and recommendations of this editorial.

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Sidebar

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Disability Nondiscrimination: An Urgent Issue for Pandemic Justice

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ABSTRACT (ENGLISH)

Plans such as Alabama's, which explicitly excluded disability-based categories such as severe or profound mental retardation, were challenged by disability rights groups as violating antidiscrimination law and were withdrawn.1 Left unstated in the bulletin issued by the Office for Civil Rights (OCR) at the US Department of Health and Human Services at the time was whether triage could consider individualized assessments of survival prospects beyond the immediate episode of illness.2 A resolution agreement reached between OCR and the state of Tennessee in late June 2020 takes a far-reaching antidiscrimination stance. The resolution also may be stronger than the policy statement of the American Geriatrics Association that some degree of benefit to patients may be considered in the form of short-term survival up to six months.5 The resolution agreement applies to Tennessee; how further hospital or state plans may be evaluated by OCR will surely continue to unfold. Calling attention to the many aspects of disability discrimination in pandemic times, as Sabatello et al. do, reminds us that disability nondiscrimination has implications for social justice that reach far beyond a single group. >4jPI-l Leslie P. Francis, JD, PhD CONFLICTS OF INTEREST The author has no conflicts of interest to disclose.

FULL TEXT

See also Sabatello et al., p. 1523.

Pandemics are great levelers, placing all who lack immunity at risk. But pandemics do not level equally. In the coronavirus disease 2019 (COVID-19) pandemic, people of color, people without access to health care, and people in poverty are suffering more from physical dislocation, economic stress, and burdens of disease. People with disabilities also are at greater risk in ways that are not always easily noticed. Disputes about allocating ventilators have been in the public eye, from photographs of overwhelmed hospitals in northern Italy to the white morgue trucks lining the streets of New York several weeks later. However, many other risks for people with disabilities during pandemics have been underappreciated. In this issue of AJPH, Sabatello et al. (p. 1523) provide a nuanced yet broad-gauged account of these risks. The authors recommend nondiscrimination strategies and working with people with disabilities and disability-related organizations to mitigate these risks. Their recommendations for disability nondiscrimination are of paramount public health importance.

As the COVID-19 pandemic hit northern Italy and then New York City, the first pressing question was prioritization for ventilator access. Many pandemic plans that had been adopted by states in response to the 2009 threat of pandemic influenza, and not significantly updated, put lower priority on care for older people or those with disabilities. Disabilities singled out for lower priority included compromised cognitive function or conditions thought to be life-limiting such as neuromuscular diseases requiring long-term ventilator support. These plans reasoned that the primary goal of allocation was to protect overall community health, not the health of individuals. The plans antedated the nondiscrimination provision of the Affordable Care Act, Section 1557, although not the disability nondiscrimination prohibition of Section 504 of the Rehabilitation Act of 1973 incorporated into Section 1557. These nondiscrimination provisions apply to all health care facilities receiving federal funding. They require individualized assessment of each patient's condition rather than priority setting based on categories into which patients fall, such as age greater than 85 years or moderate dementia. Plans such as Alabama's, which explicitly excluded disability-based categories such as severe or profound mental retardation, were challenged by disability rights groups as violating antidiscrimination law and were withdrawn.1 Left unstated in the bulletin issued by the Office for Civil Rights (OCR) at the US Department of Health and Human Services at the time was whether triage could consider individualized assessments of survival prospects beyond the immediate episode of illness.2

A resolution agreement reached between OCR and the state of Tennessee in late June 2020 takes a far-reaching antidiscrimination stance. This agreement required Tennessee to state explicitly in its plan

that people who may consume more resources for care or require resources for longer on the basis of age or disability cannot be grounds for allocation or reallocation decisions;

that long-term life expectancy cannot be a factor in the allocation or reallocation of scarce resources; only "risk of imminent mortality" may be used;

that reasonable modifications should be made to the use of the state's instrument for assessing likelihood of shortterm survival when necessary for accurate use with patients with underlying disabilities;

that no exclusion criteria may prohibit people with disabilities from receiving care on the basis of their diagnoses; individualized assessments of all patients based on the best available objective medical evidence are required; and that personal ventilators brought to the hospital by someone needing care are not subject to reallocation.3

The upshot of this resolution is that only short-term survivability can be considered. Metastatic cancer that affects immediate survival would appear to warrant lower priority, but metastatic cancer that is likely to lead to death within a year will not. The resolution would appear in line with the recommendation made by Sabatello and coauthors that disability should be distinguished from comorbidities that affect survival. It would not, however, agree with the view defended by Mello et al.1 that nearer-term prognosis may be considered, at least up to one year. The resolution is also contrary to the influential early proposal by Emanuel et al.4 that there may be some balancing between numbers of lives saved and life years saved in developing ethical allocation standards. The resolution also may be stronger than the policy statement of the American Geriatrics Association that some degree of benefit to patients may be considered in the form of short-term survival up to six months.5 The resolution agreement applies to Tennessee; how further hospital or state plans may be evaluated by OCR will surely continue to unfold.

A great strength of the article is that Sabatello and coauthors do not stop with ventilators. Rather, the authors remind us of how disability-based discrimination can affect many other aspects of life in a pandemic. Access to information is one critical aspect. Here, the authors point out that standard modes of communication may fail those with visual impairments, hearing impairments, or cognitive disabilities that make understanding difficult. They make the imaginative suggestion that facilities should plan to have clear masks on hand so that people will be able to lip-read despite masks. Telehealth is a particular area of concern because people with disabilities may lack adequate Internet access, may have difficulty communicating in an electronic environment, or may live in circumstances in which confidentiality cannot be ensured.

Disability nondiscrimination requires both reasonable modification of structures or policies and reasonable accommodation of individual differences that impede meaningful access to care. Sabatello et al. point out that accessibility may be difficult to achieve when alternative care settings must be rapidly built. Nonetheless, advance planning should attempt to avoid inaccessibility to the extent possible. Similarly, policies such as strict limits on visitors may need adjustments to allow assistance from patients' usual caregivers. These adjustments may be particularly critical for people with intellectual disabilities who may be greatly disturbed by changes that they cannot fully understand. A distinction explained briefly by the authors but worth calling attention to is that between modifications (general changes) and accommodations for individual differences.6 Modifications are general, such as having accessible equipment on site or a sign interpreter on call. Accommodations are tailored to individual needs and may be easier to achieve in crisis situations when full redesign is not readily available. Accommodations also can be responsive to individual requests and thus fit individual differences more successfully.

"Nothing about us without us," the cornerstone of the disability rights movement, signals the call to involve people with disabilities in pandemic planning and its implementation.7 Sabatello et al. emphasize the role for disability organizations, especially to develop alternative forms of communication. They also rightly point out that these organizations may require resources, for example, to develop informational materials for people with sensory or intellectual disabilities.

Disability discrimination is closely intertwined with other forms of pandemic disadvantage and discrimination. Many elderly people are also people with disabilities. Nursing homes and other congregate settings where people with disabilities live have been particularly hard hit by the COVID-19 pandemic. Care providers for people with disabilities are often poorly paid and may lack sick leave or other benefits. Calling attention to the many aspects of disability discrimination in pandemic times, as Sabatello et al. do, reminds us that disability nondiscrimination has implications for social justice that reach far beyond a single group. >4jPI-l

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Sidebar

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Community Health Worker Leadership In Louisiana, During and After Hurricane Katrina

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ABSTRACT (ENGLISH)

Community health workers (CHWs) have been building capacity among underresourced populations in the United States for decades by addressing health inequity and its underlying social determinants.1 In 2005, hurricanes Katrina and Rita struck the Greater New Orleans, Louisiana area, bringing massive infrastructure damage and loss of life. A complex series of political and social issues followed, leaving close to half of the city's residents displaced a year later.2 Those who returned struggled to rebuild their homes, enroll their children in a newly privatized school system,3 live in increasingly gentrified neighborhoods,4 navigate a fragmented health care system,5 and grieve the loss of entire communities. CHWs not only supported recovery from the devastation but also learned important lessons through organizing themselves into a professional association to support their growing workforce and influence policy.

FULL TEXT

Community health workers (CHWs) have been building capacity among underresourced populations in the United States for decades by addressing health inequity and its underlying social determinants.1 In 2005, hurricanes Katrina and Rita struck the Greater New Orleans, Louisiana area, bringing massive infrastructure damage and loss of life. A complex series of political and social issues followed, leaving close to half of the city's residents displaced a year later.2 Those who returned struggled to rebuild their homes, enroll their children in a newly privatized school system,3 live in increasingly gentrified neighborhoods,4 navigate a fragmented health care system,5 and grieve the loss of entire communities. CHWs not only supported recovery from the devastation but also learned important lessons through organizing themselves into a professional association to support their growing workforce and influence policy.

INITIAL RESPONSE

After Katrina, communitybased and state-funded programs immediately hired CHWs to engage in recovery efforts. CHWs labored to expand access to health care and social services, with community-based organizations employing them to conduct Medicaid and Supplemental Nutrition Assistance Program enrollment. CHWs also navigated clients through a confusing and ever-changing web of resources for food, housing, and employment. In the absence ofa functioning public hospital system and with many paper health records destroyed, CHWs employed by cancer control programs engaged in door-todoor outreach to locate patients in need oftreatment. With this surge in activity, experienced CHWs often found themselves doing community outreach alongside CHWs employed by other organizations. They raised concerns with their supervisors about overlapping efforts and the possibility of overwhelming or confusing residents with contacts from multiple agencies. As gentrification changed neighborhoods, CHWs also advocated shifting their service delivery areas to better reach the populations they previously served. Ultimately, program managers began to trust CHWs' insights about where to reach vulnerable populations and the importance of coordinating efforts across agencies.

IN MENTAL HEALTH

For many New Orleanians, depression and other mental health conditions presented an ongoing challenge after Katrina. From 2008 to 2010, a community-academic partnered program aimed to bolster local health professionals' capacity to address mental health, in part by training more than 60 CHWs from a variety of agencies to provide community education and referrals for mental health services.6,7 Most CHW trainees previously worked exclusively on physical health (e.g., diabetes and HIV) or social issues (e.g., housing and food security), so the program offered optional monthly meetings for CHWs to discuss challenges with talking about and making referrals for mental health, voice professional frustrations, and share information about ever-evolving community resources. When the program's funding ended, CHWs and a university-based CHW ally agreed to continue convening meetings to help CHWs cope with the ongoing emotional turmoil of providing community service and the instability ofworking on grant-funded positions. CHWs engaged colleagues and friends through word of mouth, and meetings grew to include CHWs working across a myriad of organizations, neighborhoods, and health issues.

UNITING

In 2011, the group formally became the Louisiana Community Health Outreach Network (LACHON). Like CHW professional networks in other states and the National Association of CHWs formed in 2019, LACHON aims to unite and champion CHWs of various job titles (e.g., community health navigator, outreach worker). Operating without full-time staff and very limited administrative funds for almost a decade, LACHON has offered ongoing CHW professional development seminars and core competency training, convened monthly membership meetings, hosted an annual conference highlighting Louisiana CHWs' accomplishments, and kept more than 300 community health professionals informed through an active e-mail listserv. Most importantly, LACHON has become a wellrecognized voice for CHWs in Louisiana.

COLLABORATION

In 2016, the Louisiana Office of Public Health engaged LACHON to begin considering how to expand the state's CHW workforce. The Louisiana Office of Public Health readily agreed to follow national best practices in CHW policy development, many of which are process oriented and time intensive. The work became formalized in 2019 when a legislative resolution created the Louisiana CHW Workforce Study Committee, naming two of LACHON's cofounders to lead the group. Committee members included Louisiana Office ofPublic Health staff, researchers, and legislators, and in accordance with an American Public Health Association policy on CHW selfdetermination, halfwere CHWs. Committee coleads and their staff conducted the first-ever statewide study of Louisiana CHWs and their employers. Based on data gathered, consultation with national experts, and a review of the existing literature, the committee made policy recommendations to support and expand the CHW workforce in Louisiana. LACHON has been, and will continue to be, at the forefront of implementing these recommendations in collaboration with the state and other allies.

LESSONS LEARNED

Lessons learned from building a CHW movement in a postdisaster setting are applicable to other communities. First, the experience did not entail recovering from merely a natural disaster but also a political one. CHWs, who had limited agency in disaster response planning, were largely responsible for doing the painstaking work of reaching out to communities most affected, while also dealing with their own trauma. CHWs should be engaged in planning any disaster preparedness programs or response efforts in which they are to be involved. Their insight into the strengths and needs of marginalized populations is invaluable.

Finally, this work highlights the value of CHWs advocating for their communities and for their profession. CHWs who constructively challenged ineffective program structures after Katrina were better able to serve their communities. LACHON's founders created the organization not because they had funding, permission, institutional backing, or even knowledge of how to start an organization but because CHWs needed support. By creating their own professional association and embracing the concept of "nothing about us without us," Louisiana CHWs created a collective voice that is now driving policy decisions about their workforce. CHWs nationwide can harness their own power and ensure their needs are represented by participating in the growing number of local, state, and national CHW associations. >4jPI-l

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CONFLICTS OF INTEREST

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Sidebar

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Reopening the United States: Black and Hispanic Workers Are Essential and Expendable Again

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ABSTRACT (ENGLISH)

By May 15, 2020, all 50 states had announced plans to reopen their economies. These plans emerged on the heels of an increasing awareness that COVID-19 had hit minority communities particularly hard, especially Black communities. Despite constituting only 13% of the US population, Blacks have made up 24% of the deaths from COVID-19 nationally, rendering them at least twice as likely to die from COVID-19 than are other groups.1 A recent survey from Johns Hopkins University and the American Community Survey indicated that the death rate for predominantly Black counties is sixfold higher than the rate in predominantly White counties.1

The disproportionate impact of COVID-19 on minority communities has been partly attributed to the racial composition of the workers in economic sectors deemed essential, including home health care, nursing homes, and community food and housing services. In these sectors, where employees are likely to come into contact with COVID-19 (i.e., high-contact jobs), Blacks and Hispanics are more likely to be employed than are Whites.2 Data from a recent McKinsey Report2 show examples from critical economic sectors where the laborers are predominantly people of color. For example, in jobs such as psychiatric aid, nursing assistant, and orderly, Blacks make up more than twice their relative proportion of the broader US population (i.e., 13%). Because it is difficult for these jobs to be performed remotely, racial minorities have shouldered more than their share of essential labor during the COVID-19 pandemic, and their communities have been disparately endangered as a result.

FULL TEXT

By May 15, 2020, all 50 states had announced plans to reopen their economies. These plans emerged on the heels of an increasing awareness that COVID-19 had hit minority communities particularly hard, especially Black communities. Despite constituting only 13% of the US population, Blacks have made up 24% of the deaths from COVID-19 nationally, rendering them at least twice as likely to die from COVID-19 than are other groups.1 A recent survey from Johns Hopkins University and the American Community Survey indicated that the death rate for predominantly Black counties is sixfold higher than the rate in predominantly White counties.1

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The plans that states have outlined to reopen economies will likely exacerbate the racial disparities in COVID-19 infection and mortality because of the imbalance in racial and ethnic labor composition. For example, in Georgia, the first industries that are set to reopen are gyms, hair salons, tattoo parlors, movie theaters and dine-in restaurants; New York announced plans to allow manufacturing, construction, and certain retailers to reopen first; and other states have announced plans to reopen food services and department stores first.3

According to data from the Department of Labor Statistics,4 Black and Hispanic workers are overrepresented in several of the industries set to reopen across the country. Figure 1 illustrates that, despite being only about 17% of the US population, Hispanic workers make up 30% of the labor force in construction, one ofthe first industries scheduled to reopen. In addition, Black and Hispanic workers are overrepresented in accommodation and food services and will have a greater risk of COVID-19 exposure as the summer begins and people begin to frequent restaurants and tourist attractions. It should be noted that this data set does not include all races, and because the racial composition of the labor force is highly regional, these demographic data will be exacerbated or alleviated depending on characteristics of the region (i.e., urban vs rural). However, it is clear that the national numbers reflect that Black and Hispanic workers are overrepresented in the industries slated to reopen first, which puts them at disproportionate risk for infection, illness, and death from COVID-19.

As the corpses from COVID-19 pile up, policymakers are fully aware that certain minority groups, particularly Blacks, have been disproportionately ravaged by the pandemic. Therefore, as governors across the nation announce plans to reopen certain industries in a stepwise fashion, they do so with the knowledge that this will exacerbate COVID-19's devastation of communities of color. Their disregard for this potential outcome as they reopen industries with mostly Black laborers exemplifies the essential-expendable paradox of Black lives in the United States. This means that, although many Blacks have been designated essential laborers during COVID-19 and are celebrated in many instances, many businesses and state governments have simultaneously treated them as expendable by not providing them with proper protection or support, which shows that their lives are devalued and their suffering ignored.

This treatment of Black people as both essential and expendable dates back to the era of chattel slavery. Before slavery was abolished, enslaved Black labor was essential to the US economy.5 But the very society that relied on enslaved Black people's toil also subjected them to unspeakably cruel living conditions, psychological terror, and backbreaking labor under the presumption that Black lives were an expendable resource to be used, discarded, and then replaced. In fact, it was only by deeming Black lives expendable that White society was able to economically extract their essential labor. Thus, enslaved Black people in the United States were simultaneously essential and expendable. Black and Hispanic people have been cast in this paradoxical role as both essential and expendable up to the present day. This paradox has been reflected in the ways that Black and Hispanic people were and are subjected to exploitive medical experiments and research, including experimental gynecological surgeries on enslaved women, the US Public Health Service's syphilis studies in both the United States and Guatemala, and more recent lead poisoning studies.6

Although the reopening of the economy during COVID-19 is not a formal scientific study, the plans to reopen the economy mirror a national experiment. States such as Florida, Texas, and Arizona, which were among the earliest to start reopening, currently have stark increases in COVID-19 cases. To date, there is no published data showing that racial disparities have worsened in these states that reopened first. There is much uncertainty about what will occur in the coming weeks and months as the economy tiptoes forward, and more time is needed to definitively demonstrate whether a rise in infections has occurred among Blacks and Hispanics during reopening. Because of the disproportionate representation of Black and Hispanic workers in both essential industries and the first wave of reopening industries, they will disproportionately be the subjects in an experiment administered by the state. And so, as US society looks on, working-class, vulnerable people of color will march back to the shop, office, or factory under life-threatening conditions, subjects in a national experiment to which they did not consent-an experiment that, like many before it, exploits the essentialexpendable paradox of Black existence in the United States for the benefit of broader society.

To disrupt this essentialexpendable paradox, there needs to be a targeted response to specifically supporting laborers of color and neighborhoods ofcolor on state and federal levels. State and federal policymakers should swiftly implement holistic protections for essential workers. For example, the Occupational Safety and Health Administration should provide employers with resources to make COVID-19 tests freely available to workers in essential and reopening industries, especially given that data suggest that more of the testing is performed in White communities.7 Community-based testing efforts should accommodate essential worker schedules, organize contact-tracing teams to reduce community spread, and have linguistically competent staff and materials. Additionally, there should be federal support for the expansion of "hero pay" programs -pay raises offered by some companies for essential workers- given the precarious conditions faced by essential workers and the first wave of the reopening workforce. If federal and state legislators do not systematically support and prioritize minority workers, we will see a worsening disaster in these communities and perpetuate the ongoing legacy of sacrificing Black and Hispanic lives.

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CONTRIBUTORS

J. Corey Williams was the primary writer of the editorial. Nientara Anderson was the primary editor of the first draft. Terrell Holloway collected and managed the data. Ezelle Samford III, Jeffrey Eugene, and Jessica Isom were the

secondary editors.

CONFLICTS OF INTEREST

The authors have no conflicts ofinterest to declare.

Sidebar

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Document 56 of 61

From Katrina to COVID-19: Hard-Learned Lessons and Resilience

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ABSTRACT (ENGLISH)

During March and early April 2020, Louisiana experienced a surge in the number of cases and deaths from COVID-19-and New Orleans quickly became an epicenter for the pandemic. With Carnival season came 1.4 million visitors to New Orleans, and with them came COVID-19. Unfortunately, the Mardi Gras celebrations were some of the most populous events in the United States at the very time the virus was circulating and before the spread had been widely understood or acknowledged. Almost two weeks to the day after our Fat Tuesday celebration, Louisiana identified the first case of COVID-19, and the state quickly began to realize that our celebration of life would leave a trail of thousands of deaths in its wake.

The federal government mismanaged public health surveillance efforts. The lack of widespread testing and contact tracing and the poor communication in the early days of the pandemic were catalysts for exponential viral spread. Although many would exclusively blame national leadership, our failures are also owing to chronic underfunding and poor engineering of national public health systems combined with a highly infectious virus that can spread even from people without symptoms.

FULL TEXT

See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503..

During March and early April 2020, Louisiana experienced a surge in the number of cases and deaths from COVID-19-and New Orleans quickly became an epicenter for the pandemic. With Carnival season came 1.4 million visitors to New Orleans, and with them came COVID-19. Unfortunately, the Mardi Gras celebrations were some of the most populous events in the United States at the very time the virus was circulating and before the spread had been widely understood or acknowledged. Almost two weeks to the day after our Fat Tuesday celebration, Louisiana identified the first case of COVID-19, and the state quickly began to realize that our celebration of life would leave a trail of thousands of deaths in its wake.

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Louisiana is not new to bad luck, perfect storms, tragedy, or poor engineering. We are a resilient people. Our unique culture and celebrations unite us, and our tragedies level and teach us. In the aftermath of Hurricane Katrina, the state developed some of the most robust public health data collection systems and disaster preparedness infrastructures in the nation. While I was the secretary of the Louisiana Department of Health (LDH), I led disaster recovery and preparedness efforts and witnessed these systems in action. The lessons learned from our experiences with natural disasters can serve as a roadmap to other states to navigate back to normalcy.

HURRICANE KATRINA

In 2005, Hurricane Katrina tore a path through New Orleans that laid bare the social fabric of our city. Water, like COVID-19, spread quickly through New Orleans before the city had a chance to defend itself. Much of the medical infrastructure in south Louisiana flooded, and contracts and plans assumed to be in place for buses and shelters were inadequate.1 The federal government failed to act quickly and was not helped by a reportedly panicked mayor and indecisive governor. This convergence of ineffective leadership, poor engineering, and lack of coordination contributed to the deaths of more than 1100 people.2

As a result of Katrina, $14 billion was spent bolstering the levees.3 Our public health infrastructure, as well, has been bolstered. Louisiana has a public health unit in each parish (or county) with doctors, nurses, and public health professionals that can be activated into an incident command system immediately in the face of a disaster. Our data systems are sophisticated and give us real-time information on bed and ventilator availability, adequacy of generators in hospitals and nursing homes, and the number of patients in each facility. LDH operates a command center that links directly to the Governor's Office of Homeland Security and Preparedness. In turn, this office is aware of federal assets as well as the needs of other state entities, such as the Department of Transportation and Development and Child and Family Services.

BATON ROUGE FLOODS

In 2016, as a new secretary of health, I witnessed how the groundwork that had been put in place helped us overcome the disaster. Baton Rouge, our capital city, flooded and a large swath of the state was underwater after several days of heavy rain saturated local waterways. More than 110 000 buildings and homes were destroyed.4 Several state and local agencies, including LDH and the Governor's Office of Homeland Security and Preparedness, swiftly organized and executed preexisting plans for medical and general population shelters. The federal government responded quickly, and within days medical teams from the US Public Health Service were in the trenches helping us to staff medical shelters. As a result of these efforts, the response to the crisis was effective and there was minimal loss of life. This same responsive infrastructure used in 2016, such as operationalizing the Governor's Office of Homeland Security and Preparedness, has enabled Louisiana to effectively combat COVID-19.

COVID-19 CRISIS

The crisis we are currently experiencing is different from a weather event. Although hurricanes and floods can be unpredictable, they do not hit an entire nation at once. Governor John Bel Edwards is using the hospital and public health reporting systems to plan the deployment of needed resources. The city and state quickly mobilized to reduce hospital capacity burdens by working with the National Guard to set up a 2000-bed temporary hospital in the New Orleans convention center. A robust vital records system and infectious disease registry, made better by LDH's recent efforts to eliminate hepatitis C, allow leaders to have near real-time understanding of the impact of measures such as social distancing and areas where greater resources are needed. Testing capacity bolstered by our state's retooled public health lab has allowed Louisiana to rank first in the nation on numbers of citizens tested. LDH rapidly built a publicly available COVID-19 dashboard that shows the rate of testing, the number of deaths, the spread of disease by parish, and the availability of hospital beds and ventilators. These data help leaders such as Governor Edwards and New Orleans mayor Latoya Cantrell make informed decisions and help the public understand the need for measures such as school closures and shelter in place orders. Now, as we move to reopen, this early legwork in using existing infrastructure and learning from past experience has paid dividends in ensuring public health.

Unfortunately, Louisiana has experienced disproportionate deaths from infections, owing predominantly to racial disparities and a high burden ofchronic disease. Louisiana has some ofthe highest rates in the nation of obesity, hypertension, and diabetes, which makes our most vulnerable citizens even more susceptible to this virus. Tragically, we now know that 54% of those who have died in our state have been African Americans, almost double the percentage of African Americans who live in our state. Essential workers, such as grocery store clerks, bus drivers, and food delivery service workers, who are unable to social distance, have had to choose between personal safety and a paycheck, as businesses have been slow to provide protective gear. Another way Louisiana is leading by example is Governor Edward's efforts to set up a health equity task force to evaluate the underlying and systemic causes of health disparities in our state.5

Although Louisiana has greater vulnerability than most states, we have strengths that complement our resilience. In 2016, Governor Edwards expanded Medicaid. He was the only Deep South governor to do so. Medicaid expansion means that more than 480 000 lowincome working Louisianans have access to primary and preventive care instead of simply an emergency department. Our hospitals can focus on COVID-19 patients and true emergencies instead of being a source of primary care for individuals who have no insurance.

Months into this crisis, the people of Louisiana understood the importance of staying home and other social-distancing measures, as evidenced by the declining rates of hospitalization and the need for ventilators. Despite more than 4000 deaths, data indicate that the situation is gradually improving. At the time of this writing, we are now moving into reopening in accordance with federal guidelines. Although Louisiana was hit hard by this pandemic, our reopening strategy is putting our citizens in a better position than neighboring states to weather the rise in caseloads as the United States reopens. The public health infrastructure that has been bolstered after Katrina is serving us well and has allowed Louisiana to lead the nation in testing and develop a statewide contact tracing strategy that is superior to that of many states.

There is no better way to learn than from experience. Our new emergency and disaster response infrastructure is guiding us through this pandemic and will navigate us through the storms to come. Â1PU

Rebekák E. Gee, MD, MPH

CONFLICTS OF INTEREST

The authordeclares no conflicts ofinterest in the conceptualization, drafting, and development ofthis editorial.

Sidebar

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Document 57 of 61

Inclusion of Disability Content in Graduate Public Health Curricula

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ABSTRACT (ENGLISH)

Because 26% of the US population live with a disabling condition,1 the health of this population should by both magnitude and severity be an integral part of all public health activities, including education and training. With a case definition now well accepted in national health surveys, a health agenda set through Healthy People 2010 and 2020 objectives, and research establishing the disparities experienced by this population, public health professionals should be knowledgeable about the health needs of this heterogeneous population. Healthy People 2020 included an objective (DH-3) to increase by 10% the number of master of public health (MPH)-granting institutions that offer courses or studies in disability and health. Previous studies established a baseline for this objective.

FULL TEXT

Because 26% of the US population live with a disabling condition,1 the health of this population should by both magnitude and severity be an integral part of all public health activities, including education and training. With a case definition now well accepted in national health surveys, a health agenda set through Healthy People 2010 and 2020 objectives, and research establishing the disparities experienced by this population, public health professionals should be knowledgeable about the health needs of this heterogeneous population. Healthy People 2020 included an objective (DH-3) to increase by 10% the number of master of public health (MPH)-granting institutions that offer courses or studies in disability and health. Previous studies established a baseline for this objective.2,3

DISABILITY IN MPH CURRICULA SURVEYS

To assess the current state of inclusion of disability-related courses in MPH programs, we sent a survey in the fall of 2019 to 128 schools and programs of public health, affiliated and listed with the Association of Schools and Programs of Public Health. The first survey in 1998 was completed by 30 accredited schools of public health, and the second survey in 2011 was completed by 78 accredited schools and programs of public health. Our study used the same basic survey of five questions (Table 1), using Qualtrics for data collection. We reordered the 2019 survey content, and the final question asked whether the schools and programs of public health ever considered including disability content.

Seventy institutions responded to the online Qualtrics questionnaire, and 42 institutions participated in the follow-up telephone discussion. The results from the five questions were as follows:

1. Ten institutions reported having at least one graduatelevel course dealing exclusively or comprehensively with disability.
2. Only three institutions said that they offer a graduatelevel track or concentration in disability content, and only one ofthe three public health programs offers a disability studies certificate.
3. Twelve institutions indicated that their university offered dual degrees with a disabilityfocused discipline, most commonly physical therapy and rehabilitation science.
4. Fifty-three institutions indicated that their universities include disability content in non-MPH curricula, 80% in aging, 60% in equity or disparities, 44% in special education, and 40% in physical and occupational therapies.
5. Thirty-eight institutions have considered including disability content.

Follow-up discussions with numerous institutions provided further insights about disability inclusion.

FOLLOW-UP CONVERSATIONS WITH ACADEMICS

Across all institutions, respondents were diligent in their efforts to engage disability as a civil right and a demographic or a public health outcome and to engage disability from a social determinants of health perspective. There was consensus that people with disabilities as a population experience health disparities that should be addressed. One academic said, "This has given me reasons to sit back and rethink. Disability can be an independent study."

For the institutions not offering disability content within public health, some responses included "dependent on faculty and areas of interest." Those in this diverse group showed a broad array of exposure to disabilityrelated issues, such as emergency preparedness, global disability and health, and the equalityequity difference. Several, however, indicated an awareness of the heterogeneous nature of disability, making interventions more challenging, and of the environment's impact on the health of people with disabilities.

Those considering adding disability content were being challenged. One respondent indicated that there are "lots of classes dealing with social determinants of health, and even just including disability in the discussion would be a huge exposure for students to new ideas and issues of disability." "We can't increase faculty, but we could look at projects, health promotion, small group discussion or include as part of a certificate already under consideration," said another respondent. "This is really a good question to ask ourselves as we revamp our curriculum," said another. In summary, the discussions with respondents showed both a sincere interest and an engagement in the topic of disability in public health curricula.

CURRENT STATE OF DISABILITY IN MPH CURRICULA

This survey was our third attempt to clarify the place of disability content in public health curricula, specifically in MPH programs across the United States. Although the specific survey targets and respondents differ across all three surveys, limiting exact comparisons, general changes are worth noting. A cursory comparison of the studies reveals that although the 1999 study recommended systemic and comprehensive coverage of matters related to disability in public health curricula, with dedicated courses across the curricula,2 disability content in 2019 was more likely in dual degree and multidisciplinary programs. The 2011 study recommended clarifying disability content in MPH curricula in future follow-up studies.3 Only a handful of MPH courses were found in 2019 that specifically dealt with disability content: foundations of public health and disability; epidemiology of disability; disability law, policy, ethics, and advocacy; public health interventions in disability; and leadership education in neurodevelopmental and related disabilities. This MPH disability-specific content was distributed among two or three schools and programs of public health. The results indicate that students in MPH programs are rarely gaining an orientation, much less an intentional education, that will help them serve this population.

Public health curricula development has not seized the opportunity to train a workforce ready to improve public infrastructure and environmental designs for people with disabilities. Other disciplines have taken this on. This observation is amplified by the fact that 84% of the respondents indicated that non-MPH graduate programs in their university provide courses that highlight or deal substantially with disability. Schools and programs of public health in our study may believe that the health and well-being of people with disabilities are being sufficiently served by other academic units. Unfortunately, this is not the case. The health disparities literature is replete with data showing the vulnerability of this population.4-6 However, 38 (64%) of the respondents indicated that they had considered greater inclusion of disability in their curriculum, and our conversations with respondents after completion of the survey suggested that they are willing to explore disability content. The subjective results of the follow-up discussions provided us with some clear ideas of the challenges and opportunities. Faculty are often unfamiliar with disability constructs and may not themselves have been exposed to the health and well-being issues of this population. We found the openness of the discussions encouraging, and we are optimistic about improved inclusion.

IMPROVING PUBLIC HEALTH DISABILITY TRAINING

Public health is a foundation for our society. Its mission is to protect and improve the health and well-being of all its citizens. Public health's story is one of progressively identifying vulnerable populations and creating and implementing population-based approaches to support the health of those populations. Training professionals in how to identify the magnitude and severity of problems in the population and then appropriately intervening is the cornerstone of academic education in public health. Disability as a construct and people with disabilities as a population facing health inequalities have not yet emerged as integral parts of public health education and training. Perhaps training in undergraduate public health will be a subject for future exploration.

It is now time for public health programs to engage fully in training and educating both public health students and working public health professionals. Griffen and Havercamp have provided a framework and essential competencies for implementing this agenda to develop a disabilitycompetent workforce.7 It is left for academic partners to accept the challenge of adding disability in a substantive way to standalone courses and integrating disability into existing courses in public health science, policy, and practice. ÂfPU

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Purchaser Licensing, Point-of-Sale Background Check Laws, and Firearm Homicide and Suicide in 4 US States, 1985–2017

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ABSTRACT (ENGLISH)

Objectives. To estimate and compare the effects of state background check policies on firearm-related mortality in 4 US states. Methods. Annual data from 1985 to 2017 were used to examine Maryland and Pennsylvania, which implemented point-of-sale comprehensive background check (CBC) laws for handgun purchasers;Connecticut, which adopted a handgun purchaser licensing law;and Missouri, which repealed a similar law. Using synthetic control methods, we estimated the effects of these laws on homicide and suicide rates stratified by firearm involvement. Results. There was no consistent relationship between CBC laws and mortality rates. There were estimated decreases in firearm homicide (27.8%) and firearm suicide (23.2%-40.5%) rates associated with Connecticut's law. There were estimated increases in firearm homicide (47.3%), nonfirearm homicide (18.1%), and firearm suicide (23.5%) rates associated with Missouri's repeal. Conclusions. Purchaser licensing laws coupled with CBC requirements were consistently associated with lower firearm homicide and suicide rates, but CBC laws alone were not. Public Health Implications. Our results contribute to a body of research showing that CBC laws are not associated with reductions in firearm-related deaths unless they are coupled with handgun purchaser licensing laws.

FULL TEXT

Headnote

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Methods. Annual data from 1985 to 2017 were used to examine Maryland and Pennsylvania, which implemented point-of-sale comprehensive background check (CBC) laws for handgun purchasers;Connecticut, which adopted a handgun purchaser licensing law;and Missouri, which repealed a similar law. Using synthetic control methods, we estimated the effects of these laws on homicide and suicide rates stratified by firearm involvement.

Results. There was no consistent relationship between CBC laws and mortality rates. There were estimated decreases in firearm homicide (27.8%) and firearm suicide (23.2%-40.5%) rates associated with Connecticut's law. There were estimated increases in firearm homicide (47.3%), nonfirearm homicide (18.1%), and firearm suicide (23.5%) rates associated with Missouri's repeal.

Conclusions. Purchaser licensing laws coupled with CBC requirements were consistently associated with lower firearm homicide and suicide rates, but CBC laws alone were not.

Public Health Implications. Our results contribute to a body of research showing that CBC laws are not associated with reductions in firearm-related deaths unless they are coupled with handgun purchaser licensing laws. (Am J Public Health. 2020;110:15461552. doi:10.2105/AJPH.2020.305822)

Firearms were the second-leading mechanism of death by injury in the United States in 2018, resulting in 39 740 deaths.1 Laws intended to keep firearms from individuals at the highest risk of harming themselves or others may reduce firearm-related deaths, but they rely on background checks and other systems for vetting those seeking to acquire firearms.

Although federal law requires individuals who purchase firearms from federally licensed dealers to pass a background check, no background check is required for purchases from private sellers. As of January 2020, 21 states required a background check for at least some private firearm sales. These state laws can be sorted into 2 broad categories: pointof-sale comprehensive background check (CBC) laws and purchaser licensing laws. Both categories require firearm purchasers to pass a background check prior to a sale or transfer, but they differ with respect to timing and process.

CBC laws require a background check for private purchasers at the point of sale. Prospective purchasers and sellers typically go to federally licensed dealers who process the transfer by submitting applications to the Federal Bureau of Investigation or state law enforcement agencies to determine whether the applicant is legally qualified to acquire a firearm. Under purchaser licensing laws, a prospective purchaser is required to apply for a license directly to a state or local law enforcement agency that vets the application and initiates a background check, often aided by mandated fingerprinting. Private sellers and federally licensed dealers can sell handguns only to individuals with valid licenses. Absent a CBC law, residents of states with a licensing law may not need to undergo a point-of-sale background check if they have a valid license to purchase. In some states, a valid permit to carry a concealed handgun can substitute for a license to purchase or a point-of-sale background check.

Although individual-level studies of background checks suggest that they are effective,2 4 recent state-level research casts doubt on the population-level effectiveness of CBC laws alone in reducing firearm-related deaths.5 7 Studies suggesting CBC law effectiveness have methodological limitations including cross-sectional designs8 and exclusion of CBC laws that apply only to handguns.9 In 2018, handguns accounted for 90% of the firearms used in homicides in which the type of firearm was specified.10

Studies in several US states have shown that firearm purchaser licensing laws are associated with reductions in firearm homicides.3,8 Connecticut enacted a handgun purchaser licensing law in 1995 that was associated with significant decreases in rates of firearm homicides11 and firearm suicides.12 After the 2007 repeal of Missouri's handgun purchaser licensing law that also functioned as a point-of-sale CBC law, rates of firearm homicides13,14 and suicides12 increased in the state, as did indicators of guns diverted for criminal use.15 Critics of these studies identified the relatively short periods of postlaw data in Missouri and Connecticut and possible overreliance on Rhode Island as a point of comparison with Connecticut's trends.16

In this study, we improved on prior analyses of purchaser licensing laws in Connecticut and Missouri and applied similar methods to analyze point-of-sale-only laws in Maryland and Pennsylvania, which adopted typical CBC laws in 1996 and 1995, respectively. We lengthened the period of observation for Connecticut and Missouri and applied a uniform analytic approach across all 4 states, comparing the findings with respect to CBC and licensing policies.

METHODS

Following the example of some earlier studies oflicensing and CBC laws,6,7,11,13 we used the synthetic control method17 to compare each state's homicide and suicide rates with estimates of the counterfactual: each intervention state's forecasted homicide and suicide rates had the law not been enacted. In accord with the synthetic control method, we used a series of preintervention outcomes and other covariates to construct a convex combination ofweighted donor states that best approximated the pretreatment outcome and covariate trends in the treated state (the state with the relevant policy change). The weights were determined on the basis of their capability to minimize the prediction error during the period prior to the law change being evaluated. The donor pool of potential controls contained states that did not have the law of interest in place during the study period. This weighted combination of donor states-the synthetic control-was compared with the treated state in the posttreatment period to estimate the effect of the intervention. We present the mean square predicted error (MSPE) for the preintervention period as a measure of model fit.

Each state law change was evaluated for its association with rates of firearm homicides, nonfirearm homicides, firearm suicides, and nonfirearm suicides. Each prelaw period was 10 years; the postlaw period was determined by the amount of postlaw data available after the law change and the legal environment of each state. The time period for Pennsylvania's 1995 CBC law ran from 1985 to 2017. For Maryland's 1996 CBC law, the postlaw period was truncated at 2013 because the state adopted a handgun purchaser licensing law late that year. The study period for Missouri's repeal of its 2007 licensing law started in 1997 and ended in 2016 because Missouri began allowing permitless concealed carry on January 1, 2017. Prior work has shown an association between less restrictive concealed carry laws and violent crime.18 For Connecticut, we present data through 2017 but also provide estimates that exclude 2013 to 2017 because ofa state program under which several cities began implementing focused deterrence programs to curb gang violence.19

The donor pools of potential controls for Pennsylvania (29 states), Maryland (33 states), and Connecticut (39 states) consisted ofstates that did not have the law of interest in place throughout the study periods just described. Missouri's donor pool (8 states) consisted of states that had a purchaser licensing law for the entirety of the study period.

For each model, the effect was estimated by determining the difference in postlaw means between the treated state and the synthetic control and calculating the percentage increase or decrease from the synthetic control. To assess whether the estimated effects of CBC and purchaser licensing laws were unusual with respect to effects that would be estimated in other states, we performed placebo tests with all states in the donor pool for each law change.17 The estimated effect for the treated state was compared with the placebo effect distribution estimated from the donor states. To make a reliable inference, we had to find that only a small proportion of control states had a more extreme placebo effect estimate than the effect estimated for the true treated state. We used this proportion as a permutation distribution pseudo P value. Because a synthetic control that adequately fit the preintervention data could not be estimated for each donor state, we restricted the placebo tests to the subset of donor states with prelaw MSPEs less than 5 times the treated state's prelaw MSPE to avoid comparisons with synthetic controls that had poor fits.

We used death certificate data obtained from the National Center for Health Statistics through the CDC WONDER database to generate homicide and suicide mortality rates.20 Because annual state suicide data are often volatile, we smoothed suicide mortality rates by analyzing 3-year moving averages. Annual state-level predictors were chosen on the basis of prior research and theoretical relationships between sociodemographic variables and the dependent variables of interest.

For homicide, state-level predictors were population size, law enforcement expenditures per capita, law enforcement officer population, percentage of the population identifying as Black, percentage of the population identifying as Latino, the Gini coefficient (a measure of income inequality), percentage ofthe population 15 to 24 years of age, percentage ofthe population 0 to 18 years of age, percentage of the population living in a metropolitan statistical area, robbery rate, population density, poverty rate, jobs per capita, average individual income per capita, unemployment rate, and incarceration rate.

For suicide, the predictors were unemployment rate, poverty rate, percentage ofthe population identifying as male, percentage of the population reporting being married, percentage of the population identifying as Black, percentage of the population identifying as a veteran, percentage ofthe population living in a metropolitan statistical area, ethanol consumption per capita, religious adherence, educational attainment, and overdose rate.

Each model included prelaw averages for all of these predictors and values of the outcome variable for every other prelaw year. When necessary, missing predictor data from intercensal years were interpolated. These data were obtained from the Bureau of Economic Analysis,21 the Bureau ofLabor Statistics,22 the Census Bureau,23 and the Federal Bureau of Investigation's Uniform Crime Report.24

RESULTS

The synthetic control models revealed no consistent relationship between comprehensive background check laws and firearm mortality in Maryland and Pennsylvania. There were, however, consistent relationships between firearm mortality and purchaser licensing laws in Connecticut and Missouri. Measures of synthetic control model fit, donor states contributing to each synthetic control, and donor weights are presented in Appendix Table A (available as a supplement to the online version ofthis article at http://www.ajph.org). The placebo results we report are the proportions of control states that had a more extreme placebo effect estimate than the effect estimated for the true treated state. We also report these proportions as fractions, with the number of states with a more extreme placebo effect estimate in the numerator and the number of total control states in the denominator. We restricted the denominator to the subset ofdonor states with prelaw MSPEs less than 5 times the treated state's prelaw MSPE.

Comprehensive Background Check Laws

Results for Maryland and Pennsylvania are presented in Table 1. After implementation of a CBC law (1996-2013), Maryland saw a 17.5% increase in firearm homicide rates relative to its synthetic control (placebo = 0.06; 2/32) and a 33.2% increase in nonfirearm homicide rates (placebo = 0.06; 2/33). Maryland's firearm suicide rate was 15.4% lower than that of its synthetic control following the state's passage of a CBC law (placebo = 0.13; 3/24), but there was also a 21.8% decrease in nonfirearm suicides (placebo = 0.03; 1/32) relative to the synthetic control. Pennsylvania's firearm homicide rate was 21.5% higher than that of its synthetic control for the post-CBC law period 1996 to 2017 (placebo = 0.13; 3/23), whereas its nonfirearm homicide rate was 10.0% lower (placebo = 0.26; 5/19). During the same period, Pennsylvania saw a 5.3% increase in firearm suicides relative to its synthetic control (placebo = 0.21; 4/19) and an 11.8% decrease in nonfirearm suicides (placebo = 0.09; 1/11).

We performed post hoc analyses to determine whether these results might be partially explained by factors unique to the largest cities in Maryland and Pennsylvania, which accounted for a substantial share of homicides in the 2 states. When Baltimore data were excluded from the Maryland model, the CBC law was associated with insignificant increases inboth firearm (3.1%; placebo = 0.34; 11/32) and nonfirearm (10.8%; placebo = 0.17; 4/ 24) homicides. However, the estimated effect of the CBC law in Pennsylvania on firearm homicides did not diminish when Philadelphia data were excluded (23.9%; placebo = 0.14; 2/14). Nonfirearm homicides increased 4.1% in the model without Philadelphia (placebo = 0.33; 5/15).

Purchaser Licensing Laws

Purchaser licensing laws were more clearly associated with changes in firearm homicide rates (Table 2 and Figure 1). After implementation of Connecticut's licensing law, there was a 27.8% decrease in firearm homicides relative to the state's synthetic control from 1995 to 2017 (placebo = 0.03; 1/38). This effect was similar when deaths from the 2012 Newtown school shooting were removed from homicide counts (Appendix Table J, available as a supplement to the online version of this article at http://www.ajph.org; change = -24.2%; placebo = 0.00; 0/35). The estimate for the effect of Connecticut's licensing law is somewhat smaller if the data extend only to 2012, before focused deterrence programs curbed urban gang violence in several of the state's cities (Appendix Table I, available as a supplement to the online version of this article at http://www.ajph.org; change = -19.9%; placebo = 0.03; 1/34). Nonfirearm homicide rates did not change relative to the synthetic control over the period from 1995 to 2017 (placebo = 0.61; 20/33).

From the 1995 implementation of its law through 2017, Connecticut saw a 32.8% decrease in firearm suicides (Table 2 and Figure 2; placebo = 0.06; 2/35) and a 3.3% decrease in nonfirearm suicides (placebo = 0.60; 15/25) relative to its synthetic control. In 1999, Connecticut adopted a law akin to an extreme risk protection order law. Under this law, police are authorized to temporarily take guns from individuals when there is probable cause to believe that they are at imminent risk of injuring themselves or others. Despite this law, very few gun removals were carried out until 2007, after the mass shooting at Virginia Tech.25 Research has shown that individuals subjected to these orders are more often suicidal than homicidal and that the removal law is associated with 26,27 decreases in firearm suicides.

To examine the possible effects of the removal law on our models of firearm and nonfirearm suicides in Connecticut, we split the effect estimate into 2 periods: 1995 to 2006 and 2007 to 2017. From 1995 to 2006, there was a 23.2% decrease in firearm suicides and a 3.2% decrease in nonfirearm suicides in Connecticut relative to the synthetic control. From 2007 to 2017, there was a 40.5% decrease in firearm suicides and a 3.4% decrease in nonfirearm suicides.

From 2007 to 2016, following the repeal of its purchaser licensing law, Missouri's firearm homicide rate rose 47.3% relative to its synthetic control (Table 2 and Figure 1; placebo = 0.00; 0/6). Over the same period, there was an 18.1% increase in nonfirearm homicides relative to the synthetic control (placebo = 0.00; 0/8). The estimated effect on firearm homicides was 2.6 times larger than that for nonfirearm homicides. There was an abrupt increase in firearm homicides immediately after the law's repeal and no such change in nonfirearm homicides (Figure 1 and Appendix Figure F, available as a supplement to the online version ofthis article at http://www.ajph.org). Missouri's repeal of handgun purchaser licensing was associated with a 23.5% increase in firearm suicides (placebo = 0.00; 0/7) and a 6.9% increase in nonfirearm suicides (placebo = 0.25; 1/4) relative to the synthetic control (Table 2). Full truncated 10-year model results for Connecticut, Maryland, and Pennsylvania, as well as additional figures for all 4 states, are available in the appendix.

DISCUSSION

Across the 4 state law changes examined in this study, purchaser licensing laws were consistently associated with lower rates of both firearm homicides and firearm suicides, but point-of-sale CBC laws were not. Relative to Connecticut's synthetic control, we estimated a 27.8% overall decrease in the state's firearm homicide rate and a 32.8% overall decrease in its firearm suicide rate. The decrease in firearm suicides was somewhat greater after the 2007 implementation of a risk-based firearm removal law. Although this could indicate complementary effects of Connecticut's purchaser licensing and gun removal laws, the number of removal orders is likely too small to achieve population-wide effects. A more plausible explanation is that suicide mortality continued to decrease because of a growing effect of licensing stemming from reduced access to firearms in the state. For Missouri, we estimated a 47.3% overall increase in firearm homicides and a 23.5% increase in firearm suicides. In tandem, the estimates for Connecticut and Missouri suggest that purchaser licensing laws are protective.

Our results are consistent with prior studies that also revealed protective effects of Connecticut's and Missouri's handgun purchaser laws.11 14 Our study provides additional years of data and new statistical models that indicate larger protective effects for suicides in both states. In comparison with previous studies, our estimates of changes in firearm homicide rates associated with purchaser licensing were larger in the case of Missouri and smaller in the case of Connecticut. Other studies designed to estimate average associations across many law changes have also shown that licensing laws are associated with lower rates of firearm-related homicides5 and suicides,12 fewer fatal mass shootings,28 and fewer instances oflaw enforcement officers shot in the line of duty.29

Although there were increases in Missouri in both firearm and nonfirearm mortality, the differences in firearm mortality were 2.6 times larger. The increase in nonfirearm homicides coincident with the repeal of Missouri's licensing law may indicate that other factors affected mortality rates in Missouri after the repeal of its licensing law and that the actual effect on firearm mortality was somewhat smaller than our estimate. In a recent study incorporating data through 2016, there was an estimated 27% increase in firearm homicides when changes in Missouri were compared with those in states from the region with similarly high baseline homicide rates.14

Maryland's CBC law was associated with increases in homicide rates; however, the increases were specific to Baltimore and were not evident in the rest of the state. This suggests that either conditions in Baltimore modified the law's effect or the estimate of the law's effect was biased by unmeasured confounders. It is unclear how to interpret the positive association between Pennsylvania's CBC law and homicide rates. If the law substantially limited the ability of potential homicide victims to access firearms and successfully defend themselves, one would expect an even greater harmful effect of licensing. Yet, licensing laws were linked to lower homicide rates.

Consistent with previous longitudinal studies,6,7 CBC laws in Maryland and Pennsylvania did not appear to reduce firearm suicides. Although Maryland experienced a decrease in firearm suicides after implementation of a CBC law, there was an even larger percentage decrease in nonfirearm suicides. This latter drop was more unusual in contrast to placebo states, suggesting that other factors may have been contributing to changing suicide rates in Maryland.

Comprehensive background check requirements may be necessary to prevent prohibited individuals from accessing firearms; without purchaser licensing requirements, however, they may be insufficient to achieve this objective and prevent lethal gun violence. The effectiveness of CBC laws could be enhanced by more robust efforts to enforce the laws and promote compliance, broader prohibiting conditions, better record keeping, and expanded time to complete the checks.30 A prior study documented infrequent enforcement of Maryland's and Pennsylvania's CBC laws,31 which weakens the laws' capacity to deter illegal transfers of firearms. When Maryland added handgun purchaser licensing requirements to its CBC law in 2013, diversions of guns for criminal use shortly after retail sales dropped dramatically.32 This suggests that point-of-sale CBC requirements in Maryland were an insufficient deterrent to illegal diversions without purchaser licensing.

There are multiple reasons that firearm purchaser licensing might be more effective than point-of-sale CBC laws without licensing. Purchaser licensing requires vetting procedures that are more robust than is the case for point-of-sale CBC laws. This may deter individuals who might otherwise buy guns with the intention of criminal misuse or for transfer to a prohibited individual. States with purchaser licensing laws allow more time for vetting purchase applications and often check more complete sources ofstate data on prohibiting conditions than is the case under point-of-sale CBC laws. Firearm purchaser licensing also makes it easier for private sellers to verify that a prospective buyer is not prohibited from purchasing a firearm. Finally, licensing increases the real cost of purchasing firearms with additional time commitments and licensing fees. This likely reduces firearm ownership and the number of guns within a population.

The process required to obtain a purchaser license may also be protective with respect to suicide. It is much more difficult for individuals to make an impulsive decision to purchase a firearm if they need to secure a license first. Many suicide attempts occur within minutes or hours of initial suicidal ideation.33 Longer waiting periods between applying to purchase firearms and receiving the firearms are associated with lower rates of firearm homicides and suicides.34

This study has potential limitations. First, we examined a limited number of law changes. For purchaser licensing, we assessed the only 2 law changes for which there were at least 5 years of postlaw data available. For CBC law changes, prior law changes since 1990 had already been evaluated,9 and recent changes provided few postlaw data points. Second, although the synthetic control method is a robust strategy for estimating policy effects, the control pool for our analyses was somewhat limited in the case ofMissouri.

Third, we sought to expand on previous work by extending the time period for each model to include the latest possible year of data. Our results are, therefore, more informative, but longer postlaw periods may create some uncertainty with respect to the capability ofthe models to accurately estimate the counterfactual. Finally, visual analysis of some of our synthetic control plots revealed that although the prelaw MSPE was minimized, there was a separation between the synthetic control and the treated state just before a law change. Such separation prior to a change could be random variation or could be indicative of unmeasured factors influencing trends between prelaw and postlaw change periods that might bias effect estimates.

Despite these limitations, our analyses have many strengths. We used a rigorous statistical method that minimizes errors in model prediction. We contrasted the patterns of estimated law effects across firearm and nonfirearm homicides and suicides to assess whether estimated effects were specific to deaths involving firearms. The CBC laws and one of the purchaser licensing laws were all adopted in 1995 or 1996, allowing for comparisons within the same historical period. We offered a fourth law change, Missouri's repeal of purchaser licensing during a time of relatively stability in homicide trends in Missouri and nationwide, to contrast with Connecticut's implementation of purchaser licensing in a different region and time period.

Although data on public support for firearm policies reveal somewhat broader support for CBC laws than is the case for purchaser licensing, a 2019 national survey reported 77% support for handgun purchaser licensing.35 CBC laws are critical for keeping firearms from high-risk individuals, but they may be insufficient to significantly reduce firearm mortality without purchaser licensing. AfPU

CONTRIBUTORS

A.D. McCourt led the writing and analyses. A.D. McCourt, C.K. Crifasi, E.A. Stuart, J.S. Vernick, and D. W. Webster designed the study and statistical analyses. R. M. C. Kagawa and G.J. Wintemute provided critical review and interpretation of the data, analyses, and findings. All of the authors contributed to data interpretation and critical revisions of the article.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

No protocol approval was needed for this study because secondary data sources were used to analyze aggregated mortality rates.

Sidebar

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DETAILS

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Fifteen Years After Katrina: Paving the Way for Health Care Transformation

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ABSTRACT (ENGLISH)

Following the devastation of the Greater New Orleans, Louisiana, region by Hurricane Katrina, 25 nonprofit health care organizations in partnership with public and private stakeholders worked to build a community-based primary care and behavioral health network. The work was made possible in large part by a $100 million federal award, the Primary Care Access Stabilization Grant, which paved the way for innovative and sustained public health and health care transformation across the Greater New Orleans area and the state of Louisiana.

FULL TEXT

Headnote

Following the devastation of the Greater New Orleans, Louisiana, region by Hurricane Katrina, 25 nonprofit health care organizations in partnership with public and private stakeholders worked to build a community-based primary care and behavioral health network. The work was made possible in large part by a $100 million federal award, the Primary Care Access Stabilization Grant, which paved the way for innovative and sustained public health and health care transformation across the Greater New Orleans area and the state of Louisiana. (Am J Public Health. 2020; 110: 1472-1475. doi:10.2105/AJPH. 2020.305843)

1=11 See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

After Hurricane Katrina devastated the Greater New Orleans (GNO), Louisiana, area, the US Department of Health and Human Services Centers for Medicare and Medicaid Services (CMS) awarded the Primary Care Access Stabilization Grant (PCASG) to the Louisiana Department of Health to be programmatically administered by the Louisiana Public Health Institute.1,2

INTERVENTION

The PCASG was created primarily to fund the transformation of primary care services by supporting community-based health care organizations in improving care access, coordination, quality, and sustainability, while reducing the GNO area residents' reliance on emergency departments.

PLACE AND TIME

From June 2007 through September 2011, the PCASG was implemented in the GNO area, which comprises four parishes (called "counties" in many states): Jefferson, Orleans, Plaquemines, and St. Bernard.

PERSON

The PCASG was implemented across 25 community-based health care organizations, which served more than 405

000 unduplicated individuals.

PURPOSE

In August 2005, Hurricane Katrina and the subsequent failure of the levee system caused significant damage, resulting in health care infrastructure destruction and workforce displacement.3 Local, state, and national stakeholders convened to strategize and create action plans for the most immediate health needs of the GNO area residents and to address the longer term health care infrastructure needs.4

The community agreed that this crisis brought an opportunity to create a health care system that was more responsive to GNO area residents' needs, particularly residents who were lower income or under- or uninsured. Before Katrina, the Medical Center of Louisiana (formerly Charity Hospital), the state-run public hospital, served the primary care needs of lower income and uninsured GNO area residents in both its emergency departments and outpatient clinics.1

By the end of2005, the Greater New Orleans Health Planning Group released a framework report that called for increasing community-based clinics in the areas of highest need.1 This report also informed policy development for health care redesign efforts. The Louisiana Healthcare Redesign Collaborative4 convened in 2006; it released a report that informed the plan for rebuilding the health care infrastructure in the hurricane-affected areas of Louisiana and offered public testimony to federal legislators to request that immediate resources be granted to the GNO area. As a result of these efforts, on May 23, 2007, the CMS released the PCASG-a three-year $100 million grant under section 6201(a)(4) of the Deficit Reduction Act of 2005 (Pub L No. 109-171)-to fund the GNO area health care organizations in an effort to transform the primary health care infrastructure.1,2 The PCASG was awarded to the Louisiana Department ofHealth with the Louisiana Public Health Institute as the local . 1,2 partner.

The Commonwealth Fund reported that restoring health care to how it existed before the storm would have been detrimental to the health of GNO area residents-risking "experiencing the same uneven quality, high utilization, and poor health outcomes [that] historically characterized the state's health system performance. "5(p2) A new opportunity came from the PCASG to move from a hospital-based system to a community-based primary care network that was well organized and offered highquality, person-centered care.5

IMPLEMENTATION

The PCASG project team solicited applications from community-based health care organizations that provided primary care services in the GNO area at the time ofapplication. In August 2007, through a noncompetitive grant application process, the PCASG project team awarded grants to 25 of the 42 eligible applicants. To receive the grant, PCASG-participating organizations were required to attest to the grant conditions as well as the following: operating in the GNO area and offering primary care services, serving all residents regardless of ability to pay, and having created a sustainability plan.1,2 The PCASGparticipating organizations (see the box on this page) comprised 17 community health centers and eight community behavioral health organizations that separately operated 67 service delivery sites. The number of practice sites steadily grew from 67 to reach a high of 95 sites, and as of June 2011, there were 71 practice sites operating.1 The decrease in site participation was attributable to the organizations being unable to sustain operations without grant funding or to organizations opting not to continue during the no-cost extension period because of the anticipated limited PCASG funding and the continued requirement to comply with grants administration and reporting.

EVALUATION

The PCASG evaluation consisted of internal programmatic evaluation and monitoring activities at the practice and systems levels conducted by the Louisiana Public Health Institute, as well as external evaluation and research activities being administered by the University of California, San Francisco and the Commonwealth Fund.1 There was no control group.

By the end of the PCASG, participating organizations had become an essential source of care for more than 405 000 unduplicated individuals of the region's population. The PCASG resulted in a steady rise of the number of people served at the awarded grantee practice sites (Figure 1).1

As clinics reached the end of their PCASG funds, there was a decline in the number of patients served. In 2010, after the Greater New Orleans Community Health Connection was established (see the "Sustainability" section), the number ofpatients seen increased again. By the end of the PCASG, a majority of individuals seen in PCASGparticipating organizations were uninsured (44%), covered by Medicaid (24%), or privately insured (14%).1 As a result of PCASG funding, progress was made in developing a higher quality community-based health care system.6 Individuals served in the PCASG network reported greater access to high-quality health care and more confidence in their health care providers than do most US adults.5

ADVERSE EFFECTS

The PCASG funded most of the services delivered by the PCASG-participating organizations, and the individuals served remained uninsured. "Implementing new models of care became a second-tier priority after simply keeping the clinics doors open."6(p1736) This suggests that without Medicaid expansion this investment initially doubled down on what was a two-tiered system of health care delivery statewide. Today, that infrastructure is largely being used as part of what is envisioned to be a unified health care ecosystem serving all populations; however, in many places there is still a two-tiered system based on who is willing to accept Medicaid beneficiaries. Some of this is driven by the same reimbursement challenges felt nationwide, but the historical comfort with a two-tiered system in Louisiana, which this work unintentionally reinforced, has meant there is less urgency felt about the need to address this issue.

SUSTAINABILITY

Today, 504HealthNet, a local membership and advocacy organization, supports most of the PCASG-participating organizations that remain. As a result of PCASG network outcomes, in August 2010 Louisiana applied and was approved for a CMS 1115 demonstration waiver to create the Greater New Orleans Community Health Connection, which expanded insurance coverage to the area's residents aged 19 to 64 years.1 The Greater New Orleans Community Health Connection was intended to bridge funding to Louisiana's 2016 statewide Medicaid expansion, which to date has provided coverage for nearly a half million previously ineligible Louisiana residents, more than 110 000 of whom reside in the GNO area, according to the Louisiana Department of Health.

PUBLIC HEALTH SIGNIFICANCE

The PCASG investments were significant for public health, locally and nationally, and acted as a catalyst to sustain these services for the region's residents and funding to communitybased health care organizations. Studies conducted on the cost and effectiveness of the PCASG-participating organizations that became the National Committee for Quality Assurance's patient-centered medical homes can be used to guide policy to support public health and health systems transformation efforts across the country.6,7 The PCASG program offers the following lessons learned to state and local jurisdictions that have experienced a disaster: the importance of (1) policy and advocacy efforts, (2) cross-sector and public-private partnerships, and (3) using grant funding to create enduring health care systems infrastructure to support the health of all residents. Â1PU

CONTRIBUTORS

S.Davis substantially contributed to the conceptualization and design ofthe article, drafting of the content, and summarizing of Louisiana Public Health Institute's Primary Care Access Stabilization Grant program report. A. Billioux provided updated data on Medicaid expansion. A. Billioux and J. L. Avegno contributed to the "Adverse Effects" and "Public Health Significance" sections. A. Billioux, J. L. Avegno, and T. Netters contributed to the "Sustainability" section. A. Billioux, J. L. Avegno, T. Netters, G. Davis, and K. DeSalvo revised the content.J. L. Avegno contributed to the "Adverse Effects" section. J. L. Avegno, T. Netters, and G. Davis contributed to the "Purpose" section.

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To our knowledge, this article has never before been published. Data were originally presented in the PCASG final

report andaccomplishments document produced by the Louisiana Public Health Institute, were made available online, and have been cited in this article.

We are grateful to our partners who still work to achieve health equity for our residents through their current initiatives, and we would like to acknowledge the local, state, and national partners who worked tirelessly to support the PCASG program, including but certainly not limited to the leadership of the PCASGparticipating organizations, the Louisiana Department ofHealth (formerly known as the Louisiana Department ofHealth and Hospitals), the City ofNew Orleans Leadership, the Louisiana Public Health Institute Leadership and PCASG Project Team, the Commonwealth Fund, the Kaiser Family Foundation, and Louisiana Health Care Redesign Collaborative Participants. We have learned many lessons as we respond to the COVID-19 pandemicfromthefoundationthatwaslaid by this program after Hurricane Katrina.

CONFLICTS OF INTEREST

There are no conflicts of interest to report.

Sidebar

Correspondence should be sent to Shelina Davis, Chief Executive Officer, Louisiana Public Health Institute, 1515 Poydras St, Suite 1200, New Orleans, LA 70112 (e-mail: sdavis@ lphi.org). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Document 60 of 61

Meatpackers, Other Workers Face High COVID-19 Risks

Krisberg, Kim

ProQuest document link

FULL TEXT

Typical working conditions in meatpacking plants make the perfect setting for SARS-CoV-2 spread. Employees work close together, and they breathe heavily while doing physically intense high-speed labor. The plants are cold, which may affect how well the virus survives, and workers often lack paid sick leave.

As of late June, SARS-CoV-2 infections tied to US meatpacking facilities have climbed to nearly 28 000 cases and 100 deaths across 250 plants, according to the Food and Environment Reporting Network, which is mapping COVID-19 outbreaks in the food system.

Across the United States, fewer than one third of workers can do their jobs from home, putting the rest of the labor force at higher risk of contracting COVID-19 and underscoring the critical role of workplace safety in preventing spread. There is no way to know exactly how many US COVID-19 infections are attributable to workplace exposures, although some sectors-such as health care, food processing, meatpacking, agriculture, public transit, retail, and sanitation-face higher risks and are hotspots for infection.

On June 25, the United Food and Commercial Workers International Union reported that 238 of its members-workers in the grocery, meatpacking, food processing, and health care industries-had died from COVID-19 and about 29 000 had been infected or exposed in the pandemics first 100 days. In response, the union called for reinstating hazard pay in all states where COVID-19 is rising, mandating masks in public, and creating a national registry to which all employers with more than 1000 workers must regularly release data on COVID-19 illnesses, deaths, and exposures.

Despite pleas from the American Public Health Association and other advocates, the US Occupational Safety and Health Administration has failed to issue an emergency safety standard for COVID-19 as ofJuly, relegating worker safety to a patchwork of state systems and voluntary guidance.

-Kim Krisberg

Read the full story on The Nation's Health Web site at http://thenationshealth.aphapublications.org/ content/50/6/1.1.

DETAILS

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Document 61 of 61

The Environmental Health Impact of Hurricane Katrina on New Orleans

Diaz, James H, MD DrPH; Brisolara, Kari F, ScD; Harrington, Daniel J, ScD; Hu, Chih-yang, ScD; Katner, Adrienne L, DEnv

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ABSTRACT (ENGLISH)

Hurricane Katrina caused unprecedented flood damage to New Orleans, Louisiana, and has been the costliest hurricane in US history. We analyzed the environmental and public health outcomes of Hurricane Katrina by using Internet searches to identify epidemiological, socio-demographic, and toxicological measurements provided by regulatory agencies. Atmospheric scientists have now warned that global warming will increase the proportion of stronger hurricanes (categories 4-5) by 25% to 30% compared with weaker hurricanes (categories 1-2). With the new $14.6 billion Hurricane Storm Damage Risk Reduction System providing a 100-yearstorm surge-defensive wall across the Southeast Louisiana coast, New Orleans will be ready for stronger storms in the future. (Am J Public Health. 2020;110:1480-1484. doi:10. 2105/AJPH.2020.305809)

FULL TEXT

Headnote

Hurricane Katrina caused unprecedented flood damage to New Orleans, Louisiana, and has been the costliest hurricane in US history. We analyzed the environmental and public health outcomes of Hurricane Katrina by using Internet searches to identify epidemiological, socio-demographic, and toxicological measurements provided by regulatory agencies. Atmospheric scientists have now warned that global warming will increase the proportion of stronger hurricanes (categories 4-5) by 25% to 30% compared with weaker hurricanes (categories 1-2). With the new $14.6 billion Hurricane Storm Damage Risk Reduction System providing a 100-yearstorm surge-defensive wall across the Southeast Louisiana coast, New Orleans will be ready for stronger storms in the future. (Am J Public Health. 2020;110:1480-1484. doi:10. 2105/AJPH.2020.305809)

urricane Katrina caused unprecedented damage to New Orleans, Louisiana, by flooding 80% of the city. Katrina was the costliest hurricane in US history and caused $17 billion in damages in Orleans Parish (county equivalent) alone.1 Katrina also caused more deaths in Louisiana (n = 1170) than in any other Gulf Coast state.2 In addition to its tragic human toll, Katrina left an environmental toll of oil spills, storm debris, damaged sewage and water treatment systems, abandoned housing, and widespread mold.

We identify Katrina's major health and environmental impacts on New Orleans and their enduring effects. The major categories of Katrina's environmental legacies included population relocation, abandoned neighborhoods, floodwaters and sediments, solid wastes and landfills, infrastructure damages, microbiological effects, and coastal land losses.

METHODS

We used a broad array ofkey words to query the Internet search engines Medline, PubMed, Google, Google Scholar, and Cochrane to identify scientific articles on biological, epidemiological, sociodemographic, and toxicological observations and measurements.

The key words included "hurricanes," "climate change," "Hurricane Katrina," "Hurricane Rita," "New Orleans post-Katrina and Rita," "Louisiana post-Katrina and Rita," and "Louisiana coastal land loss." The articles we reviewed included local, state, and federal government publications; observational and surveillance investigations; mycological and toxicological investigations; and nongovernmental organization and press accounts ofneighborhoodlevel activities and storm-related economic and built environment damages.

RESULTS

The neighborhoods hardest hit by flooding were predominantly African American and Vietnamese American neighborhoods in eastern parts of the city, which were originally established on reclaimed, lowlying, Lake Pontchartrain-bordering wetlands.3 As Hurricane Katrina made landfall and headed inland east of the city, its counterclockwise winds forced Lake Pontchartrain's brackish waters into the city's insufficiently walled drainage canals, bursting levees and flooding 80% ofthe city for up to 43 days.1,3

Population relocation occurred soon after Katrina and continues presently as homeowners rebuild in new neighborhoods with less flood damage. Previous investigations confirmed observations that minority communities sustained more hurricane-caused damages than did affluent communities (which have greater resources to rebuild) .4

Abandoned Neighborhoods

Orleans Parish still has more than 15 000 vacant lots and more than 5000 vacant housing units.3 These vacancies resulted from combinations of the demolition of irreparably damaged homes and the abandonment of commercial and rental properties in the most heavily flooded areas of the city.3 The widespread vacancies and abandoned neighborhoods stimulated increases in rodent populations, especially in blighted areas of eastern New Orleans, which had accumulated debris from illegal dumping and unmaintained vegetation.5

Floodwaters and Sediment

A variety oftoxic compounds and pathogens contaminated more than 400 billion gallons of floodwaters.6 The concentrations ofthese compounds initially exceeded safe human exposure limits in most cases (Table 1).6 10

The major toxic compounds in floodwaters that contaminated soil sediments included (1) the heavy metals arsenic (from termiticide-treated outdoor furniture, decks, and siding) and lead (from lead-based paints and plumbing); (2) the volatile organic compounds gasoline and diesel fuel (from flooded vehicles, petrochemical refineries, and fuel storage depots); (3) the polycyclic aromatic hydrocarbon, benzo(a) pyrene (from building fires sparkignited by ruptured natural gas lines); and (4) untreated human waste from flooded sewer lift stations.7,11-13

As the floodwaters were pumped out of the city and into Lake Pontchartrain, they left behind a thick layer of soil sediments covering most of New Orleans.12 Ground-based teams soon began systematic sampling of soil sediments to determine their degree of contamination and to assess potential human health risks. Table 1 compares the levels of soil sediment contaminants, including biomarkers for molds and bacteria in New Orleans before and after Hurricane Katrina.6-10

A combination ofpre- and posthurricane initiatives made elevated soil lead levels less ofan exposure problem than anticipated. Before Katrina, federal grants supported soil lead removal and replacement initiatives on inner-city playgrounds.7-9 A series of simultaneous municipal grants sponsored neighborhood pediatric blood lead-monitoring programs.7-9 The regulation of leaded paints and their disposal, the elimination of lead additives from gasoline, and the replacement of lead plumbing with plastic began in the 1980s.9 Neighborhood blood lead levels in children soon decreased following the combined impact of these prehurricane initiatives and continued to fall after Katrina as storm debris and construction wastes were rapidly removed to nearby landfills (Table 1).6-12

Storm Debris, SoLid Wastes, and Landfills

The rapid disposal of storm debris and solid wastes posed major logistical problems for New Orleans. First, the volume of storm wastes and debris was immense. Solid wastes needing disposal included 350 000 abandoned vehicles, 120 million cubic yards of storm debris, and about 750 000 white goods (i.e., standard kitchen appliances, such as refrigerators, freezers, washers, and dryers). Second, the transportation of wastes outside the disaster impact zone was not permitted for several reasons, including the potentially hazardous nature of the wastes, (e.g., arsenical leachates from pesticide-treated wood and siding) and the potential for spreading endemic, subterranean Formosan termites. The local established landfills were also not designed to accept noncommercial and hazardous wastes. Lastly, air quality concerns eliminated onsite open-air incineration as an option.11

Massive waste and debris removal requirements left little time for the careful separation of hazardous commercial and household wastes from construction and demolition debris before transport to reopened landfills. The only solution was local waste disposal at existing and closed landfills. Although never secured for hazardous wastes, the Agriculture Street landfill reopened temporarily in 1965 to accept a variety ofwastes from Hurricane Betsy.11 In 1994, arsenic, lead, and petrochemicals were detected in soil in new neighborhoods built on top of the abandoned landfill, later designated a Superfund site.11 Based on this past experience, even the construction and demolition debris sent to nonsecured landfills during flooding disasters retained the potential to leach toxic substances from termiticide-treated wood and siding and petrochemicals from flooded vehicles, service stations, and oil storage depots, especially during heavy rains and hurricanes.11-13

The Chef Menteur Landfill in eastern New Orleans was designed for municipal use and not equipped for hazardous wastes. In early February 2006, New Orleans mayor C. Ray Nagin signed an executive order permitting the dumping of Hurricane Katrina storm debris in the Chef Menteur Landfill. Granted emergency powers by the city council in the wake of the hurricane, Mayor Nagin was able to override city-zoning ordinances and grant a six-month permit that turned the Chef Menteur site from a light industrial zone into a temporarily reopened landfill. The landfill was located less than two miles from a predominantly Vietnamese community in eastern New Orleans.14

Drainage canals ringed the landfill, which remained saturated with floodwaters. One of the primary drainage canals along the landfill, the Maxent Canal, ran through the most concentrated Vietnamese American community in the United States in Village de l'Est near Lake Borgne, an arm of the Gulf of Mexico.14 The community is adjacent to the Bayou Sauvage Wildlife Refuge-the nation's largest urban wildlife preserve. The Maxent Canal continues to be an irrigation source for crops of sprouts and vegetables, which in turn provide a revenue and food source for the Vietnamese community.14 According to the 2010 census, Village de l'Est, the community next to the canal, had a population of 8008. The population was mostly African American (43%) and Asian American (45%).14

Criticai Infrastructure Damages

New Orleans continues to face major environmental health threats from hurricane damage to its critical infrastructure services, including its storm and wastewater management and its drinking water treatment systems.15 Fifteen years after Hurricane Katrina, New Orleans continues to rebuild 400 miles of streets and underground water, sewer, and drainage systems in an unprecedented civil engineering project costing $4.3 billion.15 Although more than $15 billion was invested in flood-protection levees, pumps, generators, and drainage systems since Hurricane Katrina, widespread street flooding still occurs regularly in lowlying areas throughout New Orleans after heavy downpours.15

Microbiological Effects

Human fecal coliforms from flooded sewer lift stations contributed most of the bacterial endotoxins to Katrina's floodwaters. However, the levels of endotoxin units dropped within weeks as soil sediments dried out and fecal coliforms desiccated and died.12,16 In addition, the levels of most volatile organic compounds, including diesel and gasoline, decreased rapidly from evaporation as flooded soil sediments dried up.11,16

West Nile virus disease is the most common arthropod-borne infectious disease reported in Louisiana every August and September during the peak of hurricane season.17 Over the 20-year reporting period, 1999 to 2018, the mean number of West Nile virus disease cases per year was 91 (range 0-335 cases per year), for an annual incidence rate of 1.21 cases per 100 000 persons per year.17 However, in 2005, Louisiana reported 171 cases of West Nile virus disease to the US Centers for Disease Control and Prevention for a 53% increase above the mean.17 The combination of increased favorable, flooded breeding sites for Culex species mosquitoes and the loss of formal mosquito-control capabilities after the sequential hurricanes of2005 supported the increase in the mean annual number of West Nile virus disease cases.

Vibrio bacteria prefer salt and brackish water ecosystems, and human infections occur infrequently year round in Gulf coastal communities, with about 50 cases of Vibrio vulnificus reported every year across the Gulf Coast.18-20 Twenty-four hurricane-associated Vibrio infections and six deaths were reported in Louisiana following hurricanes Katrina and Rita.20 Most of these infections were wound infections caused by V. vulnificus following laceration and puncture wounds sustained while wading in contaminated floodwaters or sediment.18,19 There were a few nonfatal cases of gastroenteritis following floodwater exposures caused by Vibrio parahemolyticus.18 Only four cases of Vibrio cholerae, were reported, two of which occurred in a couple who consumed undercooked shrimp.18

Despite the observed increase in the city's rodent population, there were no increased reports of rodent-borne infectious diseases traditionally associated with prolonged flooding events, such as leptospirosis.5,19 In addition, there were no increased reports of legionellosis cases, which are more often associated with freshwater aerosol exposures rather than salt and brackish floodwater exposures.19

Mold is ubiquitous in humid, tropical Deep South areas, such as New Orleans. Prolonged periods of flooding allow mold to propagate in indoor environments.10 Continued flooding in most of New Orleans from the sequential hurricanes of 2005 promoted extensive indoor mold growth.10 Investigators observed mold growth in 46% of flooded homes and measured ß-D-glucan air levels indoors and outdoors.10 The ß-D-glucans are polysaccharide sugars, which occur naturally in fungal cell walls. They serve as very reliable biomarkers of mold spore contamination.10 Mean ß-D-glucan air levels indoors of 1.6 micrograms per cubic meter exceeded the recommended indoor remediation levels of 1.0 micrograms per cubic meter.10 They also exceeded outdoor levels of 0.9 micrograms per cubic meter.10 Mold exposures at these levels caused acute health effects in susceptible persons, including coughing; airway hyperreactivity; influenza-like symptoms; eye, nose, and throat irritation; and skin rashes.10

Later investigations analyzed dust for molds and mycotoxins from water-damaged homes in New Orleans after Hurricane Katrina.21 Fungal cultures and polymerase chain reaction assays confirmed the predominant mold species as Aspergillus and Penicillium.10,21 Although exposures to mycotoxinproducing molds are associated with acute adverse health outcomes, no long-term adverse effects were observed after Katrina.10,21

Coastal Land Losses

Hurricane Katrina had a dramatic impact on the accelerated erosion of Louisiana's coastline and its protective barrier islands.22 Land losses between 2004 and 2008, the period encompassing hurricanes Katrina and Rita (849.5 km2), exceeded land losses over the previous 26 years (1978-2004; 743.3 km2).22 In less than one year, Louisiana experienced a loss of more than 150 square miles of estuarine marsh and an increase of more than 200 square miles of open water, mostly attributed to Katrina.22

Future Predictions

The problems faced in Louisiana after Hurricane Katina should serve as a warning to other cities and nations. Experts predict that annual costs for repairing categories 4 and 5 hurricane damage in flooded coastal cities will one day reach $1 trillion per year.23 Global warming has now resulted in a proportional increase in stronger hurricanes compared with weaker ones.24

Scientists at the National Center for Atmospheric Research applied the Anthropogenic Climate Change Index to an assessment of the effects of global warming on hurricane activity over time.24 Although the index did not detect increases in hurricane frequency, it did detect proportional differences between weaker (categories 1 and 2) and stronger (categories 4 and 5) hurricanes.24 The proportion of category 4 and 5 hurricanes has now increased 25% to 30% per degree centigrade of global warming as balanced by a similar proportional decrease in category 1 and 2 hurricanes.24

Will New Orleans Be Ready?

With funding from the federal government, the Louisiana Coastal Protection and Restoration Authority created after Katrina collaborated with the US Army Corps of Engineers to design and construct one of the largest flood-protection systems in the world, the massive Hurricane Storm Damage Risk Reduction System (HSDRRS). Authorized by Congress after Katrina, HSDRRS is a $14.6 billion project spanning five coastal Louisiana parishes that consists of storm surge barriers, canals, sector gates, floodwalls, floodgates, and levees (Figure 1).25 The system provides a 100-year storm surge-defensive wall around New Orleans designed to protect the city from a 1 in 100 or 1% probability of a similar event (Figure 1).

Open canals continue to serve as major storm drainage conduits for most of New Orleans and receive street-drained storm water from a series of antiquated pumping stations to deliver to Lake Pontchartrain. As part of the HSDRRS, the Corps completed the Permanent Canal Closures and Pumps Project in 2019 to replace the interim canal closure structures and temporary pumps on the city's three main storm water drainage canals-the 17th Street, Orleans Avenue, and London Avenue canals.25

The permanent canal closures and pumps are now located at the mouths of each outfall canal on Lake Pontchartrain and provide permanent storm surge gates that are closed before approaching hurricanes. In addition, the permanent canal closures and pumps have massive pumps run by dedicated generators that can remove storm water received from inner-city pump stations by pumping storm water directly into Lake Pontchartrain when the barrier gates are closed. These facilities can withstand 200 miles per hour winds in three-second gusts and 155 miles per hour sustained winds.25 The structures also include control buildings, safe staff housing, and onsite diesel fuel storage for generators, enabling continuous operation at full capacity for up to five days.25 Although some elements of the HSDRRS performed well during Hurricane Isaac (category 1, maximum sustained winds 81 mph) in August 2012, none of these hurricane protection systems have been tested since Katrina by stronger hurricanes of categories 3, 4, and 5.

DISCUSSION

Hurricane Katrina left a long-term environmental legacy of soil contamination and damaged critical infrastructure throughout New Orleans that continues to require monitoring and remediation. Katrina was a threat not only to the unique culture of New Orleans but also to the nation's economy, trade balance, seafood supply, and energy supply. Only federal and state policy changes that restore and preserve buffering barrier islands and coastal wetlands, improve onshore hurricane protection systems, and upgrade antiquated municipal drainage infrastructures will protect New Orleans and other hurricaneprone coastal regions of the United States from costly, catastrophic storm damage.

CONTRIBUTORS

J. H. Diaz wrote the section on flood-waters and sediments and the section on biological effects, edited the commentary, and served as corresponding author. J. H. Diaz and D. J. Harrington cowrote the sections on coastal land. J. H. Diaz, C. Hu, and A. L. Katner cowrote the sections on solid wastes and landfills. K. F. Brisolara and A. L. Katner cowrote the sections on population relocation and abandoned neighborhoods. All authors contributed to research and contributed references.

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CONFLICTS OF INTEREST

All authors report no conflicts ofinterest.

Sidebar

1=11 See also Kim-Farley, p. 1448, and the AJPH Hurricane Katrina 15 Years After section, pp. 1460-1503.

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DETAILS

Subject:	Hurricanes; Gasoline; Epidemiology; Water treatment; Sediments; Canals; Landfill; Climate change; Regulatory agencies; Coasts; Storms; Construction; Cost analysis; Global warming; Public health; Lead content; Scientists; Neighborhoods; Risk reduction; Population; Government grants; Risk management; Flood damage; Floods; Internet; Environmental health; Outdoor air quality; Levees &battures; Environmental impact; Demolition; Infrastructure; West Nile virus; Storm damage; Arsenic; Volatile organic compounds--VOCs; Drainage; Sociodemographics
Business indexing term:	Subject: Infrastructure; Industry: 23711 : Water and Sewer Line and Related Structures Construction 56221 : Waste Treatment and Disposal 22131 : Water Supply and Irrigation Systems
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Southwell, B. G., PhD., Wood, J. L., PhD., & Navar, Ann Marie,M.D., PhD. (2020). Roles for health care professionals in addressing patient-held misinformation beyond fact correction. American Journal of Public Health, Suppl.Supplement 3, 110, S288-S289. doi:https://doi.org/10.2105/AJPH.2020.305729

Most patients trust their health care professionals,1 but many also turn to sources outside of the examination room for medical information. Although many resources provide accurate information (e.g., government health agencies, professional organizations, and patient advocacy groups), not all information that patients find is accurate. Patients may encounter medical misinformation from a variety of online sources, which can have important health consequences. Health care providers can play a critical role in addressing medical misinformation but have not yet had the opportunity to address medical misinformation fully. (Certain disciplines have made progress, such as pediatricians in mitigating vaccine misinformation.) Effectively addressing misinformation requires more than attempts to simply discredit misperceptions. Encountering patient-held misinformation offers an opportunity for clinicians to learn about patient values, preferences, comprehension, and information diets. Systematically training health care professionals to address patient-held misinformation with empathy and curiosity, acknowledging time and resource constraints, will be a crucial contribution toward future mitigation of medical misinformation.

Bonnevie, E., M.A., Goldbarg, J., M.P.H., Gallegos-Jeffrey, A., Rosenberg, S. D., M.P.H., Wartella, E., PhD., & Smyser, J., PhD. (2020). Content themes and influential voices within vaccine opposition on twitter, 2019. American Journal of Public Health, Suppl.Supplement 3, 110, S326-S330. doi:https://doi.org/10.2105/AJPH.2020.305901

Objectives. To report on vaccine opposition and misinformation promoted on Twitter, highlighting Twitter accounts that drive conversation. Methods. We used supervised machine learning to code all Twitter posts. We first identified codes and themes manually by using a grounded theoretical approach and then applied them to the full data set algorithmically. We identified the top 50 authors month-over-month to determine influential sources of information related to vaccine opposition. Results. The data collection period was June 1 to December 1, 2019, resulting in 356 594 mentions of vaccine opposition. A total of 129 Twitter authors met the qualification of a top author in at least 1 month. Top authors were responsible for 59.5% of vaccine-opposition messages. We identified 10 conversation themes. Themes were similarly distributed across top authors and all other authors mentioning vaccine opposition. Top authors appeared to be highly coordinated in their promotion of misinformation within themes. Conclusions. Public health has struggled to respond to vaccine misinformation. Results indicate that sources of vaccine misinformation are not as heterogeneous or distributed as it may first appear given the volume of messages. There are identifiable upstream sources of misinformation, which may aid in countermessaging and public health surveillance. (Am J Public Health. 2020;110:S326-S330. https://doi.org/10.2105/AJPH. 2020.305901)

Zenone, M., B.A., Snyder, J., PhD., & Caulfield, T., L.L.M. (2020). Crowdfunding cannabidiol (CBD) for cancer: Hype and misinformation on GoFundMe. American Journal of Public Health, Suppl.Supplement 3, 110, S294-S299. doi:https://doi.org/10.2105/AJPH.2020.305768

Objectives. To use crowdfunding campaigns to better understand how cannabidiol (CBD) is represented (and misrepresented) as cancer-related care. Methods. We analyzed CBD-related crowdfunding campaigns (n = 155) created between January 2017 and May 2019 in multiple countries on GoFundme.com. Results. More than 81.9% of campaigns fundraised CBD for curative or life-prolonging reasons, and 25.2% fundraised for pain management. Conclusions. Most campaigns seeking funds for CBD for cancer-related care on GoFundMe are for curative or life-prolonging purposes and present CBD definitively asan effective treatment option. In general, campaigners supported their funding requests with anecdotal claims of efficacy and referenced sources of information that were either not evidence-based or that misrepresented existing evidence. Public Health Implications. Misinformation around CBD for cancer is widespread on medical crowdfunding campaigns. Given the potential adverse impact, crowdfunding platforms, like GoFundMe, must take steps to address their role in enabling and spreading this misinformation. (Am J Public Health. 2020;110:S294-S299. https://doi.org/ 10.2105/AJPH.2020.305768)

Safarnejad, L., PhD., Xu, Q., PhD., Ge, Y., PhD., Krishnan, S., PhD., Bagarvathi, A., PhD., & Chen, S., PhD. (2020). Contrasting misinformation and real-information dissemination network structures on social media during a health emergency. American Journal of Public Health, Suppl.Supplement 3, 110, S340-S347. doi:https://doi.org/10.2105/AJPH.2020.305854

Objectives. To provide a comprehensive workflow to identify top influential health misinformation about Zika on Twitter in 2016, reconstruct information dissemination networks of retweeting, contrast mis- from real information on various metrics, and investigate how Zika misinformation proliferated on social media during the Zika epidemic. Methods. We systematically reviewed the top 5000 English-language Zika tweets, established an evidence-based definition of "misinformation," identified misinformation tweets, and matched a comparable group of real-information tweets. We developed an algorithm to reconstruct retweeting networks for 266 misinformation and 458 comparable real-information tweets. We computed and compared 9 network metrics characterizing network structure across various levels between the 2 groups. Results. There were statistically significant differences in all 9 network metrics between real and misinformation groups. Misinformation network structures were generally more sophisticated than those in the real-information group. There was substantial within-group variability, too. Conclusions. Dissemination networks of Zika misinformation differed substantially from real information on Twitter, indicating that misinformation utilized distinct dissemination mechanisms from real information. Our study will lead to a more holistic understanding of health misinformation challenges on social media. (Am J Public Health. 2020;110:S340-S347. https://doi.org/10.2105/AJPH.2020.305854)

Jamison, Amelia,M.A.A., M.P.H., Broniatowski, D. A., PhD., Smith, M. C., PhD., Parikh, K. S., B.S., Malik, Adeena,B.A., B.S., Dredze, M., PhD., & Quinn, S. C., PhD. (2020). Adapting and extending a typology to identify vaccine misinformation on twitter. American Journal of Public Health, Suppl.Supplement 3, 110, S331-S339. doi:https://doi.org/10.2105/AJPH.2020.305940

Objectives. To adapt and extend an existing typology of vaccine misinformation to classify the major topics of discussion across the total vaccine discourse on Twitter. Methods. Using 1.8 million vaccine-relevant tweets compiled from 2014 to 2017, we adapted an existing typology to Twitter data, first in a manual content analysis and then using latent Dirichlet allocation (LDA) topic modeling to extract 100 topics from the data set. Results. Manual annotation identified 22% of the data set as antivaccine, of which safety concerns and conspiracies were the most common themes. Seventeen percent of content was identified as provaccine, with roughly equal proportions of vaccine promotion, criticizing antivaccine beliefs, and vaccine safety and effectiveness. Of the 100 LDA topics, 48 contained provaccine sentiment and 28 contained antivaccine sentiment, with 9 containing both. Conclusions. Our updated typology successfully combines manual annotation with machine-learning methods to estimate the distribution of vaccine arguments, with greater detail on the most distinctive topics of discussion. With this information, communication efforts can be developed to better promote vaccines and avoid amplifying antivaccine rhetoric on Twitter. (Am J Public Health. 2020;110:S331-S339. https://doi.org/10.2105/AJPH.2020.305940)

Vraga, E. K., PhD., & Bode, L., PhD. (2020). Correction as a solution for health misinformation on social media. American Journal of Public Health, Suppl.Supplement 3, 110, S278-S280. doi:https://doi.org/10.2105/AJPH.2020.305916

Scholars (including in this issue of AJPH) have debated which interventions limit the spread of health misinformation on social media, including promoting high-quality information, removing misinformation from platforms, and inoculating people against misinformation by bolstering news, information, and health literacy. Unfortunately, these preventative solutions cannot eliminate health misinformation, necessitating strategies that respond to misinformation to limit its pernicious influence on public attitudes and behaviors. Corrections-the presentation of information designed to rebut an inaccurate claim or a misperception -are an important treatment for misinformation. Despite the relative stickiness of misinformation, corrections are typically effective in reducing beliefs in health misinformation, although they are less so as issues become more polarized or beliefs become embedded in an individual's self-concept.

Scherer, L. D., PhD., & Pennycook, G., PhD. (2020). Who is susceptible to online health misinformation? American Journal of Public Health, Suppl.Supplement 3, 110, S276-S277. doi:https://doi.org/10.2105/AJPH.2020.305908

Although everyone has the potential to be misled by false information, online misinformation is not an equal opportunity aggressor. Some of us are more likely to believe misinformation than are others and serve as vectors by sharing it on social media. To effectively combat misinformation on social media, it is crucial to understand the underlying factors that lead certain people to believe and share false and misleading content online. A growing body of research has tackled this issue by investigating who is susceptible to online misinformation and under what circumstances. This literature can help shape future research and interventions to address health misinformation. We provide a brief overview of what we know about who is susceptible and what we still have to learn.

Broniatowski, D. A., PhD., Jamison, Amelia M,M.A.A., M.P.H., Johnson, N. F., PhD., Velasquez, N., PhD., Leahy, R., B.A., Restrepo, N. J., B.Sc, . . . Quinn, S. C., PhD. (2020). Facebook pages, the "disneyland" measles outbreak, and promotion of vaccine refusal as a civil right, 2009–2019. American Journal of Public Health, Suppl.Supplement 3, 110, S312-S318. doi:https://doi.org/10.2105/AJPH.2020.305869

Objectives. To understand changes in how Facebook pages frame vaccine opposition. Methods. We categorized 204 Facebook pages expressing vaccine opposition, extracting public posts through November 20, 2019. We analyzed posts from October 2009 through October 2019 to examine if pages' content was coalescing. Results. Activity in pages promoting vaccine choice as a civil liberty increased in January 2015, April 2016, and January 2019 (t76]= 11.33 P< .001]; t46] = 7.88 P< .001];and t41] = 17.27 P<.001], respectively). The 2019 increase was strongest in pages mentioning US states (t41] = 19.06; P< .001). Discussion about vaccine safety decreased (rs119] = -0.61; P< .001) while discussion about civil liberties increased (rs119] = 0.33; Py< .001]). Page categories increasingly resembled one another (civil liberties: rs119] = -0.50 P<.001]; alternative medicine: rs84] = -0.77 P<.001];conspiracy theories: rs119] = -0.46 P< .001]; morality: rs106] = -0.65 P< .001];safety and efficacy: rs119] = -0.46 P< .001]). Conclusions. The "Disneyland" measles outbreak drew vaccine opposition into the political mainstream, followed by promotional campaigns conducted in pages framing vaccine refusal as a civil right. Political mobilization in state-focused pages followed in 2019. Public Health Implications. Policymakers should expect increasing attempts to alter state legislation associated with vaccine exemptions, potentially accompanied by fiercer lobbying from specific celebrities. (Am J Public Health. 2020;110:S312-S318. https://doi. org/10.2105/AJPH.2020.305869)

Vanderpool, R. C., DrP.H., Gaysynsky, A., M.P.H., & Chou, Wen-Ying Sylvia,PhD., M.P.H. (2020). Using a global pandemic as a teachable moment to promote vaccine literacy and build resilience to misinformation. American Journal of Public Health, Suppl.Supplement 3, 110, S284-S285. doi:https://doi.org/10.2105/AJPH.2020.305906

Vaccination against infectious disease has been recognized as one of the "Ten Greatest Public Health Achievements" of the 20th century, given the substantial impact immunizations have had globally across a range of diseases, including polio, influenza, pneumonia, measles, mumps, rubella, viral hepatitis, pertussis, and oncogenic human papillomarvirus.1 Populationlevel vaccination programs have resulted in significant declines of new cases of disease, decreased morbidity and mortality, lower health care costs, and improved productivity.1 However, despite the proven clinical and cost effectiveness of vaccination, vaccines have not yet achieved their full potential, as rates of immunization among children and adults remain suboptimal, leading to a resurgence ofsome infectious diseases (e.g., measles).

Guidry, J. P. D., PhD., Vraga, E. K., PhD., Laestadius, L. I., PhD., Miller, Carrie A,PhD., M.P.H., Occa, A., PhD., Nan, X., PhD., . . . Carlyle, Kellie E,PhD., M.P.H. (2020). HPV vaccine searches on pinterest: Before and after pinterest's actions to moderate content. American Journal of Public Health, Suppl.Supplement 3, 110, S305-S311. doi:https://doi.org/10.2105/AJPH.2020.305827

Objectives.To compare how human papillomavirus (HPV) vaccination was portrayed on Pinterest before and after the platform acted to moderate vaccine-related search results to understand (1) what the information environment looked like previously and (2) whether Pinterest's policy decisions improved this environment in terms of sources and content. Methods. In this quantitative content analysis, we compared 2 samples of 500 HPV vaccine-focused

Pinterest posts ("pins") collected before and after Pinterest's actions to provide more reliable vaccine-related information. Pins were based on search results and were analyzed using the Health Belief Model. Results. The majority of preaction search results leaned toward vaccine skepticism, specifically focused on perceived vaccine barriers. Few pins were published by public health-related Pinterest accounts. Postaction search results showed a significant shift to HPV vaccination benefits, and the number of pins by government or medical accounts increased. However, the proportion of pins in search results containing HPV content of any type was significantly lower. Conclusions. Pinterest's efforts to moderate vaccination discussions were largely successful. However, the ban also appeared to limit HPV vaccination search results overall, which may contribute to confusion or an information vacuum. (Am J Public Health. 2020;110:S305-S311. https://doi.org/10.2105/AJPH.2020.305827)

Zucker, Howard A,M.D., J.D. (2020). Tackling online misinformation: A critical component of effective public health response in the 21st century. American Journal of Public Health, Suppl.Supplement 3, 110 doi:https://doi.org/10.2105/AJPH.2020.305942

Oren, E., PhD., Martinez, L., PhD., Hensley, R. E., Jain, P., M.P.H., Ahmed, T., M.P.H., Purnajo, I., M.P.H., . . . Tsou, M., PhD. (2020). Twitter communication during an outbreak of hepatitis A in san diego, 2016–2018. American Journal of Public Health, Suppl.Supplement 3, 110, S348-S355. doi:https://doi.org/10.2105/AJPH.2020.305900

Objectives. To examine how and what information is communicated via social media during an infectious disease outbreak. Methods. In the context of the 2016 through 2018 hepatitis A outbreak in San Diego County, California, we used a grounded theory-based thematic analysis that employed qualitative and quantitative approaches to uncover themes in a sample of public tweets (n = 744) from Twitter, a primary platform used by key stakeholders to communicate to the public during the outbreak. Results. Tweets contained both general and hepatitis A-specific information related to the outbreak, restatements of policy and comments critical of government responses to the outbreak, information with the potential to shape risk perceptions, and expressions of concern regarding individuals experiencing homelessness and their role in spreading hepatitis A. We also identified misinformation and common channels of content driving themes that emerged in our sample. Conclusions. Public health professionals may identify real-time public risk perceptions and concerns via social media during an outbreak and target responses that fulfill the informational needs of those who seek direction and reassurance during times of uncertainty. (Am J Public Health. 2020; 110:S348-S355. https://doi.org/10.2105/AJPH.2020.305900)

Chou, Wen-Ying Sylvia,PhD., M.P.H., Gaysynsky, A., M.P.H., & Cappella, J. N., PhD. (2020). Where we go from here: Health misinformation on social media. American Journal of Public Health, Suppl.Supplement 3, 110, S273-S275. doi:https://doi.org/10.2105/AJPH.2020.305905

Falsehoods have been shown to spread faster and farther than accurate information,1 and research suggests that misinformation can have negative effects in the real world, such as amplifying controversy about vaccines2 and propagating unproven cancer treatments.3 Health misinformation on social media, therefore, urgently requires greater action from those working in public health research and practice. ASSESS CONSEQUENCES OF MISINFORMATION Little evidence is available regarding the extent to which misinformation exposure online affects health-related behaviors, attitudes, knowledge, and outcomes at the individual or population level, or how exposure to misinformation intersects with existing health disparities.

Dunn, A. G., PhD., Surian, D., PhD., Dalmazzo, J., B.E., Rezazadegan, D., PhD., Steffens, M., M.P.H., Dyda, A., PhD., . . . Mandl, Kenneth D,M.D., M.P.H. (2020). Limited role of bots in spreading vaccine-critical information among active twitter users in the united states: 2017–2019. American Journal of Public Health, Suppl.Supplement 3, 110, S319-S325. doi:https://doi.org/10.2105/AJPH.2020.305902

Objectives. To examine the role that bots play in spreading vaccine information on Twitter by measuring exposure and engagement among active users from the United States. Methods. We sampled 53 188 US Twitter users and examined who they follow and retweet across 21 million vaccine-related tweets (January 12, 2017-December 3, 2019). Our analyses compared bots to human-operated accounts and vaccine-critical tweets to other vaccine-related tweets. Results. The median number of potential exposures to vaccine-related tweets per user was 757 (interquartile range IQR] = 168-4435), of which 27 (IQR = 6-169) were vaccine critical, and 0 (IQR = 0-12) originated from bots. We found that 36.7% of users retweeted vaccine-related content, 4.5% retweeted vaccine-critical content, and 2.1% retweeted vaccine content from bots. Compared with other users, the 5.8% for whom vaccine-critical tweets made up most exposures more often retweeted vaccine content (62.9%; odds ratio OR] = 2.9; 95% confidence interval CI] = 2.7, 3.1), vaccine-critical content (35.0%;OR= 19.0; 95% CI = 17.3, 20.9), and bots (8.8%;OR = 5.4;95% CI = 4.7, 6.3). Conclusions. A small proportion of vaccine-critical information that reaches active US Twitter users comes from bots. (Am J Public Health. 2020;110:S319-S325. https://doi.org/10.2105/AJPH.2020.305902)

Chou, Wen-Ying Sylvia,PhD., M.P.H., & Gaysynsky, A., M.P.H. (2020). A prologue to the special issue:Health misinformation on social media. American Journal of Public Health, Suppl.Supplement 3, 110, S270-S272. doi:https://doi.org/10.2105/AlPH.2020.305943

Wilner, T., M.A., & Holton, A., PhD. (2020). Breast cancer prevention and treatment: Misinformation on pinterest, 2018. American Journal of Public Health, Suppl.Supplement 3, 110, S300-S304. doi:https://doi.org/10.2105/AJPH.2020.305812

Objectives. To quantify and describe the incidence of misinformation about breast cancer on the social media platform Pinterest, a leading source of women's health (e.g., breast cancer) information. Methods. We performed a hand-coded content analysis on 797 Pinterest posts ("pins") mentioning the terms "breast cancer" or "breast" and "cancer," collected in November 2018. Results. From the original sample of 797, 178 (22.3%) made a factual claim about what social media users could do to prevent or treat breast cancer. Of these, more than half-91 (51.1%)-contained misinformation. Therefore, 11.4% of the sample overall contained misinformation related to breast cancer prevention or treatment. Conclusions. Pinterest is a significant vector of misinformation about breast cancer, especially given the platform's overwhelmingly female composition and its visual means of conveying information. Public Health Implications. Health practitioners should be aware of the myths circulating about breast cancer prevention and treatment and be prepared both to dismantle misinformation and to stress reliable health guidance. Meanwhile, Pinterest may wish to widen the criteria it uses for identifying health misinformation on its platform. (Am J Public Health. 2020;110:S300-S304. https://doi.org/10.2105/AJPH.2020.305812)

Tan, Andy S L, PhD, MPH,M.B.A., M.B.B.S., & Bigman, C. A., PhD. (2020). Misinformation about commercial tobacco products on social media- implications and research opportunities for reducing tobacco-related health disparities. American Journal of Public Health, Suppl.Supplement 3, 110, S281-S283. doi:https://doi.org/10.2105/AJPH.2020.305910

Misinformation about commercial tobacco products is not new. For decades, major tobacco companies deliberately deceived the public through marketing practices (e.g., brand names or labels such as "natural" and "organic") and public relations campaigns. The tobacco industry's deception of the public provides an important historical context for examining current forms of tobacco product misinformation through social media. The industry's campaigns sought to downplay and deny health harms and addictiveness of combustible cigarettes. These campaigns were aimed at creating doubt about scientific evidence showing how cigarette smoking harmed smokers and those exposed to secondhand smoke.The tobacco industry's deliberate deception has led to tremendous human suffering and millions oflives lost in the United States and globally every year because of smoking and secondhand smoke exposure. Although the overall prevalence of smoking in the United States has declined over the past 50 years because of comprehensive tobacco-control policies and efforts, targeted marketing campaigns and community sponsorships among disparity populations-including African American communities, sexual and gender minorities, and populations experiencing homelessness-contribute to persistent disparities in cigarette smoking and related health consequences in these populations.

Donovan, J., PhD. (2020). Concrete recommendations for cutting through misinformation during the COVID-19 pandemic. American Journal of Public Health, Suppl.Supplement 3, 110, S286-S287. doi:https://doi.org/10.2105/AJPH.2020.305922

The COVID-19 pandemic presents multifaceted challenges for the US health care system. One such challenge is in delivering vital health information to the public-a task made harder by the scourge of health misinformation across the information ecosystem (Southwell et al., p. S288 in this issue of AJPH, and Southwell etal.1). I offer concrete recommendations for public health information officers and communication professionals drafting communication campaigns for health agencies and health organizations to maximize the chance that timely health advisories reach the public. At Harvard Kennedy's Shorenstein Center, the Technology and Social Change Research Project studies how misinformation spreads and what its impact is on politics and society (bit.ly/2YcTX09bit.l). Unlike political disinformation, or fake news, health misinformation can quickly lead to changes in behaviors, which is why health communicators can't wait for tech companies to solve the problem. For example, research on antivaccination movements shows how celebrities, activists, and discredited physicians gain influence over vaccination policies, while also promoting quackery, misinformation, and conspiracies on social media.3 Although it is difficult to know who has been affected by health misinformation, best strategies to counter it focus on addressing "silent audiences" with direct, careful, and succinct messaging.

Susser, D., PhD. (2020). Ethical considerations for digitally targeted public health interventions. American Journal of Public Health, Suppl.Supplement 3, 110, S290-S291. doi:https://doi.org/10.2105/AJPH.2020.305758

Researchers, advocates, and policymakers increasingly worry that the Internet generally, and social media specifically, have become vectors of misinformation, manipulation, and other forms of malign influence.1,2 Unlike older forms of media, such as radio and television, Internet-driven influence differs in its capacity for individualized targeting, the speed with which messages can be transmitted and amplified, and the extent to which the creation and distribution of messages can be automated. While much attention has focused on the effects of such messaging on political discourse, researchers have traced equally concerning impacts on discussions pertaining to health-related issues, such as vaccine safety.3 Searching for ways to respond, public health officials and public health scholars have suggested a range of approaches, including increasing existing efforts to promote information and health literacy, devising strategies for publicly rebutting misinformation, and preparing clinicians and public health officials to address misinformation one on one.4

Walsh-Buhi, E. (2020). Social media and cancer misinformation: Additional platforms to explore. American Journal of Public Health, Suppl.Supplement 3, 110, S292-S293. doi:https://doi.org/10.2105/AJPH.2020.305949

This special issue of AJPH, sponsored by the National Cancer Institute, represents important and exciting research addressing the major issues of misinformation on social media and cancer. There are excellent research articles and editorials included in this issue on topics such as breast cancer prevention and treatment misinformation on Pinterest (Wilner and Holton, p. S300), bots (Dunn et al., p. S319) and human papillomavirus (HPV) vaccine opposition (Bonnevie et al., p. S326) on Twitter, and cannabidiol (CBD)-related misinformation on GoFundMe (Zenone et al., p. S294). Misinformation, defined as false or inaccurate information, regardless of intentional authorship,1 is not a new issue to society or to public health. While misinformation, truth framed as “fake news,” and other efforts to spread false stories have likely been around as long as humans have lived in groups, according to the World Economic Forum (WEF), digital misinformation is becoming pervasive in online social media; in fact, it has been listed by the WEF as a global risk and one of the main threats to society

Corso, P. S., PhD., Ingels, J., PhD., Rajbhandari-Thapa, J., & Davis, M., PhD. (2020). Implementation of a statewide policy mandating school-based fitness assessment screening, georgia: 2018. American Journal of Public Health, 110(10), 1564-1566. doi:https://doi.org/10.2105/AJPH.2020.305834

Objectives. To evaluate the statewide implementation of childhood fitness assessment and reporting in Georgia. Methods. We collected survey data from 1683 (919 valid responses from a randomdigit-dialed survey and 764 valid responses from a Qualtrics panel) parents of public school students in Georgia in 2018. Results. Most parents reported that their child participated in fitness assessments at school, yet only 31% reported receiving results. If a child was identified as needing improvement, parents were significantly more likely to change the diet and exercise of both the child and the family. Conclusions. A state-level mandatory fitness assessment for children may be successful in state-level surveillance of fitness levels;parental awareness of the policy, receipt of the fitness assessment information, and action on receiving the screening information require more efforts in implementation.

Blanchflower, D. G., PhD., & Oswald, A. J., D.Phil. (2020). Trends in extreme distress in the united states, 1993–2019. American Journal of Public Health, 110(10), 1538-1544. doi:https://doi.org/10.2105/AJPH.2020.305811

Objectives. To investigate changes from 1993 to 2019 in the percentage of US citizens suffering extreme distress. Methods. Using data on 8.1 million randomly sampled US citizens, we created a new proxy measure for exceptional distress (the percentage who reported major mental and emotional problems in all 30 of the last 30 days). We examined time trends for different groups and predictors of distress. Results. The proportion of the US population in extreme distress rose from 3.6% in 1993 to 6.4% in 2019. Among low-education midlife White persons, the percentage more than doubled, from 4.8% to 11.5%. Regression analysis revealed that (1) at the personal level, the strongest statistical predictor of extreme distress was "I am unable to work," and (2) at the state level, a decline in the share of manufacturing jobs was a predictor of greater distress. Conclusions. Increasing numbers of US citizens report extreme levels of mental distress. This links to poor labor-market prospects. Inequality of distress has also widened. Public Health Implications. Policymakers need to recognize the crisis of an ever-growing group of US citizens in extreme distress. (Am J Public Health. 2020;110:1538-1544. doi: 10.2105/AJPH.2020.305811)

Rodríguez-Díaz, Carlos E, PhD, MPHE. (2020). Community resistance as public health activism in puerto rico. American Journal of Public Health, 110(10), 1454-1455. doi:https://doi.org/10.2105AJPH.2020.305884

After nearly three years, Puerto Rico is still recovering from the consequences of these hurricanes. Since the summer of 20 19, it has also been dealing with political and economic bankruptcy, earthquakes, air pollution, and the COVID-19 pandemic.3,4 As we know in Puerto Rico. when a disaster strikes, it blows the leaves away from the rotten problems that lay beneath them. Rivera Joseph et al. suggest a human rights approach as a way to "assess the ongoing human rights violations of the quality of life to support millions of American citizens on the island."(p1512) I agree with the authors' rights-based approach, but such a response is warranted not because Puerto Ricans are US citizens but because we are humans. ...]the remedy for colonization is self-determination, a prerequisite to the full enjoyment of all other human rights. In their essay, Rivera |oseph et al. highlight a variety of human rights violations in Puerto Rico, including those affecting the right to water, electricity, and health care access; these are, in fact, well-documented inequities affecting people living in Puerto Rico.

Statz, M., PhD., & Termuhlen, P., M.D. (2020). Rural legal deserts are a critical health determinant. American Journal of Public Health, 110(10), 1519-1522. doi:https://doi.org/10.2105/AJPH.2020.305807

We introduce "rural legal deserts," or rural areas experiencing attorney shortages, as a meaningful health determinant. We demonstrate that the absence of rural attorneys has significant impacts on public health-impacts that are rapidly exacerbated by COVID-19. Our work builds on recent scholarship that underscores the public health relevance of attorneys in civil and criminal contexts. It recognizes attorneys as crucial to interprofessional health care teams and to establishing equitable health-related laws and policies. Attorney interventions transform institutional practices and help facilitate the stability necessary for health maintenance and recovery. Yet, critically, many rural residents cannot access legal supports. As more individuals experience unemployment, eviction, and insecure benefits amid the COVID-19 pandemic, there is a need for attorneys to address these social determinants of health as legal needs. Accordingly, the growing absence of attorneys in the rural United States proves particularly consequential-because of this pandemic context but also because of rural health disparities. We argue that unlessa collaborative understanding of these interrelated phenomena is adopted, justice gaps will continue to compound rural health inequities. (Am J Public Health. 2020;110: 1519-1522. doi:10.2105/AJPH. 2020.305807)

LaVeist, T. A., PhD. (2020). Katrina's lesson:Time to imagine an after COVID-19. American Journal of Public Health, 110(10), 1445. doi:https://doi.org/10.2105/AJPH.2020.305883

Some events are so powerful they mark our lives-before and after. In New Orleans, Louisiana, the split between what existed before and what came after is marked by Hurricane Katrina.Hurricane Katrina started as a tropical depression in the Caribbean on August 23, 2005. It initially made landfall at the southern tip of Florida as a category 1 storm before spiraling back over warm Gulf of Mexico waters, where it intensified. It made landfall for a second time days later at the border between Louisiana and Mississippi before moving inland, slowly weakening. Many fled for safety as the storm grew and barreled toward the Gulf Coast. Others remained, some unwilling to leave, many more unable to leave because of lack of transportation, health concerns, or lack of financial resources. In the aftermath, the world watched as the levees failed and the floodwaters rose. The wind, flooding, and storm surge mowed down much of the Gulf Coast. Everyone in New Orleans has a story about after. Some are heartbreaking. Lost loved ones. Days spent in miserable conditions desperately waiting for help. Patients on hospital rooftops. The sick doing theirbest to care forthe sickest. Displacement to new cities, unprepared and knowing no one.

Kok, V. T. J., M.P.H., Chiew, C. J., M.P.H., Ong, S. W. X., M.B.B.S., Mandar, K., M.P.H., Lee, A., B.Sc, Foo, K., M.P.H., . . . Lee, V., PhD. (2020). Outbreak of measles in a residential home for the intellectually disabled in singapore in 2019. American Journal of Public Health, 110(10), 1532-1534. doi:https://doi.org/10.2105/AJPH.2020.305820

A measles outbreak involving 19 adults in a home for the intellectually disabled occurred in Singapore in 2019. Further investigation, including a serological survey, was conducted. Mass vaccination and infection control measures were implemented, terminating further secondary transmission. Seropositivity among residents aged 40 to 49 years (90.7%; 95% confidence interval = 78.4%, 96.3%) was lower than among the Singapore adult population (P<.001). This sheltered population, like others previously reported in the literature, had lower measles immunity than the general community, possibly because of limited social interaction. Targeted catch-up vaccination for similarly vulnerable populations should be considered. (Am J Public Health. 2020;110:1532-1534. doi:10. 2105/AJPH.2020.305820) An outbreak of measles occurred in a home for intellectually disabled adults in Singapore in 2019, involving 19 patients (16 intellectually disabled residents, two staff members, and one day-activity center client; Appendix, Figure A, available as a supplement to the online version of this article at http://www.ajph.org). This was unexpected, as measles vaccination was implemented in the national childhood immunization program in Singapore in 1975 and made compulsory in 1985.1 High natural immunity was expected in adults born before 1975, and the National Seroprevalence Survey in 2018 showed almost 100% measles immunity in adults aged 45 years and older (Ministry of Health, Singapore, unpublished data, 2018).

Babcock, S. A., & Smith, D. G. (2020). Pets in comprehensive disaster planning: The Post–Hurricane katrina experience. American Journal of Public Health, 110(10), 1500-1501. doi:https://doi.org/10.2105/AJPH.2020.305752

Before Hurricane Katrina, the City of New Orleans, Louisiana, had emergency preparedness plans that focused on the care of pets in shelters. With required evacuation of the city, pets of families without transportation or other options were left behind or became separated. Many people refused evacuation efforts to remain with their pets, some to their own peril. People take great risks by refusing to evacuate and by seeking to retrieve pets.1 Including pets in disaster plans can benefit pet owners' physical and mental wellbeing, ensure an adequate workforce, and prevent the spread of zoonotic diseases and other consequences of unattended pets. As a direct consequence of Katrina, Congress passed the Pets Evacuation and Transportation Standards Act of 2006 (PETS Act; Pub L No. 109-308, HR 3858). The PETS Act and related legislation at the national, state, and local levels provide authorization and resources for care of pets and planning for disasters and emergencies. Following the guidance of the PETS Act and lessons learned from the experience ofKatrina, the City ofNew Orleans prepared a new evacuation plan for humans and animals. Three years later, Hurricane Gustav put the new plan to the test. People without other means of transportation brought their pets to parish pickup points. Owners and their pets received bar-coded wristbands and had their information entered into databases. People rode on buses and pets rode on trucks destined for the same sites. The basic requirements of a functional plan were met: people understood the plan, an adequate number of carriers and vehicles were available for pets, and few pets were lost in the process.

Smart, R., PhD., Schell, T. L., PhD., Cefalu, M., PhD., & Morral, A. R., PhD. (2020). Impact on nonfirearm deaths of firearm laws affecting firearm deaths: A systematic review and meta-analysis. American Journal of Public Health, 110(10), E1-E9. doi:https://doi.org/10.2105/AJPH.2020.305808

Background. There is debate whether policies that reduce firearm suicides or homicides are offset by increases in non-firearm-related deaths. Objectives. To assess the extent to which changes in firearm homicides and suicides following implementation of various gun laws affect nonfirearm homicides and suicides. Search Methods. We performed a literature search on 13 databases for studies published between 1995 and October 31, 2018 (PROSPERO CRD42019120105). Selection Criteria. We included studies if they (1) estimated an effect of 1 of 18 included classes of gun policy on firearm homicides or suicides, (2) included a control group or comparison group and evaluated time series data to establish that policies preceded their purported effects, and (3) provided estimated effects of the policy and inferential statistics for either total or nonfirearm homicides or suicides. Data Collection and Analysis. We extracted data from each study, including study timeframe, population, and statistical methods, as well as point estimates and inferential statistics for the effects of firearm policies on firearm deaths as well as either nonfirearm or overall deaths. We assessed quality at the estimate (study-policy-outcome) level by using prespecified criteria to evaluate the validity of inference and causal identification. For each estimate, we derived the mortality multiplier (i.e., the ratio of the policy's effect on total homicides or suicides; expressed as a change in the number of deaths) as a proportion of its effect on firearm homicides or suicides. Finally, we performed a meta-analysis to estimate overall mortality multipliers for suicide and homicide that account for both within- and between-study heterogeneity. Main Results. We identified 16 eligible studies (study timeframes spanning 1977-2015). All examined state-level policies in the United States, with most estimating effects of multiple policies, yielding 60 separate estimates of the mortality multiplier. From these, we estimated that a firearm law's effect on homicide, expressed as a change in the number of total homicide deaths, is 0.99 (95% confidence interval = 0.76, 1.22) times its effect on the number of firearm homicides. Thus, on average, changes in the number of firearm homicides caused by gun policies are neither offset nor compounded by second-order effects on nonfirearm homicides. There is insufficient evidence in the existing literature on suicide to indicate the extent to which the effects of gun policy changes on firearm suicides are offset or compounded by their effects on nonfirearm suicides. Authors' Conclusions. State gun policies that reduce firearm homicides are likely to reduce overall homicides in the state by approximately the same number. It is currently unknown whether the same holds for state gun policies that significantly reduce firearm suicides. The small number of studies meeting our inclusion criteria, issues of methodological quality within those studies, and the possibility of reporting bias are potential limitations of this review. Public Health Implications. Policies that reduce firearm homicides likely have large benefits for public health as there is little evidence to support a strong substitution effect between firearm and nonfirearm homicides at the population level. Further research is needed to determine whether policies that produce population-level reductions in firearm suicides will translate to overall declines in suicide rates. (Am J Public Health. 2020; 110: e1-e9. doi:10.2105/AJPH.2020.305808)

Carpenter, J. E., M.D., Chang, Arthur S,M.D., M.S., Bronstein, A. C., M.D., Thomas, R. G., PharmD., & Law, Royal K,PhD., M.P.H. (2020). Identifying incidents of public health significance using the national poison data system, 2013–2018. American Journal of Public Health, 110(10), 1528-1531. doi:https://doi.org/10.2105/AJPH.2020.305842

Data System. The American Association of Poison Control Centers (AAPCC) and the Centers for Disease Control and Prevention (CDC) jointly monitor the National Poison Data System (NPDS) for incidents of public health significance (IPHSs). Data Collection/Processing. NPDS is the data repository for US poison centers, which together cover all 50 states, the District of Columbia, and multiple territories. Information from calls to poison centers is uploaded to NPDS in near real time and continuously monitored for specific exposures and anomalies relative to historic data. Data Analysis/Dissemination. AAPCC and CDC toxicologists analyze NPDS-generated anomalies for evidence of public health significance. Presumptive results are confirmed with the receiving poison center to correctly identify IPHSs. Once verified, CDC notifies the state public health department. Implications. During 2013 to 2018, 3.7% of all NPDS-generated anomalies represented IPHSs. NPDS surveillance findings may be the first alert to state epidemiologists of IPHSs. Data are used locally and nationally to enhance situational awareness during a suspected or known public health threat. NPDS improves CDC's national surveillance capacity by identifying early markers of IPHSs.

Azrael, D., & Miller, M. (2020). Access to firearms, homicide, and suicide: Role of the mortality multiplier. American Journal of Public Health, 110(10), 1456-1457. doi:https://doi.org/10.2105/AJPH.2020.305876

...]if m = 0.8 for the effect of a given set of firearm laws on homicide, for every 10 firearm homicides averted by the laws there would be two additional nonfirearm homicides that would not have occurred in the absence of the laws, resulting in eight homicides averted. ...]the mortality multiplier is an index of the extent of lethal substitution of nonfirearm means when firearm deaths decline (increase) and of contagion, or secondary feedback effects, on nonfirearm homicide when firearm deaths increase or decrease. In particular, although the meta-analysis that generated the mortality multiplier for homicides drew on 16 studies, only a single study,4 of child access prevention laws, effectively determined the metaanalytic m for suicides. ...]as Smart et al. note, the direct effect measure used to calculate m from this study was based on the reported effect of child access prevention laws on those aged 18 to 20 years, rather than on those aged 14 to 17 years, even though those aged 18 to 20 years were chosen as negative controls by the original investigators. ...]studies from other countries have shown that when populationlevel policies substantially reduce the ready availability of highly lethal, culturally acceptable, commonly used methods of suicide (e.g., coal gas CO2], pesticides in Sri Lanka, firearms in the Israeli military), sustained declines in overall suicide results, driven by declines in suicide by the restricted method, with minimal compensatory increases in suicides by nonrestricted methods.5 Moreover, a large and compelling body of empirical studies supports a causal connection between access to firearms and the risk of dying by suicide, driven, in effect, by an elevated rate of firearm suicide, with at best modest lethal substitution of nonfirearm methods. ...]handgun ownership was associated with a greatly elevated and enduring risk of suicide by firearm, with minimal second-order substitution effects.

Honore, R. L., M.A. (2020). Speaking truth to power on how hurricane katrina beat us. American Journal of Public Health, 110(10), 1463-1465. doi:https://doi.org/10.2105/AJPH.2020.305778

Hurricane Katrina beat us.1 We lost the ability to communicate, transport by land and air, and provide health care for the population. Louisiana and Mississippi communities sustained a complete collapse of their civil infrastructures, including police, fire, medical and public health, and communication. The storm and its ensuing flooding caused the largest forced migration in US history. Hurricane Katrinas eastward path spared metro New Orleans, Louisiana, from a direct hit. However, the coastal storm surge, combined with surge in a manmade canal (Mississippi River Gulf Outlet) that over 30 years destroyed important protective wetlands, severely strained the levee system.2 The result was 12 feet of flooding in 80% of New Orleans.The Mississippi River Gulf Outlet project, constructed to provide a shorter route between New Orleans and the Gulf of Mexico, is widely described as a dangerous alteration to the areas ecosystem.2 In addition, state and federal authorities approved construction of a levee system to withstand a Category 3 storm when evidence showed the eventual likelihood ofa Category 5. On average, 70% of New Orleans sits between two and five feet below sea level. The Mississippi River, which divides the city, ranges from 4 to 20 feet above sea level based on seasonal flood stages.

Raunig, Brooke L,J.D., R.N., Kesselheim, Aaron S, MD,J.D., M.P.H., & Darrow, Jonathan J, SJD,J.D., M.B.A. (2020). Drug shortages and the defense production act. American Journal of Public Health, 110(10), 1504-1505. doi:https://doi.org/10.2105/AJPH.2020.305862
