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COVER: Rachel Shoapik, Leetia Kootoo, Cory Shoapik, and Emily Shoapik fill containers with water from the Sylvia Grinnell River after authorities ordered the 7000 residents of Iqaluit (the capital of Canada's northernmost territory, Nunavut) not to drink the city's water because of suspected fuel contamination: October 14, 2021.
Cover concept and selection by Aleisha Kropf. Photo by REUTERS/Casey Lessard. Printed with permission.

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Deconstructing "Normal" for a More Equitable Post–COVID-19 World

History tells us that postpandemic worlds (e.g., after the second pandemic of plague in the 14th century and the 1918 influenza pandemic) were dramatically altered in almost every conceivable way, from human biology and demography to politics, economics, and religion. The reality that we left at the beginning of 2020 can no longer be restored.

In discussions throughout our tenure as the *AJPH* 2021 Student Think Tank cohort, we found ourselves contemplating what it might mean to "return to normal" once the COVID-19 pandemic is over. Two viewpoints became apparent: (1) normal, as a construct, is relative to individuals or groups, and (2) the prepandemic normal as an indicator of equity was not working for everyone. Exacerbations of health and economic inequalities glared as the pandemic disrupted our lives. Disenfranchised people, such as those with disabilities, people of color, those residing in low- to middle-income households, and those with chronic illnesses, found themselves at the crosshairs of COVID-19, a stressed health care system, and economic shock. Perhaps conceptualizations of what we previously deemed as "normal" need to be challenged given that, in the practice of public health policy and leadership, realities are not static; normal is a fluid state in constant change as opposed to something to which we can collectively return.

At the start of our fellowship as the *AJPH* Think Tank, we developed a mission to collaborate with each other and other public health students, to promote student engagement, to support equitable resources for present and future leaders, and to endorse intersectionality in public health practice. We believe that each of these goals serves as a framework to encourage more intentional practices beyond our fellowship. Reconstructing normal to promote health equity must include large-scale collaboration at the community and international levels with a focus on global, not national, self-interest. In addition, we must prop up students and early-career professionals from backgrounds and experiences that have been institutionally marginalized into positions of leadership with ample resources to promote information sharing, to fight misinformation and disinformation, and to focus on mutual aid.

The state of public health in prepandemic times already included a laundry list of issues that aimed to narrow health equity gaps in areas such as access to health care and mortality rates. Mass deaths, overworked first responders, and racial injustice swept across the globe, with many people feeling the initial shock of collective pandemic trauma. However, those who faced worse health conditions, loss of income, and racial injustice experienced the collective trauma in an almost familiar way. "Normal" for the marginalized meant navigating institutions and structures that were not built with them in mind. For many, COVID-19 has maintained or worsened these navigational paths. We feel a profound duty to ponder more deeply how we can directly address the health of populations by elevating existing strengths within communities, equitably distributing resources to communities in need, and keeping leaders accountable in terms of policies that shape the lives of those they represent.

We have an opportunity to build a public health apparatus and a world that are more equitable than what we left behind in 2020. AJPH

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2021 *AJPH* Student Think Tank

DOI: https://doi.org/10.2105/AJPH.2022.306743

10 Years Ago

Integration of Social Epidemiology and Community-Engaged Interventions to Improve Health Equity

Collaborations between social epidemiologists and community-engaged intervention researchers can enhance the contributions of both to reducing health inequities. Unlike their colleagues in other types of epidemiological research, social epidemiologists do not have clinical counterparts. Cardiovascular epidemiologists partner with cardiologists and nephrologists; cancer epidemiologists partner with oncologists. To acquire effective investigative approaches and the ability to translate results to actionable knowledge, social epidemiologists must forge partnerships with those who are targeting social determinants through health-enhancing policies, practices, and interventions. Similarly, this interaction enriches community-engaged intervention researchers' creation and modification of interventions, measurement of appropriate constructs, evaluation findings, and generation of new theories and strategies for change. Developing and translating data into real-world use with community players then becomes a more important role for both sets of researchers.

From AJPH*, May 2011, p. 827*

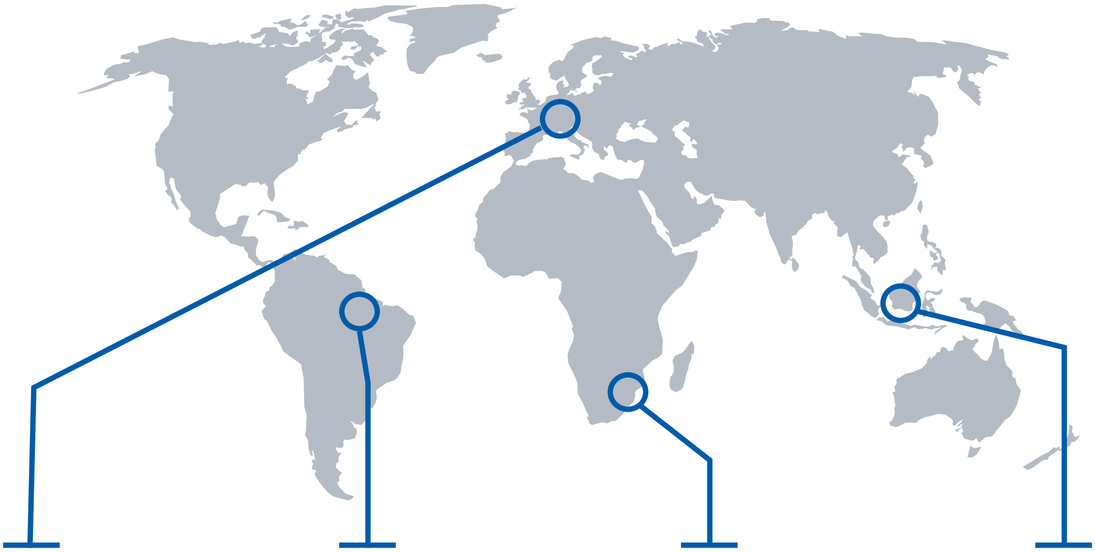
11 Years Ago

Health Equity and Public Health Leadership

Public health in general, and health equity in particular, promote themes of human interconnection, egalitarianism, and community. Fundamentally, we are all interdependent and interconnected, with "promises to keep." Building community involves invoking the theme of shared responsibility that can be made explicit by effective public health leaders. Achieving true health equity means that despite our differences and diversity, a revitalized community can arise that truly acknowledges the health aspirations of each individual. . . . Leadership in health equity remains unfinished business for the 21st century. A future free from health inequity will require renewed commitment to unite the forces of science, practice, and policy for positive social change. All sectors of society must heed the call and many can contribute.

From AJPH*, Supplement 1 2010, pp. S10-S11 passim*

Editor's Choice *Park et al.* **533**



Effects of Heat on Cardiovascular Disease

Schulte et al. assessed the effect of daily maximum temperature on morbidity and mortality in 9 cardiovascular disease groups across Switzerland. The study was based on medical and death statistics from 1998 to 2016. The authors identified mortality increases for hypertension, heart failure, stroke of unknown origin, and arrhythmia—outcomes potentially exacerbated by antihypertensive medications. They observed decreases in emergency hospital admissions with rising temperature for hypertension, heart failure, and myocardial infarction, which may be explained by cardioprotective volume depletion and vasodilation. The main results agree with previous findings and inform strategies for the prevention and treatment of heat-related illnesses.

Citation. Schulte F, Röösli M, Ragettli MS. Heat-related cardiovascular morbidity and mortality in Switzerland: a clinical perspective. *Swiss Med Wkly*. 2021;151:w30013. https://doi.org/10.4414/SMW.2021.w30013

Prepared by Stephen Lewandowski, Megan Marziali, and Vrinda Kalia, Columbia University, New York, NY. Correspondence should be sent to the AJPH Global News team at vk2316@cumc.columbia.edu.

DOI: https://doi.org/10.2105/AJPH.2022.306752

Disproportionate Burden of COVID-19 on the Indigenous Population in Brazil

Using a nationwide registry-based study, Santos et al. estimated the incidence and mortality rates of COVID-19 among Indigenous people living in Brazil's 5 regions (Northeast, North, Central-West, Southeast, and South) between February 26 and August 28, 2020. The national incidence and mortality rates were 3546.4 cases and 65.0 deaths per 100 000 people, respectively, and the case fatality rate (CFR) was 1.8%. Among the Indigenous population, rates were higher than the national estimate of the population in the Central-West and North regions. The Central-West region had incidence and mortality rates of 3135.0 and 101.2 per 100 000 people, and the CFR was 3.2%, whereas in the North region, incidence and mortality rates were 5664.4 and 92.2 per 100 000 people, respectively, and the CFR was 1.6%. These findings showed a disproportionate burden of COVID-19 on the Indigenous population in Brazil.

Citation. Santos VS, Souza Araújo AA, de Oliveira JR, Quintans-Júnior LJ, Martins-Filho PR. COVID-19 mortality among Indigenous people in Brazil: a nationwide register-based study. *J Public Health (Oxf)*. 2021;43(2):e250–e251. https://doi.org/10.1093/pubmed/fdaa176.

Traditional Healers as Client Advocates for HIV Services

Traditional healers hold positions of authority in communities and often occupy roles such as spiritualists, herbalists, and birth attendants. Estimates suggest that more than 800 000 traditional healers practice in Mozambique. Sundararajan et al. conducted a qualitative study to understand HIV-related knowledge among traditional healers in urban settings, where biomedical resources are more accessible, and their attitudes toward biomedicine. They used an inductive, grounded theory approach with 36 traditional healers in Maputo from April through November 2016. Prominent themes included healers having a positive attitude toward biomedicine and acting as advocates for their clients who are HIV positive. Healers self-identified as acting together with biomedical providers to facilitate health care access. Findings highlight the import role of traditional healers in improving uptake of HIV services and engagement.

Citation. Sundararajan R, Langa PV, Morshed T, Manuel S. Traditional healers as client advocates in the HIV-endemic region of Maputo, Mozambique: results from a qualitative study. *SAHARA J*. 2021;18(1):77–85. https://doi.org/10.1080/17290376.2021.1909492

Cognitive Function of Children Living in Forest Fire–Prone Provinces

Seasonal forest fires that occur on the Indonesian islands of Sumatra and Kalimantan can produce high concentrations of ambient particulate matter of less than 2.5 micrometers in diameter (PM2.5). Using data from the Indonesia Family Life Survey, Jalaludin et al. determined whether exposure to PM2.5 is associated with children's cognitive function (assessed through Ravens Colored Progressive Matrices; RCPM) and whether cognitive function differed in children who have always lived in forest fire–prone provinces compared to children who have always lived in provinces not prone to forest fires. Using multilevel mixed linear regression models, Jalaludin et al. found a small positive association between PM2.5 exposure and RCPM scores (b = 0.1%; 95% confidence interval [CI] = 0.01%, 0.19%) and lower RCPM scores for children who had lived in a forest fire–prone province all their lives (b = −1.50%; 95% CI = –2.94, –0.07) after adjusting for individual factors.

Citation. Jalaludin B, Garden FL, Chrzanowska A, et al. Associations between ambient particulate air pollution and cognitive function in Indonesian children living in forest fire–prone provinces. *Asia Pac J Public Health*. 2022;34(1):96–105. https://doi.org/10.1177/10105395211031735

Recreating Society for Better Health

Michael Marmot, MD, PhD

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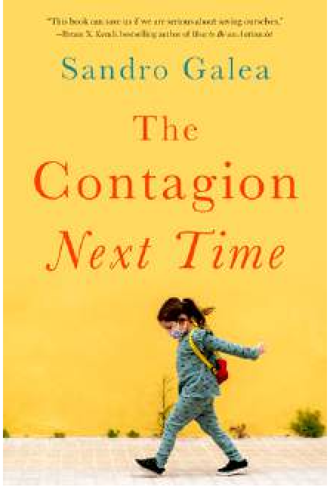

The Contagion Next Time
By: Sandro Galea
296 pp; $24.95
New York, NY: Oxford University Press; 2021 (hardcover)
ISBN-10: 0197576427
ISBN-13: 978-0197576427

US society has been doing badly. That simple judgement comes from examining health statistics. Figure 6.7 from Sandro Galea's book, *The Contagion Next Time,* shows the evidence, based on Raj Chetty's work (Figure 1).[1] The graph shows three clear features of population health, here measured as life expectancy. First, health follows the social gradient—the lower the income, the shorter the life expectancy; it is not simply the poor versus the rest. Second, the gradient got steeper between 2000 and 2014; inequalities in health increased. Third, from around 2008, there was no improvement in life expectancy—even a decline—for the poorer two income quartiles. Not shown here is that from 2014, US life expectancy declined for the next three years.

The thesis of *The Contagion Next Time* is that this health picture reflects the operation of deep structural forces in society. We cannot understand what happened to health simply by examining access to health care or features of human behavior. We have to go deeper. Hence my comment that the society has been doing badly.

Galea's focus is the United States, but in recent years health in the United Kingdom has, to some extent, followed the dismal path of the United States. From 2010 on, the increase in life expectancy in the United Kingdom, which had continued for a century, slowed dramatically and just about ground to a halt. The social gradient in life expectancy grew steeper; inequalities increased. And life expectancy declined for the most deprived decile outside London.[2] The evidence showed clear adverse trends in what we have called the social determinants of health.[3] Plausibly, and consistent with Galea's thesis, it was political choices and the organization of society that led to this worsening health picture.

All of this was before the pandemic. An effect of COVID-19 was to expose and amplify the underlying inequalities in society. Further, the United States and the United Kingdom were among the countries with the highest excess mortality during the pandemic. Not only did both our countries show marked inequalities in who succumbed to COVID-19, but overall mortality was high. Galea's thesis is that the United States, and I would add the United Kingdom, was vulnerable to the pandemic precisely because of marked social, economic, and racial inequalities. It may also work at another level: the kind of societies that allow such inequalities to develop do not have the social organization to handle a pandemic well. Both in the United States and the United Kingdom, the dithering incompetence, and worse, of national governments in the face of the pandemic was of tragic proportion.

One of Galea's important themes is that the US focus on the individual is antithetical to the kind of social action necessary to improve population health and reduce inequalities. There was a time in the United States when there were important discussions between those on the political right and those on the left about where responsibility for health should lie on the spectrum from the individual to the society. Galea, perhaps harking back to such halcyon days, writes:

> Politics may well be the most important foundational influence on health. Politics fundamentally shapes the distribution of the resources necessary for health. These resources include money, legal protections, the expectation of a level playing field in society, and the focus of public opinion, with its power to either alter or entrench the status quo.

It is difficult to avoid the impression that the possibility for such reasoned and necessary debate has been destroyed by intense political polarization in the United States. The megaphone employed by the former occupant of the White House, and his followers, has drowned out reasoned discussion. That said, the health problems on which Galea focuses did not begin with the presidential election of 2016. A report from the Institute of Medicine in 2013, taking note of the US high expenditure on health care, gave little ground for US self-congratulation as it documented the poor health performance of the United States compared with other high-income countries.[4]

In the same vein, Case and Deaton riveted national attention on "Deaths of Despair"—the rise in mortality among middle-aged White men and women from poisonings, suicide, and alcohol-related disease.[5] There is a social gradient in such deaths—the fewer the years of education, the higher the mortality. Case and Deaton focus on people without a four-year college degree and show all the ways that the kind of influences that Galea discusses mean worse lives at home, at work, and in the community for these people—a complex that Case and Deaton argue leads to "despair." Despair may influence political choices, as well as life and death. There was a correlation, geographically, between deaths of despair and voting for Donald Trump in 2016.[6] That kind of association continues into the COVID era with vaccine reluctance higher in Trump-voting counties.

A welcome feature of *The Contagion Next Time* is its emphasis on values: compassion, the pursuit of social and economic justice, and understanding that health is a public good. Would politicians exercising compassion readily make the decisions that consign children to being raised in poverty? On social and economic justice, Galea quotes Martin Luther King: "We have deluded ourselves into believing the myth that capitalism grew and prospered out of the Protestant ethic of hard work and sacrifice. The fact is that capitalism was built on the exploitation of the poor—both black and white, both here and abroad." More prosaically, it is a focus on justice that led my colleagues and me at the UCL Institute of Health Equity to label our own prescription for a post-COVID future, *Build Back Fairer*.[7]

Hilary Cooper and Simon Szreter, in *After the Virus,* conduct an historically informed inquiry into what society should look like after the pandemic.[8] They write that the Elizabethan poor laws in England in 1601 formed the first welfare state, based on collectivist-individualism: universal provision of a social safety net and, over time, collective provision of education and other essentials that provided the conditions for individuals to flourish. That could form a credo, consistent with Galea's argument. To create a fairer distribution of health now, and prepare for future shocks, we need the social commitment to creating the conditions in which all individuals can flourish. AJPH

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PUBLICATION INFORMATION

Full Citation: Marmot M. Recreating society for better health. *Am J Public Health*. 2022;112(4):535–537.

Acceptance Date: January 12, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306736

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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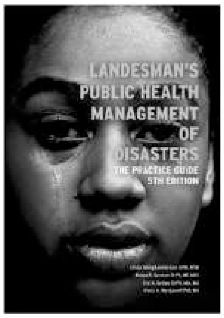

Psychotic Disorders and Structural Racism: On Considering Complexity

Ruth S. Shim, MD, MPH

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See also Misra et al., p. 624.

After the death of George Floyd and amid the glaring racial inequities of the COVID-19 pandemic, the United States entered into a "racial reckoning" in which the health impacts of structural racism became more obvious to a wider segment of the population than ever before.[1] This reckoning led the fields of medicine and public health to call for greater emphasis on examining the detrimental health effects of structural racism. For example, a PubMed search of the term "structural racism" found a 354% increase in journal references between 2019 and 2021. In a policy statement issued in October 2020, the American Public Health Association officially declared that structural racism is a public health crisis, and in April 2021, the Centers for Disease Control and Prevention followed suit in declaring racism a "serious public health threat."[2,3] Yet, with all this renewed attention and focus, the precise mechanisms by which structural racism drives health inequities and health outcomes largely remain unclear.

STRUCTURAL RACISM AND MENTAL HEALTH

Nowhere is the impact of structural racism more directly relevant than in considering mental health problems, which are filtered directly through the cultural lens of society in ways that can exacerbate its effects. Because they are so highly stigmatized, psychotic disorders are particularly sensitive to "racial and political currents" that underlie the evaluation, diagnosis, and management of these conditions.[4] In this issue of *AJPH*, Misra et al. (p. 624) seek to clarify these difficult associations and draw more direct lines from the role of structural racism to inequitable outcomes of psychotic disorders in current practice. This is a highly complex task because the etiology of inequities in psychotic disorders is complicated, multifaceted, and steeped in historical injustice, discrimination, and racism.[5]

This work is highly personal to me. As a Black psychiatrist whose clinical practice is focused on providing mental health services to young people experiencing early psychotic illnesses, I have watched the detrimental impacts of structural racism on psychotic disorders play out in real time at the individual level. In my clinical experience, I have witnessed my Black patients who were hospitalized for stabilization during a mental health crisis removed from their second-generation antipsychotic medications and switched to high doses of haloperidol, a first-generation antipsychotic medication that was specifically associated (via print advertisements from pharmaceutical companies to prescribers) with images of aggressive and hostile Black men in the 1960s.[5,6] I have directly observed psychiatrists and other mental health providers misinterpret adaptive suspicious behaviors and symptoms of distress in Black patients as paranoid delusions, leading to misdiagnoses of psychotic illness. I have noticed, consistent with the research literature, that Black patients in emergency settings are more likely than White patients to be placed in seclusion and restraints.[7]

My clinical experience has taught me that explanations for the cause of inequities in psychotic disorders, a condition that has historically been racialized and stigmatized, are extremely complex, as are the mechanisms by which structural racism interacts with these outcomes. The prevailing theory for the development of psychosis risk is the vulnerability-stress model, which hypothesizes that the interaction between biological vulnerability and environmental stressors leads to the development of psychotic symptoms.[4] This theory helps to explain how the environmental stressor of structural racism can interact with biological risk to increase the likelihood of developing psychotic illness. Similarly, the social defeat hypothesis incorporates the role of oppression and minoritized status as a driver of psychotic illness (via increased dopaminergic activity).[4] Structural racism, as a tool used to oppress racially minoritized groups, must be conceptualized as a system based on the belief that human hierarchies exist in our society.[8] Unfortunately, both people with psychotic illnesses and people from racially minoritized groups (Black people in particular) are at the highest risk to be oppressed and forced to the bottom of the social hierarchy.

CONNECTING STRUCTURAL RACISM AND PSYCHOSIS

Misra et al. specifically highlight the role of racialized policing and economic exploitation as the most salient contributors to inequities in outcomes. Although these particular examples of structural racism are a reasonable starting point for further research and exploration, they do not encompass the entirety of the impact of structural racism on outcomes associated with psychotic illnesses. Even when considering these examples, there are multiple layers of complexity that must be explored. For example, the War on Drugs (which encompasses both racialized policing and additional structurally racist policies) is a salient example of how stigmatized negative beliefs about certain populations (e.g., Black people who use crack cocaine) led to inequitable policies such as the Anti-Drug Abuse Act of 1986, which mandated a 100:1 jail sentencing disparity in which 1 gram of crack cocaine carried the same jail sentence as 100 grams of powder cocaine. Similarly, cannabis is associated with an increased risk of psychosis,[9] and the racialized criminalization of cannabis use has led to high rates of people with psychotic disorders being incarcerated instead of receiving mental health treatment.[10] Evaluation of structural racism as it relates to cannabis policy then becomes a highly complicated endeavor, because antiracist policies legalizing cannabis use could increase the risk or prevalence of psychotic illness but must be weighed against the significant psychological damage of inequitable rates of incarceration of Black people, despite their use of cannabis at rates similar to or lower than those of White people.

Misra et al. attempt to create distance between the concept of provider bias in diagnosis and assessment from the consideration of a structural racism framework. However, it is worth noting that provider bias is yet another manifestation of structural racism. The structural level of discrimination within the health care system has effectively penetrated all other levels, including institutions (such as the institution of psychiatry) and individuals.[5] The history of the reconceptualization of schizophrenia from a psychotic illness affecting docile White women who did not meet gendered, patriarchal expectations for their roles in society to an illness centrally defined as one in which Black men were hostile, aggressive, and "delusional" for seeking to assert their civil rights and rejecting notions of White superiority is well documented.[5] However, one cannot overstate the impact that this reconceptualization, codified into various editions of the *Diagnostic and Statistical Manual of Mental Disorders*,[11] has had on the modern conceptualization of schizophrenia and other psychotic disorders. Thus, the bias that clinicians bring to their assessment, including misdiagnosis and overdiagnosis, is the foundation for inequities through racialized perceptions of the very definitions of what psychosis is and how it presents in different populations. Structural racism, enacted through mental health providers' clinical decision-making, is the reason for the increase in involuntary hospitalizations of Black people starting in the 1960s and for the association of aggressiveness and hostility with both Black people and people with psychotic disorders, despite evidence that people with psychosis are more likely to be victims than perpetrators of violent crimes.[12]

CONSIDERING COMPLEXITY

Connecting the inequities associated with psychotic disorders in the diagnosis and outcomes of Black Americans is indeed a complex undertaking. A host of health outcomes are directly impacted by structural racism, and psychotic disorders in particular, which represent a complicated intersection of genetic and environmental factors. The task for public health providers is to begin to educate themselves on this complexity by actively learning the history of structural racism in psychiatry (a history that has been intentionally suppressed) and, armed with this information, conduct more thoughtful and nuanced research. This renewed commitment could lead to policies and interventions that account for the complexity and could intentionally seek to eliminate racial inequities associated with psychotic disorders. AJPH

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PUBLICATION INFORMATION

Full Citation: Shim RS. Psychotic disorders and structural racism: on considering complexity. *Am J Public Health*. 2022;112(4):538–540.

Acceptance Date: December 23, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306705

ACKNOWLEDGMENTS

The author thanks Micaela Godzich, MD, MS, and Laura M. Tully, PhD, for their input and insights on this editorial.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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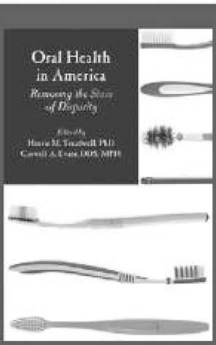

The Importance of Global Youth E-Cigarette Use Surveillance: Opportunities and Next Steps

Elizabeth L. Seaman, PhD, MHS, and Rachna Chandora, MPH

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Note. The views expressed are those of the authors and do not necessarily represent those of the CDC Foundation.

See also Sun et al., p. 650.

Tobacco is a leading cause of preventable death, disease, and impoverishment globally[1,2] and an important public health challenge for assessment and intervention. Youth through young adulthood is the most important time to prevent uptake and intervene; US studies have found that 90% of cigarette smokers initiate smoking before age 18 years, and 99% initiate before age 25 years.[3] Moving past experimentation, global studies have found that the average cigarette smoker begins regular use by age 15 years,[4] again underscoring the importance of youth and young adulthood as a time for tobacco use surveillance and intervention. Historically, tobacco control research has focused on conventional combustible cigarettes; however, given the tobacco industry's history and tactics, specifically in low- and middle-income countries,[5] and the proliferation of novel tobacco and nicotine products in the United States and globally,[1] it is necessary to understand trends in the use of tobacco and nicotine products broadly. Product use assessed across countries and regions provides both important insight into concerted industry tactics and timely awareness of emerging products. The assessment of use of these products across countries can also aid in country-to-country cooperation. Tobacco use and associated health outcomes are a global epidemic; however, the majority of the burden of tobacco-related morbidity and mortality falls on low- and middle-income countries.[2] In response to the globalization of the tobacco epidemic, the World Health Organization (WHO) developed the Framework Convention on Tobacco Control, a global treaty establishing the dangers of tobacco and aimed at reducing its use. Subsequently, MPOWER, a policy package designed to assist countries with implementing Framework Convention on Tobacco Control, was launched, urging countries to monitor tobacco use and prevention; protect people from smoke; offer cessation support; warn about the dangers of tobacco; enforce bans on advertising, promotion, and sponsorship; and raise tobacco taxes.

E-CIGARETTE USE AND YOUTHS

Since their introduction to the US market, e-cigarettes have experienced a dramatic rise in use, particularly among youths and young adults. This alarming and rapid increase in use has been well documented in the United States.[6] In an attempt to reduce use among youths and young adults, many US states and localities enacted policies that limit access to e-cigarettes, particularly flavored e-cigarettes. These trends in use and the response in the form of policies have not been limited to the United States. Recently, WHO published case studies highlighting various countries' e-cigarette regulations, demonstrating the diversity of product availability and the policy landscape in Brazil, Canada, the Republic of Korea, and the United Kingdom.[7] The long-term health risks of e-cigarettes are still largely unknown, and although they are sometimes recommended as a harm reduction cigarette cessation strategy, they are not currently reviewed or approved as cessation devices in the United States and many other countries. E-cigarette use by nicotine-naive youths poses many potential harms and should be actively avoided.

THE GLOBAL YOUTH TOBACCO SURVEY

The Global Youth Tobacco Survey (GYTS) is a school-based survey developed by WHO and the Centers for Disease Control and Prevention. The GYTS uses a standard methodology to collect data on youth tobacco use to inform and evaluate tobacco control and prevention efforts. The school-based survey of students aged 13 to 15 years has a core questionnaire with optional modules and questions based on country context.[8] The WHO and the Centers for Disease Control and Prevention offer technical support to countries during the planning, implementation, and quality control phases of the survey, ensuring that the methodology and survey instrument are standardized across countries. The GYTS was initiated in 1999, and questions about e-cigarettes have been included as part of the core questionnaire since 2012. GYTS data are critical to monitor country progress toward evidence-based MPOWER measures. The standardized GYTS instrument and methodology ensure that data can be compared both across countries and over time. Many prior studies, including several recent ones,[9,10] have made use of this important survey.

In "Prevalence of E-Cigarette Use and Its Associated Factors Among Youths Aged 12 to 16 Years in 68 Countries and Territories: Global Youth Tobacco Survey 2012–2019," Sun et al. (p. 650), from China and Switzerland, used the GYTS to present prevalence estimates of youth e-cigarette use from various countries as well as an exploration of associated factors through regression modeling. This work is critically important; by using the GYTS data with the same survey methodology and core questionnaire administered across countries, the authors present a clear comparison of e-cigarette use across different countries and regions. Previous work has been limited by different survey designs and instruments; however, this work reduces much of the background noise resulting from sampling and instrument effects. The authors included a host of important covariates in their regression modeling and also conducted sensitivity analyses to compare the usual threshold for current use (≥ 1 day in the past month) with higher thresholds that would be indicative of more regular use than experimentation (≥ 3 days in the past month, ≥ 6 days in the past month, ≥ 10 days in the past month), which are significant strengths.

There are some limitations to this piece. These prevalence estimates cannot be interpreted in a vacuum—although it is easy to note the largest differences in prevalence (1.9% of youths reported past-month e-cigarette use in Kazakhstan in 2014 compared with 33.2% in Guam in 2017), these cannot be interpreted without considering historical and cultural contexts and tobacco industry marketing and promotion activities in each country included. The authors used the most recent GYTS data available for each country for the 2012–2019 period. However, dramatic shifts in e-cigarette use and product availability occurred globally from 2012 to 2019, which makes direct comparisons across years and countries challenging. Current e-cigarette use among US high school students increased 10-fold between 2012 (2.8%[11]) and 2019 (27.5%[12]); it is likely that many other countries experienced a similar dramatic upward trend in use in this time period. Although the estimates presented in this paper can be used as a general indicator for e-cigarette use in a country, without multiple years of data to assess, trendlines within countries, and a thorough understanding of the product landscape and tobacco industry marketing and promotion efforts in each included country, it is difficult to generalize without overinterpretation.

The article by Sun et al. has far-reaching implications. The findings can help inform tobacco regulation and education priorities for countries included, especially those with higher prevalence of youth e-cigarette use. For countries with higher youth e-cigarette use, additional data analysis and surveillance efforts are warranted to understand the scope of the use of these products and associated behaviors and health outcomes. For countries with relatively lower prevalence of youth e-cigarette use, this work can help shift tobacco control priorities toward other, more commonly used products to ensure the greatest possible benefit. This article helps to dispel the notion that e-cigarettes are only commonly used in wealthier countries, because the tobacco industry has a long history of targeting its marketing and promotion in low- and middle-income countries. Most importantly, however, this article illustrates the utility and unique value of GYTS and other global surveillance efforts in providing crucial multicountry analyses. AJPH

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PUBLICATION INFORMATION

Full Citation: Seaman EL, Chandora R. The importance of global youth e-cigarette use surveillance: opportunities and next steps. *Am J Public Health*. 2022;112(4):541–543.

Acceptance Date: January 16, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306745

CONTRIBUTORS

Both authors conceptualized and wrote the editorial.

ACKNOWLEDGMENTS

The authors thank the CDC Foundation tobacco control program teams.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare. The CDC Foundation has received grants for global tobacco surveillance and monitoring and e-cigarette monitoring programs that both coauthors have worked on and have been involved with; however, this editorial was not funded by any specific program or grant.

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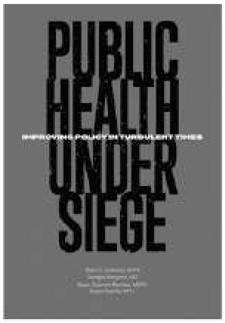

Quantifying Homeless Populations

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See also Tsai and Alarcón, p. 633.

Quantifying homeless populations has never been more important. Accurate counts of populations in need are the fundamental data needed to decide policy and program recommendations. Historically, the Department of Housing and Urban Development has relied on a one-point-in-time count—that is, on a given day and time workers canvas a city or other jurisdiction to count the homeless people sleeping outside and those in shelters and they then add the two numbers to get the total number of homeless. Unfortunately, methods for this count are not standardized across jurisdictions. This leaves open the questions as to whether the counts are accurate in any given jurisdiction and whether these counts can be compared across jurisdictions.

In this issue of *AJPH*, Tsai and Alarcón (p. 633) propose novel methods to improve these counts. However, I believe there are additional methods that should be considered. While advocating for epidemiological surveys, the authors fall short of recommending key approaches to population size estimation. These include capture–recapture methods[1] and successive size estimation (built into respondent-driven sampling methods),[2] unique object multiplier, service multiplier,[3] and multiple regression approaches.[4] A useful primer to estimating the size of hard-to-reach populations is available from the United Nations Programme of HIV/AIDS and the World Health Organization.[5] Finally, the definition of homelessness needs to be standardized. In my view, current definitions only encompass those sleeping rough on the streets, living in homeless encampments, or staying in shelters. These do not account for those who are homeless but may be staying with friends or family, although these individuals would undoubtably benefit from services. AJPH

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PUBLICATION INFORMATION

Full Citation: Raymond HF. Quantifying homeless populations. *Am J Public Health*. 2022;112(4):544.

Acceptance Date: January 19, 2022

DOI: https://doi.org/10.2105/AJPH.2022.306755

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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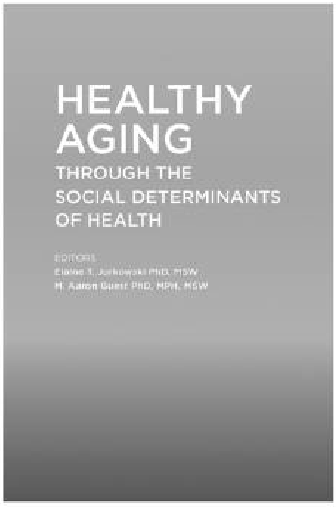

Online Hate: The New Virus

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See also Hohl et al., p. 646.

In their article in this issue, Hohl et al. (p. 646) illustrate the spatiotemporal distribution of geolocated tweets that contain anti-Asian hate language during the onset of the COVID-19 pandemic. In this research, Hohl et al. discovered, from more than 4 million geolocated tweets collected from Twitter, that clusters of hate appeared to be distributed across the United States. These results expand on previous efforts by showing that, across all geographic regions, there was a high degree of anti-Asian hate perpetuated through the social media platform Twitter. Interestingly, this included the Northeast and the West Coast, both regions that have traditionally appeared supportive of issues related to racial equity and social justice.[1] In the findings presented by Hohl et al., even areas such as New York and California, often considered progressive beacons, experienced clusters of hate against Asians. While potentially humbling, this finding is not entirely surprising, and potentially reflects the deep-seated structural racism that exists across all regions of the country.

ANTI-ASIAN VIOLENCE

Consider, for example, that the New York City Police Department has reported that hate crimes against Asians have increased by more than 360% since the start of the pandemic.[2] This dramatic increase is reflected through terrifying examples at the individual level. In one of the most egregious examples, a horrendous hate crime that occurred on July 11, 2020, an 89-year-old Asian grandmother was set on fire by two men as she was walking outside her home in Brooklyn, New York.[3] Despite this clearly violent act, the New York City Police Department remained hesitant to classify this as a hate crime.[3] Interestingly, in the same neighborhood, only a week before this incident, anti-Asian flyers were posted.[3] The findings reported by Hohl et al. further confirm these unsettling trends, demonstrating that online anti-Asian sentiments have been rising, with the peak occurring in March 2020. Hohl et al. also report that a significant cluster of anti-Asian hate appeared in the same county in New York, reporting a proportion 3.39 times higher than in other areas in the United States. This not only suggests that this is a region susceptible to Asian hate but also may indicate that there will be continued patterns of these types of hate crimes in the area.

NOVEL VIRUS, ANCIENT RACISM

These findings from Hohl et al. of anti-Asian sentiment are unfortunately not new in the United States. There has been a long history of xenophobia against people from Asia, whereby the Page Act of 1875 was the first restrictive federal immigration law prohibiting entry of Chinese women[4] and the 1882 Chinese Exclusion Act banned immigration of Chinese men.[5] The goal was to "end the danger of cheap Chinese labor and immoral Chinese women."[6] These laws sparked violence against Chinese persons,[5] including the Rock Springs massacre of 1885, where White miners who were envious of the employment by the Chinese murdered them by shooting, stabbing, or burning them alive in their homes.[7]

These structural forms of racism against Asians have further led to the racialization of disease. For instance, James D. Phelan, the mayor of San Francisco during the plague in 1900, whose slogan was "Keep California White," and who wrote an article entitled "Why Chinese Should be Excluded," kept Chinese residents separated from Whites because Phelan believed the Chinese would "breed the germs of a national disease."[8(p675)] Driven by these racist beliefs, Chinatown in San Francisco was quarantined and Chinese residents were not allowed to leave, yet Whites were allowed the privilege of egress and entry[7]—because it was stated that the Chinese were "indifferent to sanitary regulations and breeding disease."[8(p674)] In addition, all East Asians were prohibited from crossing state borders, and alarmingly, without their consent, persons of Asian heritage in Chinatown were inoculated with an experimental vaccine.[7,9,10]

ONLINE HATE SPEECH TO REAL-WORLD HATE CRIMES

Remarkably, this transformation of an outbreak into a sociopolitical crisis has reemerged and manifested parallel

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racialized views expressed by some contemporary political figures. On March 16, 2021, former president Donald Trump used the term "Chinese Virus" in a tweet. The study by Hohl et al. found a clustered surge of anti-Asian hate in March 2020, which is consistent with a previous study by Hswen et al.,[11] which found that a massive surge in anti-Asian hate hashtags were used on Twitter following use of this racist rhetoric of the term "Chinese Virus." These hateful sentiments by persons of influence may be linked to blaming the COVID-19 pandemic on Asians and the rising verbal and physical attacks directed toward Asians. Nguyen et al. showcased how area-level racist sentiment online has been associated with residential racial prejudice,[12] and results from Muller and Schwartz showed the link between racist hashtags and real-world hate crimes.[13] Yet, despite strong evidence linking the discussion of hate online with real-world impacts, as further exemplified in the research by Hohl et al., this has been met with lackluster countermeasures and response from public health officials and ultimately has done little to spark the civic action needed to tackle and prevent the perpetuation of online hate head on.

It is noteworthy that a causal relationship has not yet been determined through scientific inquiry. Yet, one must ask whether such a relationship is necessary to establish to deem online hate as a hate crime and serious assault on our communities. Consider other domains, where ample evidence has been provided that sentiment on Twitter is predictive of stock market fluctuations.[14] Or consider the real-world consequences of errant tweets from those with influential power such as celebrities—for instance, Kylie Jenner's singular tweet, comprising a mere 18 words (including terms "sooo" and "urg") to illustrate her dissatisfaction with Snapchat. The repercussions of this tweet were extensive, equating to roughly $72 million in loss per word that was used, amounting to a total of $1.3 billion in stock loss for Snapchat.[15] In another example, Elon Musk's 2020 tweet commenting that Tesla's stock price was too high resulted in significant losses to the carmaker in excess of $14 billion.[16]

These examples illustrate the power of words. In the context of online hate and perpetuating racist attitudes, why would we doubt that such online conversations would not have similarly extensive impacts? Repeating the need for additional research at times feels futile, simply because these events pertaining to hate cannot (and should not) be tested empirically. We should acknowledge the serious threats that these types of online communications have and, more importantly, that such conversations reflect deep-seated and racist beliefs that permeate many communities, even those that we believed were free from such prejudice.

Posting hateful content online has become the graffiti of the online world. This can be equated to the horrendous acts of defacing and graffiti that we have witnessed directed toward Black churches, synagogues, and mosques. Yet, no consequences exist in holding those accountable in the online world. Online threats posted on Facebook, Twitter, or Instagram, to name a few among the many social medial platforms that exist today, can and should be considered criminal charges. These types of attacks on the basis of an individual's identity—their racial, ethnic, or gender background—may result in serious threats to their well-being, including physical harm or even death. Yet, public health officials, the research community, and the general public continue to ignore or overlook its causality. As a member of the research and public health community, I implore that we take stock of these issues, recognizing the link between the online and offline (real) worlds, and begin to realize the power and impact of online hate.

The average person in the United States spends 7 hours and 50 minutes with digital media each day (https://bit.ly/3C3QAer). There is no doubt that we are living in the online world more than the offline world, considering how the pandemic has ushered our day-to-day interactions to virtual media and has further entrenched our attention on social media feeds and other online media. Researchers have been slow to calculate the effect that the digital online world has had on health and society. As we continue to deepen our reach into the online world, it is critical that we expand on the work presented by Hohl et al. and study its impact on the health and well-being of those who are most vulnerable. It is necessary for public health and government officials to invest in the surveillance of online hate, in a similar manner as has been demonstrated for tracking the COVID-19 pandemic, to detect hate earlier and prevent the spread of hate and resulting real-world violence and harm. AJPH

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PUBLICATION INFORMATION

Full Citation: Hswen Y. Online hate: the new virus. *Am J Public Health*. 2022;112(4):545–547.

Acceptance Date: January 19, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306754

CONFLICTS OF INTEREST

The author has no conflicts of interest from funding or affiliation-related activities.

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Value and Challenges of Using Observational Studies in Systematic Reviews of Public Health Interventions

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AJPH April 2022, Vol 112, No. 4

Recent developments in systematic review methods provide opportunities to draw more robust conclusions from observational studies of interventions and increase the public health relevance of reviews. Cochrane public health and health systems reviews have expanded in scope and methods, supported by new chapters on nonrandomized studies in the updated *Cochrane Handbook* (2021)[1] and the development of new, related guidance by the Cochrane Methods Executive. We illustrate these changes while also summarizing the most recent guidance and research on deciding when to include observational studies, identifying and selecting studies, extracting and synthesizing data, assessing risk of bias, and grading certainty of evidence.

These developments are particularly important for systematic reviews in public health, in which randomized trials to assess health outcomes are often unfeasible, for example, in the case of large and irreversible infrastructure interventions; unethical, for example, where the primary aim of the intervention is to prevent certain harm; unavailable when decisions are urgently required; or unable to detect harms at the population level, for example, observational pharmacovigilance studies that use adverse event data sets to detect harms after a drug is already on the market and in widespread use. We draw on our experience as editors and authors of Cochrane public health and health systems reviews and as methodologists, supplemented by a hand search of the past five years of key methodology journals. Observational studies of exposures (e.g., environmental exposures) also constitute an important area of current methodological development but are outside the scope of this editorial.

Including observational studies in systematic reviews of interventions produces challenges at every stage of designing and conducting a review, beginning with the terminology used to define and identify these studies. Despite efforts to encourage classification according to study design elements rather than labels,[2] agreement on terminology is elusive. By "observational studies of interventions," we intend to encompass the range of classifications that may be encountered when considering quantitative evidence of intervention effects other than from randomized trials. These terms include (but are not limited to) nonrandomized studies of interventions,[1] quasiexperiments,[3] natural experiments,[4] and the many specific study design labels that fall within these categories.

It is important to note that many of these terms have overlapping meanings and are applied in diverse and inconsistent ways, both in primary research and in systematic reviews. However, for the full value of observational studies of interventions to be realized, it is essential that systematic reviewers look beyond traditional study designs, such as cohort and case–control, and consider the relevance of quasiexperimental designs that can adjust for unobserved confounding, or selection on unobservables.[5] At the same time, systematic reviewers must recognize that observational studies are not all of equal evidentiary value, requiring careful assessment of risk of bias, and that their inclusion may increase the resource requirements of a review.

CHANGES IN UNDERSTANDING

Early methodological guidance recognized that observational studies can fill gaps in the literature, provide long-term follow-up that can identify harms of treatments, and answer questions that cannot (for reasons of ethics or feasibility) be investigated in randomized trials.[6] However, recognition of this value was tempered by caveats on the vulnerability of observational studies to bias and confounding, increased heterogeneity in meta-analyses, and the assertion that observational studies can estimate associations only between treatment and outcome, rather than unbiased causal effects.[6] A further concern has been understanding the extent to which observational studies may overestimate the effects of interventions compared with randomized trials. Interestingly, systematic reviews have generally found a lack of statistically significant differences in pooled results when systematically comparing randomized and observational studies,[7,8] identifying differences in the specific research question, heterogeneity, or risk of bias[9] as explanations for any dissimilar results.

Although randomized trials remain the gold standard for estimating the effects of interventions, the “causal turn” in epidemiology has facilitated an explicit acknowledgment that observational studies may also aim to estimate causal effects.[10] Causal inference can be strengthened by designs that postulate a plausible counterfactual under certain assumptions, such as the preintervention trend in an interrupted time-series study, Mendelian randomization, instrumental variables, or the untreated control group in a regression discontinuity design, which allow the causal effect of an intervention to be estimated.[4] Recent systematic reviews have demonstrated these designs to have been more widely implemented in health research than previously believed; however, these reviews have also noted issues in the quality of the conduct and reporting of these studies.[11–13]

Recent Cochrane reviews illustrate how including observational studies is essential for providing a comprehensive picture of the range of interventions and evidence available for some public health questions, such as the effects of large-scale primary prevention interventions, particularly when these have been implemented and evaluated across different contexts. For example, a Cochrane review (in progress) of sugar-sweetened beverage taxation has identified no eligible randomized trials, but a large body of at least 39 nonrandomized studies will contribute to a comprehensive evaluation of the effects of these taxes on consumption and sales.[14] A review of interventions to reduce ambient air pollution similarly identified no randomized trials, but 42 nonrandomized studies provide evidence on the effectiveness of 38 different interventions, albeit with low and very low certainty.[15] In a review of environmental interventions to reduce sugar-sweetened beverage consumption, the majority of well-known interventions (including traffic light labels, nutritional rating scores, and price increases) have been evaluated only in observational studies and therefore would not have been represented in the review if only randomized trials had been included.[16]

CHALLENGES AND ADVANCES

Although these reviews serve as examples of the value of including observational studies in evidence synthesis, these studies presented challenges at every stage of the review, from designing the protocol and identifying studies to extracting, evaluating, and synthesizing the results. The online appendix (available as a supplement to the online version of this article at http://www.ajph.org) provides a table summarizing the challenges encountered, recent methodological developments that have contributed to meeting these challenges, and priorities for future research.

WHEN TO INCLUDE OBSERVATIONAL STUDIES

The newly revised *Cochrane Handbook* suggests that the inclusion of observational studies is justified when randomized trials answer a review question indirectly or incompletely or when a randomized trial is impossible or unlikely to be conducted.[1] The approach is based on a taxonomy of observational studies that replaces design labels (e.g., controlled before and after) with a breakdown of design elements (e.g., assignment mechanisms and control for confounding) that can enable the study to make causal estimates and minimize risk of bias.[2] This taxonomy is a helpful shift away from inconsistently applied design labels and toward a recognition of the role of study design elements in supporting causal inference. The *Handbook* recommends that reviewers decide which study design elements would be desirable for the review question, scope the literature to see what studies are available, and set the eligibility criteria in the protocol accordingly. In practice, this strategy requires specialist knowledge of these study designs, and examples of best practice from systematic reviews that have implemented this strategy are lacking.

SEARCHES AND STUDY SELECTION

Reviews that include observational studies typically must deal with a large volume of retrieved records. The lack of standardized terminology creates a challenge for information retrieval and for study selection. For example, in a review of taxation of sugar and sugar-added foods to prevent obesity, 24 454 records were retrieved, of which only one interrupted time-series study was eligible for inclusion.[17] Machine learning is a potential solution, although there are considerable problems in applying machine learning to fully automate the selection of nonrandomized studies owing to varying terminology.[18] Machine learning tools that prioritize studies for screening by identifying patterns in human reviewers' decisions (semiautomation) can be useful in reducing screening burden.[19] Search filters allow database-specific strategies to reduce volume but are not yet available to cover the full range of study types (with varying labels) and databases required for public health reviews.[20] Furthermore, these strategies depend on the completeness, quality, and uniformity of records and retrievable full texts so that study identification and selection remain labor-intensive steps that cannot be fully automated at present.

DATA EXTRACTION

Observational studies, in particular quasiexperimental and natural experimental designs, typically offer multiple analyses and effect estimates for the same outcome in a single study, again requiring specialist methodological knowledge on the part of the review team to undertake data extraction. Methods for addressing effect size multiplicity have been described,[21] but the impact of choice of method and of selection of effect sizes on the results of meta-analysis of observational studies is unknown.[22] In some cases the same data set may have been used in more than one secondary analysis, creating a risk of double counting of results in a review, even from independently conducted studies. Additionally, poor data quality may pose a threat to validity that is difficult to detect and assess.[9] Standardized tools for data extraction are lacking.

RISK OF BIAS

Assessing risk of bias is an essential task that poses a significant challenge for systematic reviews of observational studies, as hundreds of tools exist; no tool applies equally to all study designs, making consistent assessments difficult; and consensus is lacking on which is preferred.[23] Furthermore, there is evidence that the choice of tool can affect the conclusions of reviews of observational studies.[24] The ROBINS-I (Risk Of Bias In Non-randomized Studies–of Interventions) tool has been advanced as a solution to this dilemma.[25] ROBINS-I uses a series of signaling questions to assess risk of bias in seven domains: confounding, selection of participants, classification of intervention status, deviations from intended interventions, missing data, outcome measurement, and selective reporting.

This rigorously developed tool enables a systematic assessment of risk of bias, with signaling questions currently developed for cohort and case–control studies and versions covering additional study designs in development. However, use of this tool requires a strong understanding of epidemiological principles and a significant time investment. Early reports indicate that users have difficulty in applying the tool consistently, although this is partly because observational studies of interventions are sometimes poorly reported.[26] Selective reporting bias and publication bias are especially difficult to assess, as protocol registration and prespecified analysis plans remain uncommon for observational studies. Cochrane is currently undertaking research into preferred and acceptable risk of bias tools when ROBINS-I is not appropriate. The interactive Tableau risk of bias tool finder (https://ntp.niehs.nih.gov/go/ohat_tools) can help users compare and select from 62 risk of bias tools for observational studies of exposures.

SYNTHESIS

The *Cochrane Handbook* notes that the inclusion of observational studies of interventions, with various design elements and conducted in a range of populations and settings, typically leads to high statistical heterogeneity that may be methodological, contextual, or unclear in origin. In principle, meta-analysis can be conducted using effect estimates from observational studies. The *Handbook* recommends that a random-effects model be the default approach and that separate analyses be conducted for studies with very different design features[1]; however, detailed guidance on how and when to do so is lacking. In practice, pooling these studies is often deemed inappropriate because of very large heterogeneity across interventions and outcomes, statistical heterogeneity encountered as a default for population-level interventions, or outcomes data assessed and reported in a manner that precludes meta-analysis. The little guidance that exists suggests that meta-analysis of observational studies should focus not only on a pooled effect estimate but also on assessing the influence of moderators and potential sources of bias, employing subgroup analysis and metaregression;[27,28] leave-one-out meta-analysis would be another option to identify exaggerated effect sizes that stem from a particular study.

Reviewers face a considerable challenge in structuring and reporting a nonstatistical synthesis, which may be narrative, tabular, or graphical. New reporting guidelines on SWiM (Synthesis Without Meta-analysis) help to address this challenge by detailing how reporting can be improved in aspects of methods and results that often lack transparency in such reviews, including how studies have been grouped and how heterogeneity has been investigated.[29]

CERTAINTY OF EVIDENCE

The introduction of the target trial concept and ROBINS-I have contributed to a significant advance in GRADE (Grading of Recommendations Assessment, Development and Evaluation), a methodology widely used to assess the certainty of a body of evidence in systematic reviews and guidelines. GRADE originally reflected the traditional hierarchy of evidence by having all bodies of observational evidence start with a low rating and bodies of randomized trial evidence start as high certainty. Although, crucially, observational evidence could be upgraded in certain circumstances, upgrading rarely occurred, and concerns were raised that GRADE underrated the certainty of evidence in areas lacking in randomized trials, such as population health.[30] New GRADE guidance indicates that when ROBINS-I is used, observational studies also start with a high certainty rating, allowing better comparison and integration of randomized and nonrandomized evidence; however, examples are lacking.[31] To address this gap, the GRADE Public Health Group is undertaking research into the conditions under which evidence from designs such as interrupted time series can produce a body of high- or moderate-certainty evidence.[30]

FURTHER DEVELOPMENTS NEEDED

Systematic reviews vary in methodological and reporting quality.[32] Including observational studies introduces additional challenges and resource requirements but can also increase the public health relevance of a review if study quality is rigorously assessed and guidelines for producing a high-quality systematic review are followed. Given both the value and the challenges of including observational studies in systematic reviews of interventions, we look forward to further development of methods and tools to ensure that such studies are identified, assessed, and incorporated into public health and health systems reviews in the best possible manner. Machine learning algorithms and search filters, data extraction tools, and ROBINS-I extensions will help to address these challenges. A greater focus on study design elements that reduce bias and confounding and on investigation of whether underlying design assumptions have been met, rather than design labels that are inconsistently applied in the literature, may contribute to producing tools that are easier to use and apply. Meta-epidemiological research on less familiar study designs, such as natural experiment and quasiexperimental designs, is needed to support the development of tools and reporting standards with empirical evidence. The online appendix summarizes challenges, developments, and priorities for further research.

RECOMMENDATIONS FOR REVIEWERS

Systematic reviews in public health and health systems should be designed at the protocol stage to consider the potential relevance of different observational study types, notably natural experimental and quasiexperimental studies, to the research question and specify inclusion and exclusion criteria, search strategies, risk of bias assessment, and synthesis plans accordingly. Risk of bias tools should be comprehensive in addressing selection bias, confounding, information bias, and selective reporting. Where possible, they should specifically apply to the study designs included in the review, and the rationale for the choice of tool should be reported. Data extraction should identify the data set used in secondary analyses, as reviewers will need to guard against double counting if multiple independent studies have analyzed the same data. Review teams need to be appropriately resourced, given the large amounts of search results, methodological expertise, and time required for reviews of observational studies. Finally, along with implications for the education and training of researchers to appropriately conduct observational studies of the effects of interventions, systematic review authors should be appropriately trained to identify, analyze, and assess these studies. AJPH

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PUBLICATION INFORMATION

Full Citation: Hilton Boon M, Burns J, Craig P, et al. Value and challenges of using observational studies in systematic reviews of public health interventions. *Am J Public Health*. 2022;112(4):548–552.

Acceptance Date: December 6, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306658

CONTRIBUTORS

M. Hilton Boon drafted the first version of the editorial. All authors revised, completed, and approved the editorial.

ACKNOWLEDGMENTS

This work received no specific funding, but M. Hilton Boon, P. Craig, S. V. Katikireddi, and H. Thomson would like to acknowledge funding from the UK Medical Research Council (grant MC_UU_00022/2) and the Scottish Government Chief Scientist Office (grant SPHSU17). S. V. Katikireddi additionally acknowledges funding from a National Health Service Research Scotland Senior Clinical Fellowship (grant SCAF/15/02).

The authors would like to acknowledge the three anonymous reviewers and the associate editor for their constructive comments and suggestions.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Governing Global Antimicrobial Resistance: 6 Key Lessons From the Paris Climate Agreement

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Antimicrobial resistance (AMR) is among the most urgent global health challenges of our time. AMR can develop with each use of an antimicrobial, regardless of the setting. The ongoing use of the same antimicrobials across sectors and the ability of microbes to transfer among people, animals, food, and environments; spread across borders through global trade and travel; and bring entire economies to a halt means that every antimicrobial consumed has global implications. Some microbes have already developed resistance to all known antimicrobials, meaning previously curable diseases have become untreatable. If immediate action is not taken, the effectiveness of these vital medicines will continue to diminish, further undermining modern medicine's ability to treat infectious diseases and perform essential medical procedures.[1]

The global spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its variants that cause COVID-19 has sparked new discussions on the need for an international pandemic treaty,[2] presenting a unique opportunity to reflect on AMR as one pathway through which new cross-border global health threats emerge. Similar to zoonoses such as COVID-19, AMR can lead to untreatable infectious diseases in humans with the potential to become deadly pandemics. AMR diminishes the global common pool of antimicrobial effectiveness—a nonexcludable but rivalrous resource—meaning that maintaining the viability of antimicrobial therapy is a global common-pool resource challenge.[3] Overcoming this challenge will require global mechanisms to coordinate interests and investments, limit free riding, and steer cooperation toward preserving the common pool. This aspect of AMR enables us to draw lessons from other common-pool resource challenges, such as climate change, in building collective action to target the pathways by which AMR may emerge, maximize the antimicrobial commons for everyone's benefit, and avoid further descending into this tragedy-of-the-commons scenario.

Building global collective action while accommodating varying national circumstances is a monumental but, in our view, achievable task. The 2015 Paris Agreement under the United Nations Framework Convention on Climate Change, for example, successfully mobilized substantial collective action to protect a shared global common-pool resource similar enough to antimicrobial effectiveness that it can provide lessons for advancing global action in this area. While countries struggle to meet their specific climate targets, the Paris Agreement has stimulated global cooperation by engaging countries in an ongoing effort to mitigate greenhouse gas emissions and adapt to the impacts of climate change. AMR lacks an equivalent global vehicle for building cooperation and would benefit from a Paris Agreement–style coordinating structure. The Paris Agreement offers 6 key lessons relevant to managing the global antimicrobial commons (Table 1).

6 KEY LESSONS FOR AMR

First, AMR needs a unifying global target to mobilize political attention and benchmark global progress. For the Paris Agreement, the world united behind the politically memorable, albeit scientifically ambiguous goal of keeping global average temperatures below 1.5°C above preindustrial levels or at least well below 2°C.[4] For AMR, the world still needs to develop, agree to, and unite behind a quantifiable goal that resonates with nonexperts.

Second, effectively mitigating the threat posed by AMR requires a recognition of how embedded social structures and incentives drive antimicrobial use across sectors. AMR efforts over many decades have largely focused on the behavior of individual health care providers and patients, emphasizing education and personal choice as the dominant strategies to reduce global antimicrobial use.[5,6] These strategies, which are reminiscent of climate change mitigation strategies that offload the responsibility for action from governments to individuals, are now acknowledged as insufficient. Antimicrobials have become such widely used tools that they are effectively invisible infrastructure underpinning our health and food systems and paper over shortcomings in basic hygiene, equality, and labor systems.[6] Individuals are therefore ill-placed to address AMR through more informed decision-making. Instead, addressing AMR requires a commitment to social and economic transformation similar to the one in the Paris Agreement's call to action.

Third, escalating commitments through national AMR action plans, which outline each country's AMR goals and planned actions, will likely increase the effectiveness of global AMR efforts. Ongoing international monitoring of national AMR action plans by the World Health Organization provides a key starting point, but more extensive and ambitious global legal commitment mechanisms are imperative.[7] In their nationally determined contributions under the Paris Agreement, countries are legally required to specify their level of ambition, regularly monitor progress to that goal, and ratchet up their commitments every five years. Escalating national commitments over time makes it easier for countries to commit to action early, shape future policy directions, and signal their willingness to cooperate. Although not perfect, this model could increase the level of ambition in current AMR commitments.

Fourth, a permanent multistakeholder forum on AMR similar to the Paris Agreement's annual Conference of the Parties to the United Nations Framework Convention on Climate Change could be highly effective in shaping consensus and action over a short time horizon.[8] A high-profile AMR forum composed of countries and nongovernmental organizations would ensure ongoing and inclusive dialogue to build a culture of accountability, trust, and good faith among relevant actors. Crafting an inclusive process will be essential for shaping equitable goals and actions, especially because attempting to govern AMR globally requires confronting questions about universal representations of the global public and its objectives.[9,10] Striking this forum, therefore, represents an important first step to ensure that future initiatives proceed fairly.

Fifth, like the Intergovernmental Panel on Climate Change guiding the Paris Agreement, ongoing AMR action would be best informed by a regular and independent stock-taking to evaluate existing measures and advise on evidence-informed adjustments.[11,12] This endeavor must (1) recognize that different ways of knowing constitute the global knowledge base, (2) ensure that using evidence to inform adjustments that work does not detract from the inherently political questions of works *for what purpose* and *for whose benefit*, and (3) come with a commitment to equitable evidence generation and prioritization. Striking a panel to assess the global knowledge base on these terms will ensure that global, regional, and national goals and policies are continually informed by the best available evidence and are in line with leading practices.[12]

Finally, an enduring international legal agreement could institutionalize

TABLE 1— Comparing the Paris Climate Agreement With Existing Global AMR Efforts

Essential Elements	Paris Climate Agreement	Current Global AMR Efforts
1. Collective global goal	Keep global temperature rise below 1.5°C above preindustrial levels or at least well below 2°C	No consensus on what a collective global goal could look like
2. A focus on social and economic transformation	Implementation of the Paris Agreement requires social and economic transformation to decarbonize national economies.	AMR discourse has historically emphasized individual behavior instead of social and economic transformation.
3. Nationally determined contributions pledged, reviewed, and ratcheted every 5 years	All parties must communicate their nationally determined contributions every 5 years and, during revisions, aim for maximally ambitious goals. Nationally determined contributions are reviewed to ensure the distribution of responsibilities is fair and that countries are ambitious in their goals. All parties must regularly provide information on activities and outcomes using methods that are articulated by the Intergovernmental Panel on Climate Change.	All WHO member states committed to having national action plans for AMR. Even though this commitment is not legally binding, more than 100 countries have published plans, and many are under development. However, there are no specified review, intensification, or accountability mechanisms, and little financial, technical, and infrastructural support is provided for achieving necessary policies. WHO, FAO, and OIE conduct self-assessment surveys on national AMR activities, but there is no regular reporting or standard methodology for reporting outcomes.
4. Annual multistakeholder forum	The annual Conference of the Parties to the UNFCCC serves as a multistakeholder meeting place for advancing the Paris Agreement.	AMR is normally discussed every 3 years at the World Health Assembly, but there is no formal or regular meeting focused on AMR and no permanent forum for multistakeholder discussions on AMR across sectors.
5. Global scientific stock taking every 5 years	Requirement to assess the best available science every 5 years; this stock-taking exercise will help ensure that the Paris Agreement's ongoing efforts are in line with scientific best practices.	No relevant comparison
6. International legal framework	The Paris Agreement is a legally binding instrument of the UNFCCC. The UNFCCC provides a broader legal framework for the Paris Agreement.	No international legal framework, although the constituting instruments of the WHO, FAO, OIE, or UN could serve as the broader legal framework for a legally binding AMR agreement

Note. AMR = antimicrobial resistance; FAO = Food and Agriculture Organization of the United Nations; OIE = World Organization for Animal Health; UN = United Nations; UNFCCC = United Nations Framework Convention on Climate Change; WHO = World Health Organization.

Source. Rogers Van Katwyk et al.[15]

these actions with a long-term vision and generate progress on AMR by charting a clear path forward, distributing responsibilities, and creating a sustainable system that makes countries active participants throughout the process. Treaties are appropriate for certain kinds of challenges only—hence, they are rare in global health. However, the escalating, transnational, and enduring AMR crisis means a strong international legal framework is required to hold actors accountable and link strategies across sectors, countries, and time.[13]

Whether through a standalone agreement or within a new pandemic treaty, an international agreement on AMR could align incentives that switch the focus of AMR efforts toward prevention and preparedness and coordinate investments to generate social and economic transformation, especially because countries are unlikely to undertake these initiatives on their own. Such an agreement must unite human health, animal, agricultural, and environmental sectors through a "One Health" approach to maximize the global antimicrobial commons for everyone's benefit and simultaneously improve infection prevention measures while promoting access, conservation, and innovation for antimicrobials, alternative therapies, and diagnostic technologies.[8] Coordinating a One Health approach that appropriately engages ministries of health, environment, agriculture, development, and finance requires new legal mechanisms beyond those available through the World Health Organization, the Food and Agriculture Organization of the United Nations, the World Organization for Animal Health, and the United Nations Environment Program, which are limited to the area-specific mandates of each institution.

TOWARD AN INTERNATIONAL TREATY

Although a universal agreement involving all countries is desirable from the outset, an effective treaty can emerge from a small group of countries willing to act immediately, as long as it is designed to incentivize and allow other countries to join later. It only took 20 countries to launch negotiations for the 1985 Vienna Convention for the Protection of the Ozone Layer, which later delivered the 1987 Montreal Protocol—the first universally ratified and possibly the most effective agreement in the history of the United Nations. For AMR, we would only need a few global leaders to decide that bold action is needed to protect the countless lives threatened by AMR. Although some countries, such as those within the G20, may be better positioned than others to take this initiative, the COVID-19 pandemic has shown that our expectations for global health leadership can rapidly change.[14] An AMR treaty—or provisions on AMR within the proposed pandemic treaty—could emerge from any group of countries ready to act quickly. With the future of antimicrobial effectiveness hanging in the balance, we cannot afford to wait any longer.

We have known about AMR for as long as we have had effective antimicrobials. Without swift collective action now, though, AMR may undo one of humanity's greatest discoveries. This outcome would make AMR the epitome of the global tragedy of the commons. To avoid such a catastrophe, world leaders must take ambitious action—similar to the steps they took when setting up the Paris Agreement—to protect antimicrobials as a precious shared resource and prevent this looming emergency. These insights could be immediately relevant for informing emerging discussions on a potential international treaty on pandemics, which must also address AMR to be comprehensive.[2]

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PUBLICATION INFORMATION

Full Citation: Weldon I, Rogers Van Katwyk S, Burci GL, et al. Governing global antimicrobial resistance: 6 key lessons from the Paris Climate Agreement. *Am J Public Health*. 2022;112(4):553–557.

Acceptance Date: December 19, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306695

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The ideas and arguments in this analysis were generated at an expert dialogue attended by all authors at the Oxford Martin School, University of Oxford, in May 2019. The workshop was co-organized by A. Giubilini, M. Harrison, S. J. Hoffman, C. Kirchhelle, A. McLean, S. Rogers Van Katwyk, J. Savulescu, and I. Weldon as part of a larger research project on collective responsibility for infectious disease. I. Weldon wrote the first draft of this editorial with the workshop co-organizers. All authors provided critical edits and approved the final version.

ACKNOWLEDGMENTS

Funding was provided by the Wellcome Trust (WT 216476/Z/19/Z), the Social Sciences & Humanities Research Council of Canada (611-2018-0567), and the Oxford Martin School.

CONFLICTS OF INTEREST

S. J. Hoffman is Scientific Director of the CIHR's Institute of Population and Public Health and is CIHR's Scientific Lead for Global Health. The views expressed in this article are those of the authors and do not necessarily reflect those of the Canadian Institutes of Health Research (CIHR) or the Government of Canada. The other authors have no conflicts of interest to disclose.

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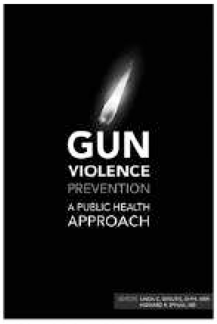

Federal Policymakers Should Urgently and Greatly Expand Naloxone Access

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AJPH April 2022, Vol 112, No. 4

Since March 2020, the US federal government has invested tremendous public health effort in COVID-19 responses by expediting the availability of vaccines and novel therapeutics. Meanwhile, addiction care providers, public health workers, and people who use drugs have been sounding alarms about the pandemic's collateral damage, which has contributed to the ongoing surge of unintentional fatal overdoses. Reduced access to addiction treatment and services combined with fentanyl infiltrating drug supplies resulted in an estimated 100 000 fatal overdoses in 2020 alone.[1] Although the Centers for Disease Control and Prevention (CDC) has released official health advisories[2] and the US Department of Health and Human Services (HHS) has supported widespread implementation of expanded distribution and use of naloxone in high-risk populations, there is not enough naloxone in the hands of those who need it most. Only one naloxone prescription is dispensed for every 70 high-dose opioid prescriptions nationwide.[3] In communities that experience disproportionate rates of overdose from illicit opioids, a recent study suggests that nonurban areas have lower naloxone distribution relative to overdose deaths than urban areas do.[4] Given the pervasiveness of this national crisis, it is critical to saturate our communities now with naloxone. The 2021 Model Expanded Access to Emergency Opioid Antagonists Act is a first step in aiming for uniform naloxone access because it provides a legislative template that states could eventually choose to implement.[5] We call on federal policymakers and regulators to take one step further to increase naloxone availability by (1) making naloxone available over the counter (OTC), (2) increasing funding for community-based programs focusing on harm reduction, (3) permanently eliminating insurance copayments and prior-authorization requirements, and (4) mandating coprescribed and codispensed naloxone with all higher-risk opioid prescriptions and medications for opioid use disorder.

OVER-THE-COUNTER NALOXONE

First, we call for an intranasal naloxone formulation to be switched to an OTC status and for mandates for insurers to cover OTC cost.[6] Traditional naloxone access points, such as local pharmacies, health care facilities, and syringe service programs, are not universally available in all communities and often lack round-the-clock availability. We envision naloxone at a subsidized cost at low-barrier access points such as gas stations and convenience stores, where people at risk for overdose could have 24-hour access. Naloxone has a benign safety profile with no significant clinical effect if opioids are not present, is rarely associated with severe adverse reactions when administered in the community,[7] and meets all 4 US Food and Drug Administration (FDA) criteria to become an OTC product.[6] Even though the FDA Center for Drug Evaluation and Research supported development of OTC naloxone products by proactively developing model consumer-friendly drug fact labels in 2020,[8] naloxone remains under prescription-only status. The opioid overdose crisis continues to ravage communities; thus, we call for federal policymakers within the US Department of Health and Human Services or the FDA to facilitate OTC approval of at least one formulation of naloxone, with or without manufacturer requests or approval. This is a crisis that demands bold and immediate action.

EXPAND FUNDING FOR COMMUNITY-BASED PROGRAMS

Second, we call for a focused effort to increase funding for all community-based programs concentrating on harm reduction. These community programs often engage people who use drugs and members of racial minority groups who have historically faced stigma and been excluded from health care systems and pharmacy-based naloxone access. People who use drugs are most likely to use naloxone to reverse a witnessed opioid overdose[9] and thus are a key population to equip with naloxone. Currently, states can seek funding toward purchasing naloxone from the Substance Abuse and Mental Health Services Administration via formula-based block grants that can be distributed to governmental and nongovernmental agencies. Although the American Rescue Plan Act of 2021 is expanding block grant availability to community harm reduction services and is an important step toward expanding access, many nongovernmental organizations, community health centers, and harm reduction organizations do not receive these federal funds and have to use their limited budgets to purchase naloxone formulations at cost or rely on mutual aid networks.[10] Manufacturing disruptions of generic naloxone in 2021 have limited the supply of this lower-cost formulation, forcing community-based programs to stretch funds for costlier formulations to sustain their naloxone demands.[11] Given the number of lost lives and the 2021 National Drug Control Strategy specifically calling for investment and dissemination of evidence-based harm reduction efforts, including naloxone access, we advocate that expansion of funding for community harm reduction organizations be coupled with securing an affordable and permanent naloxone supply for these organizations. Strategies used during the COVID-19 pandemic for procurement of vaccinations could be considered to expand naloxone availability to community health programs, including federal mass purchasing and stockpiling.

ELIMINATE INSURANCE COPAYMENTS

Third, we call for removing patients' financial barriers to obtaining naloxone by the permanent elimination of copayment and preauthorization requirements. This was done at the federal level by leveraging the Affordable Care Act to provide rapid coverage of preventive services to enable covering costs for community COVID-19 vaccinations.[12] In general, individuals with medication copays are less likely to pick up a prescription and have naloxone available when it is needed. All state Medicaid programs cover naloxone; however, even though Medicaid covers almost 40% of nonelderly adults with opioid use disorder, in 2018, it only paid for 5% of all naloxone sold in the United States.[13] Furthermore, the CDC has reported that 71% of Medicare prescriptions, compared with 42% of commercial insurance carriers, require copayments upwards of $80,[14] a financial barrier to naloxone access. In response, private insurers have attempted to address this by implementing no member cost sharing[15] or copayment waivers.[16] Other state-level responses include New York's naloxone copayment assistance program and mandate requiring that the cost of opioid antagonists be covered by health insurance.[5] Although these efforts and programs are isolated successes, we call for federal funding to enable elimination of copays to reduce costs for the public.

MANDATE COPRESCRIBING

Fourth, there should be a federal mandate for prescribers to coprescribe naloxone with all higher-risk opioid prescriptions and medications for opioid use disorder (methadone, naltrexone, or buprenorphine-naloxone) and for pharmacists to codispense naloxone. Coprescribing is an established concept and practice, included in the 2016 CDC Guideline for Prescribing Opioids for Chronic Pain, which recommends that providers consider coprescribing to patients receiving daily opioid dosages of 50 morphine milligram equivalents or greater or receiving benzodiazepines,[17] and was supported by the 2021 Model Expanded Access to Emergency Opioid Antagonists Act. State legislatures that implemented coprescribing mandates have seen substantial increases in naloxone prescribing, engagement of a larger and more diverse set of prescribers, expanded geographic reach, and reductions in opioid-related harm.[18–20] In 2018, a panel of experts at the Drug Safety and Risk Management Advisory Committee narrowly voted against a coprescribing mandate, citing concerns for potential risks of drug shortages, diverting naloxone from community programs, rise in health care costs, institutional racism benefiting insured patients, and threats to provider autonomy in identifying patient risk.[21] Instead, this committee recommended changing opioid prescription labels to encourage coprescription, which was released as an FDA mandate in July 2020 to opioid drug manufacturers.[22] Although it remains unclear if these label changes were widely implemented, they serve as a mere nudge for providers to have discussions with their patients about the importance of naloxone, whereas mandatory coprescribing will facilitate increased distribution of this lifesaving medication. We also encourage that future coprescribing mandates be coupled with proactive approaches to ensure that coprescribing does not exacerbate health inequities, given the presence of systemic racism faced by persons using illicit opioids, including Black, Indigenous, and People of Color communities that have had inequitable access to health care, pharmacies, and insurance benefits. Furthermore, manufacturing supply chains should be augmented to ensure that coprescribing does not cause drug shortages. If these coprescription policies were applied on a national scale, there would be dramatic increases in naloxone availability with spillover to the community, awareness about what overdose is and how it can be prevented, and creation of a sustainable culture of opioid safety.

Every overdose death is preventable. Ensuring equitable access to and saturating communities with naloxone is critical, given the more than 1 million persons who have died of drug overdose since 1999. We must move beyond public health advisories and take federal policy actions to make naloxone available OTC, expand funding for community-based programs providing harm reduction, eliminate naloxone copayments and prior authorizations, and mandate coprescribing naloxone with high-risk prescriptions and medications for opioid use disorder to save lives. The ongoing surge in overdose deaths during the COVID-19 pandemic is a warning that immediate and comprehensive steps must be taken to reduce deaths. To curb overdose, we need to greatly increase naloxone access in all communities. AJPH

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PUBLICATION INFORMATION

Full Citation: Jawa R, Murray S, Tori M, Bratberg J, Walley A. Federal policymakers should urgently and greatly expand naloxone access. *Am J Public Health*. 2022;112(4):558–561.

Acceptance Date: December 20, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306699

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R. Jawa conceptualized and drafted the article. S. Murray, M. Tori, J. Bratberg, and A. Walley contributed to preparing and revising the article. All authors approved the final version for publication.

ACKNOWLEDGMENTS

R. Jawa was supported by the National Institute on Drug Abuse (grant R25DA033211) and the National Institute of Allergy and Infectious Diseases (grant T32AI052074).

Note. This article does not represent the official views of the National Institutes of Health.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Is Omicron Showing Us the Path Ahead?

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The Omicron variant of the COVID-19 virus is wreaking havoc around the world. In South Africa, where it was first identified, it resulted in an unprecedented surge in the number of cases. The travel bans that soon followed against several Southern African countries were futile gestures, as the new variant was undoubtedly already circulating in the countries that rushed to put the bans in place. This quickly became clear as surges in cases were noted in several European countries and in the United States, resulting in case numbers never seen before.[1] As they did during the initial surges, health systems across the globe fell quickly under enormous stress. In the case of the Omicron variant, this is mostly because of the large number of health providers who had to either isolate because of infection or quarantine after COVID-19 exposure rather than because of a higher risk of severe disease.[2,3] Similarly, high worker absenteeism has affected organizations and businesses, undermining already weakened economies around the world.

Yet, despite the tremendous challenges it is presenting, the Omicron variant may actually be paving a new path toward coexistence with COVID-19.

With the Omicron variant, COVID-19 offers an interesting combination. Evidence thus far suggests that the variant is highly transmissible and that progression from exposure to infection is faster than with other variants.[4,5] These characteristics have driven the extraordinarily rapid increase in the number of new cases. At the same time, although infections among vaccinated people have been noted quite frequently, these tend to be asymptomatic or to produce largely mild symptoms.[6] Consequently, a disconnect between the large number of COVID-19 cases and a disproportionately lower number of hospitalizations has become apparent. Even among those who are hospitalized, the severity of illness is notably less than what we saw in earlier surges, with less likelihood of requiring intensive care or ventilatory support. Most importantly, the data show that our vaccines continue to prevent severe illness and hospitalization during the Omicron variant surge (https://bit.ly/3K9GdJM). At the same time, it would help to better understand these issues if data on hospitalizations, intensive care unit admissions, and deaths were disaggregated by whether patients were admitted because of COVID-19–related signs and symptoms or because they had incidental COVID-19 identified through screening tests administered on admission.

Thus, despite the fear and turmoil caused by the Omicron variant, there may be a silver lining. For most of those who are fortunate enough to have access to vaccines, contracting the Omicron variant of COVID-19 may result in a mild illness. The availability of new antiviral treatments for COVID-19 that have been shown to prevent severe illness and death also offers a new reason for optimism.[7,8] These facts point to a new reality and, potentially, a new understanding of what COVID-19 means for us. The Omicron variant may help us arrive at a level of comfort in living with the virus and an acceptance of the fact that there will not be a time anytime soon when COVID-19 is completely behind us. As we head into the third year of the pandemic, we may be ready to accept the fact that getting infected with the Omicron variant is highly likely but that in all likelihood this will not result in severe disease as long as we are vaccinated and have received a booster dose. Knowing this may mean that the fear that has paralyzed so many over the past two years will diminish sharply.

How will this new understanding affect our response to the pandemic? For one thing, case numbers will have less significance, even while infected individuals may need care and require medical attention from the health care system. The focus on counting cases should give way to giving more attention to monitoring COVID-19–related severe illness, hospitalizations, intensive care admissions, and deaths. The high transmissibility, the short incubation period, and the mild symptoms will make efforts to identify every case and all possible contacts unfeasible and of limited effectiveness.[9,10] Contact-tracing programs, which have heroically sought to contact and support all persons with COVID-19 and their close contacts, will need to be transformed to deliver on a no less important effort—supporting those with substantial symptoms of COVID-19 or those at risk for

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complications by promptly guiding them to available treatment to prevent severe illness. With regards to testing efforts, we will need to shift our focus to prioritize pursuing a diagnosis among those who are ill and those who are most vulnerable to complications of COVID-19, particularly immunosuppressed individuals. Public health messaging will also need adjustment, focusing on a simple message for those who suspect infection or have tested positive, are vaccinated, and have no risk factors: mask up, avoid crowds, and suspend contact with vulnerable individuals.

But, before we can truly go down this road, we must acknowledge that vaccines are the game changers. This new reality motivated by the emergence of the Omicron variant is relevant only for those who are fortunate enough to have access to effective COVID-19 vaccines and booster doses. For much of the world, access to vaccines remains an elusive goal. Billions of people have yet to access a single dose of a COVID-19 vaccine.[11] It is likely that, unfortunately, this disparity will extend to access to new antiviral drugs. This means that not only will tremendous swaths of humanity remain susceptible—needlessly so—to more severe disease, death, and all the social and economic hardships these cause, but also we will all remain vulnerable to new emerging variants. And that next variant may not be nearly as favorable as the Omicron variant.

The road map to a new COVID-19 reality is drawn. The critical question is, are we ready to follow it and embrace this new reality?

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PUBLICATION INFORMATION

Full Citation: El-Sadr WM, Shea S. Is Omicron showing us the path ahead? *Am J Public Health*. 2022;112(4):562–563.

Acceptance Date: January 6, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306721

CONTRIBUTORS

The authors contributed equally to this editorial.

ACKNOWLEDGMENTS

We acknowledge editorial support by Joey Platt.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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National Surveillance of Youth Substance Use: Keeping Up With Changing Times

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Thirty years ago, youth smoking was in a grim place. In 1991, more than one in four US high school students smoked cigarettes, and the situation was worsening, reaching 36% smoking prevalence in 1997.[1] Likewise, adolescent alcohol use remained perniciously steady at about 50% prevalence throughout the 1990s.[1] Since then, a host of hard-fought wins for tobacco control, including prevention and cessation programs, excise taxes, marketing restrictions, and social norms change, have borne remarkable success in driving down youth smoking. In 2019, cigarette smoking by high school students stood at just 6% nationally[1] and was low enough in some regions to have policymakers aiming for a tobacco endgame. Youth alcohol use, too, has declined to its lowest level in more than 40 years of national surveillance.[2] Despite these successes, there is much work to be done. Substance use remains higher in certain geographic regions and among vulnerable groups, including racial/ethnic minorities, sexual and gender minority youths, and the socioeconomically disadvantaged.[3] Novel nicotine products and liberalizing marijuana regulations pose new challenges for youth substance use prevention. This *AJPH* Assessing Impact feature reexamines one recent look at changing youth substance use patterns over the past 30 years.

In the 2019 article "Trends in Single, Dual, and Poly Use of Alcohol, Cigarettes, and Marijuana Among US High-School Students: 1991–2017,"[4] public health successes with youth cigarette and alcohol use are only two thirds of the story. The author, Hongying Dai, contrasts the overall declines in youth cigarette and alcohol use with rising levels of youth marijuana consumption. In 1991, no US states allowed medical or recreational marijuana sales; today, more than 70% of Americans reside in a state that does. Accepting social attitudes toward marijuana have grown, and so too has marijuana use, in all age groups.[5] Dai's analysis considers trends in youth cigarette, alcohol, and marijuana use individually and in combination. Dual and polyuse are important for individual health. Use of nicotine and marijuana together is more strongly associated with adverse health risk behaviors than use of either alone.[6] Alcohol and marijuana use may make tobacco cessation more difficult.[7] Importantly, rising polyuse prevalence signals a need for more comprehensive substance use control and prevention.

The cross-sectional time series analysis draws data from the Youth Risk Behavior Survey (YRBS), an national survey of US high school students performed every odd year. For cigarettes, alcohol, and marijuana, Dai examined linear trends in using only one, two, or all three products from 1991 to 2017. Use of only cigarettes and only alcohol declined. However, use of only marijuana increased by a factor of 10: from 0.6% to 6.3%. Meanwhile, dual use of alcohol and marijuana more than doubled, whereas cigarette and marijuana dual use effectively stayed flat. Highlighting pronounced increases in marijuana-only use, particularly among girls and racial/ethnic minorities, while noting the fewer intervention and prevention programs for marijuana compared with tobacco, Dai called for "special focus" on marijuana prevention.

News coverage of the publication largely focused on marijuana, often overlooking tobacco and alcohol.[8] The 10-fold increase in marijuana-only use, although headline grabbing, obscures that overall marijuana use had increased more gradually and, at 20% in 2017,[1] substantially exceeded the widely cited 6.3% prevalence of marijuana-only use. Declining cigarette and alcohol use, coinciding with rising marijuana use, shifted the typical profile of youth substance use. In 1991, most users of cigarettes, alcohol, or both did not use marijuana; by 2017, approximately half did. Conversely, the share of marijuana users who smoke or drink shrank substantially. Substance control messages emphasizing the harms of smoking and drinking remain essential, but better integrated messaging about marijuana use, alone and with other substances, is warranted for youths who today perceive a large gap between the harms of tobacco and marijuana.

In the three years since publication, citing works have expanded on this article's findings, with more detailed pictures of polysubstance use over time. In one study, investigators queried another national time series study to identify specific periods when marijuana use was rising fastest.[9] In another, researchers prospectively followed a more recent youth cohort into the first years beyond high school.[10] The work confirmed high levels of dual or polyuse patterns featuring marijuana and additionally revealed a plurality of substance users whose use increased sharply after high school. School-based surveillance may miss climbing levels of substance use in early adulthood, a population in need of more effective prevention.

Among potential lessons is that substance use prevention should not be siloed by product, particularly that of tobacco and marijuana. Not only do many youths consume both tobacco and marijuana, but dual use may be catalyzed when tobacco and other nicotine products are repurposed for marijuana consumption, as in the case of cigar-wrapped marijuana blunts. Given that blunt use is facilitated by the widespread availability of cheap, flavored small cigars,[11] tobacco control measures, such as flavor bans that include cigars, could have implications for marijuana use. Similarly, electronic devices for aerosolizing nicotine can be redesigned or repurposed for vaping marijuana products, a trend that gained national attention when a 2019 outbreak of severe lung injury was tied to tainted marijuana cartridges.[12] Thus, policies, marketing, and public communication about vaping nicotine could also plausibly influence perceptions of and access to vaping marijuana.

Indeed, current and future developments in tobacco, nicotine, and marijuana policy all may shape which trends identified in Dai's study continue. Although the most recent YRBS wave (2019)[1] showed a further decline in cigarette smoking, there was a tremendous surge in electronic vapor product use, from 13% to 33%—a level of youth nicotine use not seen since the grim days three decades before. As of this writing, Food and Drug Administration authorizations are pending for electronic cigarette products with the largest share of the US market. Those decisions may have long-lasting implications as the agency weighs potential benefits to adult smokers against demonstrated risks to youths.

Further state-level, and potentially federal-level, marijuana legalization is possible, perhaps likely. There is conflicting evidence on whether state-level legalization is tied to short-term increases in youth marijuana use.[13,14] It is certain that marijuana use is gaining social acceptance over recent decades and decreasingly being perceived as harmful, particularly among youths.[4] Couple these changing attitudes with potential for a more commercialized marijuana industry, and the public health perils are easy to envision. The potential consequences of marijuana policy changes for children and adolescents deserve greater consideration.[15]

The featured publication uncovered youth substance use patterns visible only over time, in this case, decades. This highlights the value of ongoing, high-quality national surveillance. More frequent and more nimble surveillance is also needed to capture trends that emerge quickly, such as between biennial YRBS waves. Research should keep up with emerging products and shifting use patterns by incorporating up-to-date tobacco and marijuana product terminology and explicitly measuring dual and polyuse behaviors. Additionally, describing trends among vulnerable groups, although imperative, is just one step toward health equity: more detailed surveillance must help to advance tailored prevention and treatment.

For all the public health progress achieved in reducing youth cigarette and alcohol use, youth vaping, marijuana use, and polysubstance use deserve attention and action. Further research on the short-term and long-term health effects of marijuana and polysubstance use among youths is essential for informing effective public health practice and policy. Understanding the potential harms, the drivers of use, and how products relate to each other better equips researchers, policymakers, educators, and parents to approach youth substance use prevention comprehensively. AJPH

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PUBLICATION INFORMATION

Full Citation: Chaffee BW. National surveillance of youth substance use: keeping up with changing times. *Am J Public Health*. 2022;112(4):564–566.

Acceptance Date: December 30, 2021.

DOI: https://doi.org/10.2105/AJPH.2022.306716

ACKNOWLEDGMENTS

B. W. Chaffee receives research funding from the National Institutes of Health/Food and Drug Administration (grant U54 HL147127) and the California Department of Public Health (contract 20-10026).

CONFLICTS OF INTEREST

B. W. Chaffee has provided paid consulting to Westat related to the Population Assessment of Tobacco and Health Study.

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The Health Silk Road: How China Adapts the Belt and Road Initiative to the COVID-19 Pandemic

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As China's signature foreign policy initiative in the 21st century, the Belt and Road Initiative (BRI) is rapidly becoming a global undertaking. Initially launched in 2013 as an international infrastructure project, BRI harkened back to the Silk Road, an ancient network of trade routes connecting the East and the West. At first, BRI focused on two distinct prongs: a "belt" of overland economic corridors across Eurasia and a maritime "road" of shipping lanes through Southeast Asia to South Asia, the Middle East, and Africa. By early 2021, however, BRI encompassed more than 140 countries representing close to 40% of global output and 63% of the world's population.

Through the Health Silk Road (HSR), China has used BRI transportation networks—railroads, ports, airports, and logistics hubs—to provide medical and health care assistance to partner countries and assert China's leadership in global health. The rapid expansion and global scope of BRI and HSR, examined in the Council on Foreign Relations independent task force report *China's Belt and Road: Implications for the United States*, have been significant causes of concern for the Biden administration.[1] Against the backdrop of COVID-19, HSR is set to further advance China's role in global health governance; however, this does not justify an alarmist response from the United States.

ORIGINS OF THE HEALTH SILK ROAD

The term "Health Silk Road" first appeared in an October 2015 document issued in China by the National Health and Family Planning Commission, the predecessor of today's National Health Commission, as a response to the central government's requirements to contribute to the implementation of BRI.[2] President Xi Jinping officially put forward the HSR concept in a 2016 visit to Uzbekistan. The following year, Beijing signed a memorandum of understanding with the World Health Organization committing to support HSR and improve health outcomes in BRI countries.

Despite the blessing of President Xi and the World Health Organization, HSR remained largely an undefined initiative with a wish list of projects prior to the COVID-19 outbreak. Some of the proposed projects (e.g., providing personal protective equipment, medical supplies, and emergency medical assistance to BRI countries) had yet to materialize by March 2020. Other projects included under HSR, such as the Greater Mekong Subregion Disease Surveillance Network, had begun as part of joint disease prevention and control programs in Southeast Asia before the debut of HSR.

HEALTH SILK ROAD BUILDING DURING COVID-19

Although initially seen as a weakness, these amorphous arrangements have given HSR the flexibility to respond to new global health challenges. As China managed to curtail domestic transmission of COVID-19 and branded itself a winner in the fight against the pandemic, HSR opened "new cooperation space for BRI."[3] In a telephone call with Italian prime minister Giuseppe Conte on March 16, 2020, for instance, Xi explicitly linked HSR to the pandemic: "China is ready to work with Italy to contribute to international cooperation on epidemic control and to the building of a 'Health Silk Road.'"[4] As a leading producer of personal protective equipment and COVID-19 vaccines, China focuses on providing medical supplies and equipment to build HSR during the pandemic. By late October 2020, it had sent more than 179 billion face masks and 1.73 billion protective suits to 150 countries.[5] By late November 2021, it also had committed 1.6 billion doses of COVID-19 vaccines to more than 100 countries.[6] Roughly 40% of Chinese vaccines have been delivered to

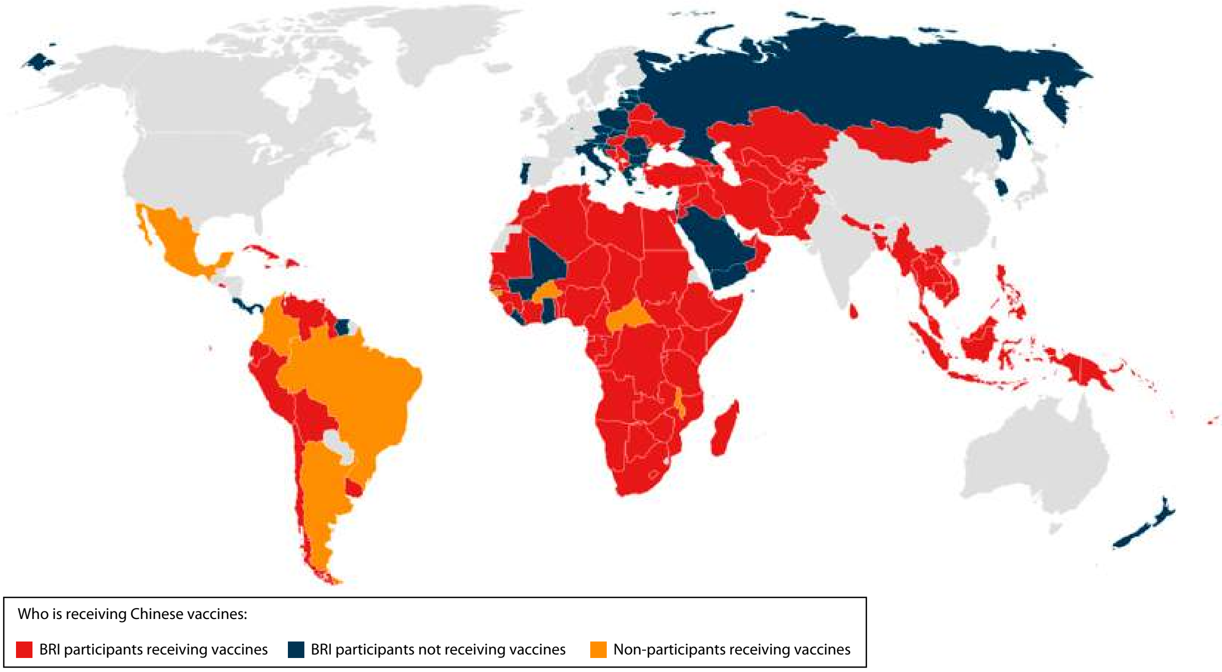

FIGURE 1— The Belt and Road Initiative (BRI) and China's Vaccine Diplomacy

Southeast Asia, the preferred region for BRI and HSR construction.

China's approach features multiple bilateral efforts under the BRI networks, which appear to be more efficient than the multilateral approach favored by the Western countries in global vaccine distribution. Chinese vaccine makers seem keener than their Western counterparts to help partner countries expand domestic vaccine manufacturing capabilities. They have built vaccine filling and finishing plants in Africa (Algeria, Egypt, Morocco), Europe (Hungary, Serbia), Latin America (Brazil, Chile, Mexico), the Middle East (Turkey, United Arab Emirates), South Asia (Pakistan), and Southeast Asia (Indonesia, Malaysia). Today, Chinese COVID-19 vaccines have claimed the largest market share in much of Asia and South America.[7] These efforts have also boosted China's international image. According to the Council on Foreign Relations report, following China's delivery of critical medical products "BRI partners closely aligned with Beijing . . . have been more willing to give China the praise it seeks."[1]

Still, China's HSR building thus far has not fundamentally challenged US leadership in health-related development assistance. The *China's Belt and Road* report discussed how substandard products and clumsy propaganda tarnished China's early efforts to supply medical equipment and testing kits. Using health aid to expand the market share of Chinese medical products also makes Beijing's rhetoric of distributing its vaccines as a "global public good" somewhat disingenuous.

Unlike the United States, which shares vaccines primarily through donations, China sends most of its vaccines abroad as commercial supplies, which are in some cases more expensive than Western ones. As of November 30, 2021, only 7% of China's vaccines that shipped overseas—119 million doses—involved grant assistance (i.e., donations).[6] The relatively low efficacy rate of Chinese vaccines and the lack of transparency in revealing phase 3 clinical trial data have also undermined China's vaccine diplomacy and the effectiveness of HSR in promoting BRI. Despite calls for prioritizing BRI countries to receive Chinese vaccines,[8] 37 of the 144 BRI countries are not currently receiving these vaccines (Figure 1). A growing number of countries, including those in Southeast Asia, are shifting away from Chinese vaccines.[9]

THE US RESPONSE

The Biden administration views HSR, which seeks to expand both market share and international influence, as a clear geopolitical challenge to the United States. To counter China's influence, the United States partnered with Australia, India, and Japan through the Quadrilateral Security Dialogue in March 2021 to finance, manufacture, and distribute at least 1 billion doses of COVID-19 vaccines by the end of 2022.[10]

Theoretically, US–China competition in vaccine distribution helps build and sustain momentum for achieving a pandemic-free world. In reality, the vaccine diplomacy of the United States and its allies targets regions or countries that are strategically important to and prioritized by China's HSR (e.g., Southeast Asia); relatively little interest is shown in satisfying the vaccine needs of low-income countries, where only 6% of people had received one dose of vaccine by the end of November 2021.[11]

Equally important, the overemphasis on US–China competition in terms of geopolitical influence and global leadership has led the Biden administration to forsake opportunities for cooperation between the countries. The US government could support the licensing of Chinese vaccine makers to mass produce mRNA vaccines, which would significantly increase the global vaccine supply. Also, building on the memorandum of understanding signed in November 2016, the United States and China could jointly support disease surveillance and response capacity building in the developing world. Framing the bilateral relationship in terms of strategic competition leaves little room for expanding cooperation in these areas.

FUTURE OF THE HEALTH SILK ROAD

On August 31, 2021, China unveiled new foreign aid guidelines that highlight BRI building as a main objective of aid provision.[12] In the future, China may use partnerships forged during the pandemic to increase its health aid and expand the international market share of Chinese medical products. It may also invoke HSR to invest in additional global health projects, especially those that help BRI countries build core disease surveillance and response capacity. Whether this will lead to substantial investment in broader health-related development assistance projects, such as universal health coverage, remains to be seen.

Unless Beijing's HSR agenda rules out cooperation with Washington, however, it is not in the interest of the United States to pursue an alarmist approach premised on US–China strategic competition. In developing initiatives to rival HSR, the Biden administration should consider tapping the large potential for cooperation between the two countries, from which the developing world would benefit immensely not only in terms of the present pandemic but in efforts to improve health security and strengthen health systems for future crises. AJPH

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PUBLICATION INFORMATION

Full Citation: Huang Y. The Health Silk Road: how China adapts the Belt and Road Initiative to the COVID-19 pandemic. *Am J Public Health*. 2022; 112(4):567–569.

Acceptance Date: November 25, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306647

ACKNOWLEDGMENTS

I thank Samantha Kiernan for her research assistance and Dan Fox and an anonymous reviewer for their comments on earlier versions of the editorial.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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Control of SARS-CoV-2 Infection Rates at a Spanish University With In-Person Class Attendance

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The “Safe Campus Program,” implemented in 2020 through 2021 at the University of Navarra (Spain), aimed to guarantee a safe return to university campus and prevent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreaks, avoiding university-wide lockdown. It included COVID-19 education, campus adaptation, and polymerase chain reaction (PCR) testing. We describe the main characteristics of the program and analyze the SARS-CoV-2 cumulative incidence among 14 496 university members. The 14-day cumulative incidence in the university was 415.2 versus 447.7 in the region. The program, sustainable in the long term, achieved low SARS-CoV-2 in-campus rates. (*Am J Public Health*. 2022;112(4):570–573. https://doi.org/10.2105/AJPH.2021.306682)

AJPH April 2022, Vol 112, No. 4

During the COVID-19 pandemic, most Spanish universities adopted only online teaching. At university campuses, it was necessary to restore the quality standards of academic education, as well as to maintain a vibrant university life, an essential ingredient of higher education training.

INTERVENTION

The “Safe Campus Program” of the University of Navarra (Spain) aimed to prevent outbreaks of SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) while keeping all in-person teaching and research activities. The program was based on three fundamental measures: education and training, campus adaptation, and polymerase chain reaction (PCR) testing and medical care (Figure B, available as a supplement to the online version of this article at http://www.ajph.org).

PLACE AND TIME

Between August 24, 2020 and May 30, 2021, a cohort study with a nine-month follow-up was carried out at the University of Navarra where in-person classes were held.

PERSON

At the beginning of the academic year, there were 14 496 members at the University of Navarra (57% women; median age = 21.9 years, interquartile range = 19.7–30.0) belonging to three campuses: Navarra (84.9%), Gipuzkoa (11.1%), and Madrid (4.1%). Students accounted for 83.1% of university members. Forty-five percent of university members lived with their families, 41.2% at a shared apartment, and 13.4% at a university residence (Table 1).

PURPOSE

Reopening educational institutions can be vital for the education and the physical and emotional health of many students.[1] Regarding university campuses, it was necessary to restore the quality standards of academic education and to maintain university life. The guarantee of a safe return to the university campus was essential for a return to normality and the best educational experience.

Spain was one of the countries most severely affected by COVID-19. After the first wave, the population SARS-CoV-2 seroprevalence was 5%; however, this percentage may represent an underestimate of the true burden of infection, given the subsequent high mortality rate during 2020.[2] We aimed to analyze the impact of a comprehensive preventive action plan

TABLE 1— Baseline Characteristics of the University of Navarra Population During the 2020–2021 Academic Year: Spain

Characteristic	Students	Employees	*P*[a]
No.	12 050	2 446	
Gender (female), no. (%)	6 887 (57.2)	1 342 (54.9)	.037
Age, y	23.87 (8.65)	44.56 (11.33)	< .001
Campus, no. (%)			< .001
Madrid	536 (4.4)	54 (2.2)	
Navarra	10 311 (85.6)	1 990 (81.4)	
Gipuzkoa	1 203 (10.0)	402 (16.4)	
Accommodation, no. (%)			< .001
Family home	3 809 (33.8)	2 397 (98.0)	
Shared apartment	5 619 (49.8)	39 (1.6)	
Residence	1 846 (16.4)	10 (0.4)	
Status, no. (%)			
Undergraduate	9 794 (81.3)		
Graduate	2 256 (18.7)		
Research and academic staff		1 043 (42.6)	
Administrative staff		1 403 (57.4)	

Note. Continuous variables are expressed as mean and standard deviation and categorical variables as percentages.

[a] Chi-square test or the Student *t* test for qualitative or quantitative variables, respectively.

against SARS-CoV-2 infection in a Spanish university that maintained in-person class attendance from August 2020 to May 2021, before youths were vaccinated in Spain.

IMPLEMENTATION

The program included three preventive activities (Figure A, available as a supplement to the online version of this article at http://www.ajph.org). The first one was COVID-19 prevention education and training for all university members. Before the academic year started, all university members received a citation for a PCR test and two guideline brochures ("Prepara2" and "Bienveni2") providing information about preventive measures (social distancing, mandatory use of masks, hand washing) and the "COVID Area": a 24-hour medical attention clinic that could be contacted by e-mail, telephone, or face-to-face. The COVID Area consisted of a team of 17 health care and community workers. Students and staff were mandated to contact the COVID Area if they had any COVID-19 symptoms or close contact with a positive case.

The second preventive activity was campus adaptation. Actions were taken in university spaces (e.g., indoor ventilation, tripled frequency of cleaning and disinfection, reorganization of desks and offices, reduction of classroom and office capacity, rescheduling of timetables, doubling of teaching hours) and personal measures (e.g., training of prevention measures, distancing, masks, hand washing, sanitizers).

Adherence to prevention measures was reinforced by "yellow vests": personnel hired to ensure compliance. They recorded the reasons for each warning. Gate custodians helped to check the use of hand sanitizer upon entrance to the premises.

The third preventive activity was PCR testing and medical care. SARS-CoV-2 PCR testing was required of all university members to access the campus at the beginning of the academic year and after Christmas holidays. Additional random PCR testing was carried out after Easter break. PCR tests were also performed on individuals reporting COVID-19–related symptoms and on their close contacts in the university. During the academic year, weekly random PCR tests were carried out on a representative sample (mean: 268/week), stratified by employee or student status and center. All PCR tests were free.

The COVID Area was contacted for medical diagnosis and early case detection within the first 24 hours. More than 12 000 emails were received and answered. A secure database was designed and managed by the COVID Area to monitor in real time the impact of COVID-19 on the campus, allowing rapid action to be taken. The COVID Area also monitored all contact tracing and clinical care of people with positive PCR tests.

EVALUATION

A total of 34 848 SARS-CoV-2 PCR tests were performed (2.4 PCR tests/person); 71.76% of the PCR tests were retests: each person at the university received between two and eight PCR tests. The overall percentage of positive PCR

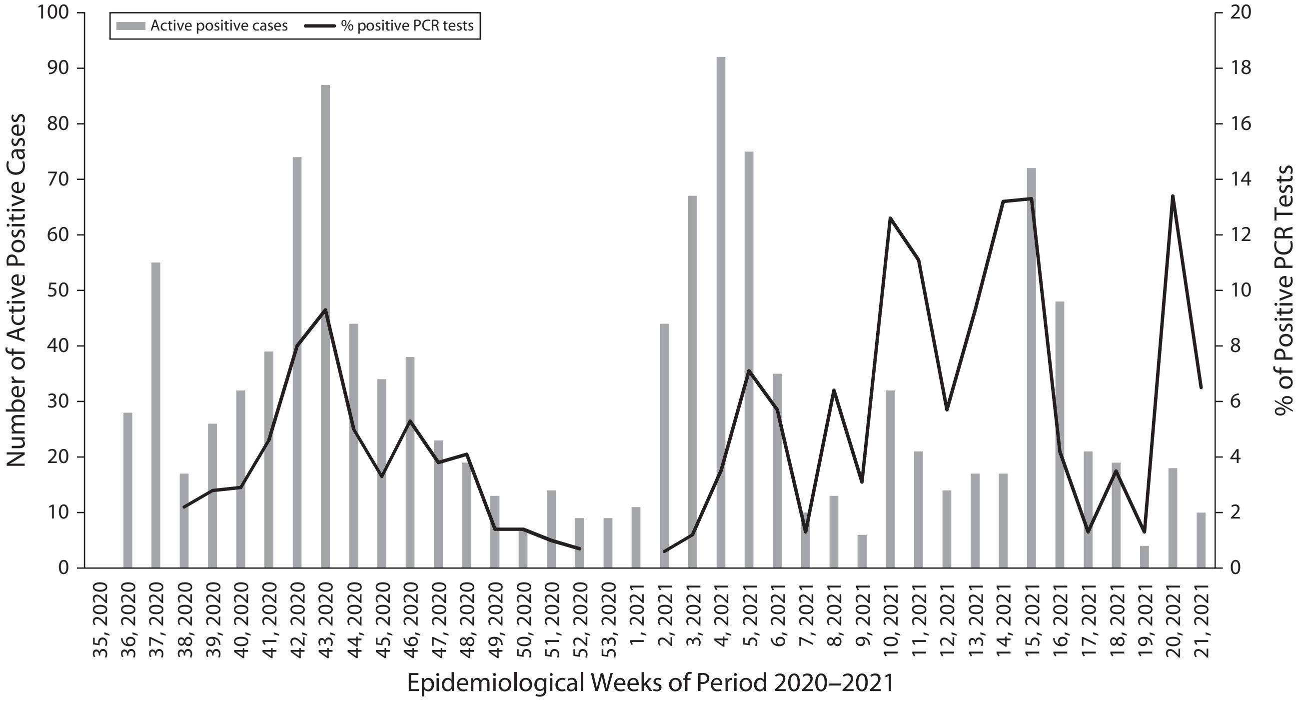

FIGURE 1— **Number of Positive COVID-19 Cases and Percentage of Positive Polymerase Chain Reaction (PCR) Tests per Week at the University of Navarra During the 2020–2021 Academic Year: Spain**

tests during the study period was 3.5% (n =1232), and a positive PCR test was counted as a positive case of COVID. Women accounted for 44.4% of diagnosed positive cases; 85.9% (n = 1058) were students and 14.1% (n = 174) were employees. During the academic year, 8.5% of university members tested positive by PCR test. Of the positive PCR tests, 82.7% (n = 1019) occurred on the Navarra campus, 8.5% (n = 105) in Gipuzkoa, and 8.8% (n = 108) in Madrid. The different peaks were related to holiday periods. The first peak seemed to be related to Columbus Day (October 12), which is a public holiday and was a long weekend in week 41 (Figure 1).

Overall, there were 4897 isolated individuals: 1232 positive cases and 3665 contacts, with a mean of 2.98 quarantined contacts for each positive case (Figure C, available as a supplement to the online version of this article at http://www.ajph.org). Of the positive PCR tests, 513 came from those previously classified as close contacts. The average reproductive number of SARS-CoV-2 during the study period was 1.36.

The 14-day cumulative incidence per 100 000 at the University of Navarra was 415.2 (95% confidence interval [CI] = 381.9, 448.6) and the 14-day cumulative incidence for the three regions was 447.7 (95% CI = 370.0, 525.3), with no significant differences between the university and the three regions combined (*P* = .113). The 14-day cumulative incidence on the Navarra campus was 405.1 (95% CI = 369.6, 440.6), whereas in the general population of Navarra it was 447.8 (95% CI = 406.9, 488.8), with no significant differences between the campus and the region where it was located (*P* = .121). The mean 14-day cumulative incidence on the university's Gipuzkoa campus was 328.7 (95% CI = 301.6, 355.8), whereas in the Gipuzkoa general population it was 448.8 (95% CI = 419.6, 478.0), with significant differences (*P* < .001). The 14-day cumulative incidence on the smaller Madrid campus was 813.1 (95% CI = 735.9, 890.3), whereas in the general population of Madrid it was 441.8 (95% CI = 410.6, 473.1), with a significant difference (*P* < .001; Figure D, available as a supplement to the online version of this article at http://www.ajph.org).

The "yellow vests" carried out a total of 5313 admonishments (mean, 161 admonishments/week) (Figure E, available as a supplement to the online version of this article at http://www.ajph.org). When asked about the possible place of transmission, only 3% of the positive cases indicated that it was the campus.

ADVERSE EFFECTS

There were no adverse effects.

SUSTAINABILITY

The percentage of positive PCR tests in our study was 3.5%, below the 5% recommended by the World Health Organization,[3] whereas in the general Spanish population it was 11.6% during the same period. In the general population of Navarra, this percentage was 8.8%.[4] Other studies have shown a reduction in anxiety and improvement in safety behavior when applying similar measures.[5,6]

This intervention shares many of its measures with the safe campus programs of other universities, such as Berkeley and Duke,[7,8] where mass testing, and compliance with individual prevention measures, led to reduced infection rates.[9] All measures taken at the University of Navarra to ensure safety followed the international official guidelines and curbed the spread of SARS-CoV-2 infection.[10]

PUBLIC HEALTH SIGNIFICANCE

During the COVID-19 pandemic, continued in-person lectures and research activities at a university with a strong prevention program, including robust screening and contact tracing, did not generate a higher SARS-CoV-2 incidence than that observed in the community. The measures proposed in the “Safe Campus Program” were useful in reducing SARS-CoV-2 infection rates in our institution. These measures can be of great help to other institutions that have remained open during the pandemic and those that will do so in the future in similar contexts. AJPH

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PUBLICATION INFORMATION

Full Citation: Gil-Conesa M, Amer F, Carlos S, Ariño AH, Martínez-González MA, Fernandez-Montero A. Control of SARS-CoV-2 infection rates at a Spanish university with in-person class attendance. *Am J Public Health*. 2022;112(4):570–573.

Acceptance Date: December 15, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306682

CONTRIBUTORS

A. Fernandez-Montero conceptualized the study. M. Gil-Conesa, A. Fernandez-Montero, and A. H. Ariño curated data. M. Gil-Conesa, F. Amer, and A. Fernandez-Montero conducted the formal analysis. A. Fernandez-Montero, M. A. Martínez-González, and F. Amer conducted the investigation. A. Fernandez-Montero, M. A. Martínez-González, F. Amer, and S. Carlos performed the methodology. A. Fernandez-Montero, S. Carlos, and M. A. Martínez-González supervised the study. M. Gil-Conesa, F. Amer, S. Carlos, and A. Fernandez-Montero wrote the original draft. M. Gil-Conesa, F. Amer, S. Carlos, A. H. Ariño, M. A. Martínez-González, and A. Fernandez-Montero reviewed and edited the writing. All authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENTS

This work was financed by the health research fund of the Government of Navarra. The Government of Navarra had no role in the study.

We thank the COVID Area, Prevention of Risks at the Work Department of the University of Navarra, CIMA (*Centro de Investigación Médica Aplicada*) PCR Area, CUN (*Clínica Universidad de Navarra*) Microbiology Department, Public Health Department of Navarra, and the professors, staff, and students who have collaborated in making the campus safe.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

This study was approved by the University of Navarra institutional review board (reference no. 2020.190).

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Rapid Population-Based Surveillance of Prenatal and Postpartum Experiences During Public Health Emergencies, Puerto Rico, 2016–2018

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The Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response study, implemented in Puerto Rico during the Zika virus outbreak (2016–2017) and after Hurricanes Irma and María (2017–2018), collected pregnancy-related data using postpartum hospital-based surveys and telephone follow-up surveys. Response rates of 75% or more were observed across five study surveys. The study informed programs, increased the Puerto Rico Department of Health's capacity to conduct maternal–infant health surveillance, and demonstrated the effectiveness of this methodology for collecting data during public health emergencies. (*Am J Public Health*. 2022;112(4):574–578. https://doi.org/10.2105/AJPH.2021.306687)

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In 2016, the Puerto Rico Department of Health (PRDH) and the Centers for Disease Control and Prevention implemented the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) study to address the urgent need for data on Zika virus infection ("Zika").

INTERVENTION

The study initially assessed Zika-related experiences and behaviors during pregnancy and later expanded to examine paternal involvement during pregnancy and the impact of Hurricanes Irma and María on access to maternal and infant health services. We describe the study methodology, which may be leveraged to rapidly respond to public health emergencies that affect maternal–infant health.

PLACE AND TIME

The PRAMS-ZPER study was implemented in Puerto Rico during the Zika outbreak (2016–2017) and after Hurricanes Irma and María (2017–2018). The two-phase study included hospital-based surveys conducted after delivery and telephone follow-up surveys conducted three to nine months postpartum. Phase 1 was fielded from August 2016 to June 2017, and phase 2 from November 2017 to April 2018. Phase 2 repeated the phase 1 maternal surveys (hospital-based and telephone follow-up) and added an in-hospital paternal survey and educational component (Tables 1 and 2).

PERSON

For both phases, women who had a live-born infant in selected hospitals and met eligibility criteria could participate. For phase 2, the paternal survey could be completed by the father of the sampled woman's live-born infant or by the woman's partner (including same-sex partners). Eligibility for the infants' fathers (or mothers' partners) was based on the mother being sampled, not on her participation in the survey.

After completing the in-hospital survey in phase 2, sampled mothers and infants' fathers (or mothers' partners) were offered the educational component. Interested family members (e.g., grandparents) were allowed to listen to the educational component if allowed by the participants.

PURPOSE

In February 2016, PRDH declared a public health emergency because of

TABLE 1— **Study Methodology, Outcomes, and Resources for the In-Hospital Surveys of the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) Study: Puerto Rico, 2016–2018**

	Phase 1	Phase 2
Data collection dates	August 28, 2016, to December 3, 2016 (98 days)	November 1, 2017, to December 19, 2017 (43 days)[a]
Participating hospitals	36 hospitals	30 hospitals
Target population	Women who were residents of Puerto Rico and had a live birth during the study period	Women who were residents of Puerto Rico and had a live birth during the study period
Sampling	Island-wide probability sampling stratified by 8 health regions, using hospital-specific sampling schedules to identify eligible women	Island-wide probability sampling, using hospital-specific sampling schedules to identify eligible women and fathers[b]
Eligibility criteria	Live birth on a sampled day in 1 of the participating hospitals, resident of Puerto Rico, and able to complete the survey in English or Spanish	Live birth on a sampled day in 1 of the participating hospitals, resident of Puerto Rico, and able to complete the survey in English or Spanish
Sample size	Women: 2933	Women: 1581 Fathers/partners: 1581
Survey (length/time)	Maternal survey (36 questions/approximately 20 minutes to complete)	Maternal survey (42 questions/approximately 20 minutes to complete) Paternal survey[b] (44 questions/approximately 20 minutes to complete)
Response rate	Maternal survey, 80.6% (n = 2364)	Maternal survey, 94.4% (n = 1492) Paternal survey, 74.6% (n = 1179)
Mode of completion[c]	Paper (28%) or electronic tablet (72%)	Maternal: paper (84%) or tablet (16%) Paternal: paper (87%) or tablet (13%)
Gift for participation	Calendar of baby's first year Crib mosquito net Mosquito repellent (for mothers of deceased infants)	Calendar of baby's first year Crib mosquito net Mosquito repellent (for mothers of deceased infants) Educational component materials (booklets, brochures, notepad, and pen)
Personnel and study support		
Core staff	1 project coordinator	1 project coordinator 1 data manager
Hospital field staff	13 hospital data collectors	11 hospital data collectors 6 regional leaders
In-kind support	Puerto Rico PRAMS Coordinator, Puerto Rico Department of Health Demographic Registry, and Division of Maternal, Child, and Adolescent Health personnel	Puerto Rico PRAMS Coordinator, Puerto Rico Department of Health Demographic Registry, and Division of Maternal, Child, and Adolescent Health personnel

[a] Implementation of the phase 2 in-hospital survey was planned to begin in September 2017. Project implementation was delayed and shortened to 43 days in phase 2 (compared with 98 days in phase 1) because of the loss of infrastructure in the aftermath of Hurricanes Irma (September 7, 2017) and María (September 20, 2017).

[b] The PRAMS-ZPER paternal/partner survey could be completed by the infant's biological father, the mother's same-sex partner, or men who were not the infant's biological father but were identified by the sampled mother as their current partner at the time of the in-hospital survey.

[c] During phase 2, in-hospital surveys were mainly self-administered on paper because of delays in the availability of the tablets; the electronic tablet mode was made available to respondents several weeks after data collection started.

the active transmission of Zika in Puerto Rico. Between 2016 and 2017, nearly 4000 pregnant women were reported to have Zika,[1] which can cause microcephaly and other birth defects in infants born to women infected during pregnancy.[2] Thus, there was an urgent need to gather information on Zika-related experiences and behaviors during pregnancy. Although PRDH declared the end of the Zika outbreak in June 2017,[3] Zika surveillance continued, administrative orders remained in place for continued testing of pregnant women,[4] and use of protective measures were still recommended during pregnancy. Phase 2 allowed continued assessment of maternal behaviors and added the paternal perspective. Implementation of the telephone follow-up surveys provided an opportunity to address new data needs as the outbreak progressed while also allowing assessment of

TABLE 2— Study Methodology, Outcomes, and Resources for the Telephone Follow-Up Surveys of the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response (PRAMS-ZPER) Study: Puerto Rico, 2016–2018

	Phase 1	Phase 2
Data collection dates[a]	May 16, 2017, to July 12, 2017 (58 days)	February 12, 2018, to April 2, 2018 (50 days)
Data collection mode	Phone only	Phone only
Sampling	Proportional random sample of in-hospital survey respondents with a positive match to Demographic Registry's birth certificate data AND all women with evidence of Zika virus infection during pregnancy (i.e., self-reported on phase 1 hospital survey or indicated on infant's birth certificate)	All respondents to the maternal in-hospital survey with a positive match to Demographic Registry's birth certificate data
Sample	Women: 1535	Women: 1485
Survey (length/time)	Maternal survey (37 questions/approximately 20 minutes to complete)	Maternal survey (49 questions/approximately 30 minutes to complete)
Response rate	76.6% (n = 1176)	82.8% (n = 1230)
Gift for participation	Packet with condoms, mosquito repellent, and educational materials	Packet with condoms, mosquito repellent, and educational materials
Personnel and study support: telephone interviewers	6 telephone interviewers	6 telephone interviewers

[a] The telephone follow-up surveys gathered supplemental data to address emerging data needs identified as the Zika outbreak progressed. The phase 1 telephone follow-up survey was implemented approximately 9 months after birth because of time needed to identify gaps, develop surveys and protocols, and obtain necessary approvals. Streamlining of methods during phase 2 allowed for implementation of the telephone follow-up survey approximately 3 months after birth.

maternal and infant postpartum health and behaviors that could not be assessed at the time of delivery.

The landfall of Hurricanes Irma and María posed new challenges to pregnant and postpartum women. The PRAMS-ZPER study was in a unique position to collect data about experiences in the aftermath of the disaster and was leveraged for that purpose by including hurricane-related questions. The in-hospital data collection also allowed PRDH to incorporate an educational component to reinforce public health messaging for postpartum women and families.

IMPLEMENTATION

Data from Puerto Rico's Demographic Registry were used to identify hospitals. Sampling hospitals were selected based on the number of births during the previous year. Hospitals with 100 or more births in 2015 were eligible for participation during phase 1, and hospitals with 100 or more births in 2016 were eligible for participation during phase 2. PRDH contacted selected hospitals to complete the study's participation agreement. In phase 1, all 36 eligible hospitals participated, representing 99.8% of live births on the island during the sampling period. In phase 2, 30 of 34 eligible hospitals participated, representing 94.2% of births. For this phase, one hospital declined participation, and three hospitals were not included because their maternity wards were closed after Hurricane María.

For phase 1, the sampling design was stratified by the island's eight health regions. Regional oversampling was not performed for phase 2 because of the shortened data collection timeframe after the hurricanes (Table 1). For both phases, probability sampling was used to identify the sampling days in each hospital. All eligible women with a live birth on sampled days were invited to participate.

For phase 1, study personnel approached women 24 or 36 hours after vaginal or cesarean section delivery, respectively. Approximately 220 women were identified to have been discharged before they could be invited to participate. For phase 2, women were approached soon after delivery because of the likelihood of early discharge (e.g., < 24 hours) after the hurricane. For phase 2, we were unable to assess the number of women who were discharged before being contacted by study personnel. In-hospital surveys were self-administered on paper or electronic tablets, with most (72.0%) completed on tablets during phase 1. For phase 2, most (84.0%) surveys were completed on paper because of delays in tablet availability. For the paternal survey, fathers were approached soon after the birth and before maternal discharge. For all surveys, respondents received a small gift for their participation (Table 1 and 2). Respondents' characteristics are shown in Table A (available as a supplement to the online version of this article at http://www.ajph.org).

After completing the in-hospital survey in phase 2, participants were offered the educational component, which included a 30-minute interactive flip-chart presentation addressing postpartum health, newborn care, and Zika prevention. Supplemental educational materials on breastfeeding, infant care, postpartum care, and mental health, and CDC's Developmental Milestones booklet were integrated into the presentation. A notepad and pen were provided to participants to write down any questions that the study staff were unable to answer, for later follow-up with hospital staff.

After completing the in-hospital data collection, PRDH performed a deterministic linkage of sampled mothers to birth certificate records. Among respondents, linkage rates were 99.4% and 99.5% for phase 1 and 2, respectively. Linkage to birth certificate data provided contact information for telephone follow-up and allowed inclusion of select birth certificate variables (Table B, available as a supplement to the online version of this article at http://www.ajph.org) in analytic data sets. Birth certificate data were also used for data weighting. Data were weighted for stratified sampling design and to adjust for differential nonresponse. The standard PRAMS protocol procedures[5] were followed for the telephone follow-up surveys.

EVALUATION

Maternal response rates were 80.6% and 94.4% for the in-hospital surveys (Table 1) and 76.6% and 82.8% for the telephone follow-up surveys for phase 1 and 2, respectively (Table 2). A response rate of 74.6% was obtained for the paternal survey (Table 1).

Dissemination efforts included a conference for health care professionals, data analysis training, and development of fact sheets and journal articles. Published findings have highlighted topics ranging from the use of Zika prevention measures during pregnancy[6–8] to assessing men's health and involvement during pregnancy.[9] Findings have informed PRDH activities, such as home-visiting and nurse-visiting programs. In addition, data have guided the development of educational and health promotion materials (e.g., provider's role in Zika prevention, maternal use of protective measures, and hurricane preparedness).[10,11]

PRAMS-ZPER study data will continue to be used to assess the effectiveness and reach of Zika emergency response activities, including implementation of clinical testing guidelines,[4] efforts to increase contraceptive use, and receipt of Zika-related screenings for infants.

ADVERSE EFFECTS

We have no adverse effects to report.

SUSTAINABILITY

Implementing the PRAMS-ZPER study during two types of public health emergencies (infectious disease outbreak and natural disaster) was labor-intensive and logistically challenging because of evolving data needs and operational limitations. During phase 2, it was necessary to rapidly adapt questionnaires, protocols, and implementation guidelines after the hurricanes. However, phase 2 response rates exceeded the already high rates obtained in phase 1 by decreasing the length of the data collection period, removing wait-time requirements for contacting mothers, providing extensive interviewer training, implementing a feasibility pilot study, including staff in project planning, and maintaining strong collaboration with partners (e.g., hospitals, Demographic Registry), and PRDH staff resilience.

PUBLIC HEALTH SIGNIFICANCE

Pregnant women and infants are at increased risk for adverse health outcomes during public health emergencies because of their unique health care and resource needs.[12] Given the impact of recent public health emergencies (e.g., Zika, natural disasters, COVID-19) on maternal and infant health and receipt of health services, establishment of new data collection mechanisms or modification of existing surveillance systems for health assessments must be done rapidly. PRAMS-ZPER study operations can be adopted by other state, local, or territorial public health departments as part of emergency preparedness planning. PRAMS-ZPER study protocols, questionnaires, data request guidance, and materials are publicly available on the PRAMS Web site[11] and may be adapted for surveillance studies examining maternal and infant health. AJPH

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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 of the CDC, the CDC Foundation, or the Puerto Rico Department of Health.

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PUBLICATION INFORMATION

Full Citation: Salvesen von Essen B, D’Angelo DV, Shulman HB, et al. Rapid population-based surveillance of prenatal and postpartum experiences during public health emergencies, Puerto Rico, 2016–2018. *Am J Public Health*. 2022;112(4): 574–578.

Acceptance Date: December 16, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306687

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ACKNOWLEDGMENTS

We thank all the personnel in the Division of Maternal, Child, and Adolescent Health and the Demographic Registry in the Puerto Rico Department of Health. We also thank all the participating hospitals and the Pregnancy Risk Assessment Monitoring System–Zika Postpartum Emergency Response study staff as their participation was instrumental throughout the data collection process. Lastly, we are grateful to all the study participants.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

HUMAN PARTICIPANT PROTECTION

This study was approved by the institutional review board of the University of Puerto Rico Medical Sciences Campus and the CDC.

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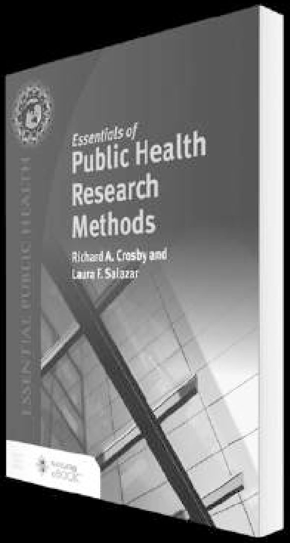

Training the Next Generation of Public Health Professionals

Laura Magaña, PhD, and Dorothy Biberman, MPH

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See also Reflecting on Health Inequities, pp. 579–607.

During the past two years, we have faced unprecedented challenges—the COVID-19 pandemic, social unrest, environmental crisis, and economic struggles, just to name the most visible ones. Our ability to cope with uncertainty and rapid change has been tested, and the academic public health community has risen to the moment. Schools and programs of public health (SPPH) immediately pivoted to remote education, ensuring that learners continue their educational programs, while working tirelessly with their communities and health agencies to mitigate the pandemic. Amid these trying times, myriad new opportunities for human development have arisen.

COMPETENCIES FOR THE FUTURE

The pandemic and societal challenges are a good reminder that SPPH need to prepare students "for jobs that have not yet been created, and for technologies that have not yet been invented, to solve problems that have not yet been anticipated."[1(p2)] We are at a turning point whereby the academic sector is exploring and envisioning a new way to educate the current and future generations. The COVID-19 crisis may well change our world and our global outlook; it may also teach us about how education needs to change to be able to better prepare public health professionals for what the present and the future might hold.

Research from Plepys et al. shows a minority of graduates (17%) now work in traditional governmental public health,[2] but the pandemic has brought a revitalized view of the importance of governmental public health, so, with intentional actions and initiatives, this might change. But we also must prepare students for a broader range of employment options, such as the increasing opportunities in health care and private industry[3] as well as foundations and nonprofit organizations. Similarly, we must prepare them for the different responsibilities these jobs may have and incorporate competencies drawn from related fields, such as management of resources and supply chains from business, combatting misinformation from communications,[4] advocacy, journalism, and media management, among many others.

The next generation of the public health workforce will need to strengthen the evolving technical and scientific competencies in public health, but, also, it will be crucial for them to develop human competencies such as resilience, curiosity, communication, cultural agility, empathy, compassion, flexibility, and the ability to cope with failure and rejection.[5,6] Future employers will also be looking for skills in critical thinking, problem-solving, creativity, adaptability, collaboration, teamwork, emotional intelligence, self-regulation, digital technology, and comfort working with diverse populations.[1,7] SPPH will also need to continue to instill appreciation for the values of our field: appreciation of diversity, ethical practice, and intolerance for injustice and inequities.

REDUCING HEALTH INEQUITIES

The pandemic has highlighted many health inequities and the impacts of social determinants of health. In this issue of *AJPH*, seven students present thoughts on reducing health inequities in relation to pandemics. Their work reflects the need to amplify our efforts to reduce health inequities, with examples including global interconnectedness, community engagement, digital literacy, focus on vulnerable populations, and supporting the public health workforce.

Addressing the social determinants of health is at the core of public health practice and, therefore, also at the core of public health academia. The Association of Schools and Programs of Public Health (ASPPH) is focusing on critical initiatives to lead academic public health forward and support the next generation of public health professionals—always through the lenses of diversity, inclusivity, justice, and equity:

- Creating "equitable, quality education for achieving health equity and well-being for everyone, everywhere”[8] in three areas: inclusive excellence through an antiracism lens, transformative educational models and pedagogy, and expanding the reach, visibility, and impact of the field of academic public health.

- Dismantling racism and structural racism in academic public health: Racism is a public health crisis that demands bold action on many fronts, including academic public health. A long history of cultural and structural racism, along with other forms of discrimination, have shaped schools and programs of public health. Major changes are needed to “dismantle the conditions that enable racism in academic public health institutions and empower all our faculty, staff, and students to succeed in the 21st century,” including development of antiracism competencies.[9(p3)]
- Addressing climate change in four primary domains: education and training, research, policy and advocacy, and practice. Three cross-cutting domains—health equity, environmental justice, and social justice; partnerships for impact; and interprofessional and interdisciplinary collaborations—are also being examined within the context of the primary domains.[10]
- A holistic approach to education: As the pandemic highlighted, it is critical that all citizens understand the foundations and concepts of health, disease, and prevention; these public health concepts should be included as part of a liberal arts education.[11] Regardless of a graduate’s ultimate career destination, having the core knowledge, skills, and competencies will open career opportunities and better prepare people for positions in public health, health professions, and other fields. We must also identify approaches to introduce public health concepts into teaching for students in grades K through 12 and in community colleges. Finally, we must continue to provide training opportunities and resources for the public health and health professions workforce, and for related fields, to ensure the workforce has the knowledge and skills necessary to respond to new and evolving public health challenges.
- Global collaboration in an interconnected world: Academic public health needs to have a more powerful voice on global issues and continue to create opportunities for global collaboration between leaders, faculty, and students. The Global Network for Academic Public Health is an alliance of seven regional associations that represent schools and programs of public health around the world, with the goal of enhancing academic public health worldwide through mutual learning and collaborations between academic public health institutions globally to improve and protect the health of people and the planet.[12]
- Intersectoral and interprofessional collaboration: Addressing the social determinants of health is an issue that involves all health professions and many related fields, such as law, city planning, architecture, agriculture, transportation, and many others. It also requires collaboration between government, nonprofit organizations, and for-profit organizations. This type of intersectoral and interprofessional collaboration can be difficult because these fields often work in silos and are also trained in silos. A systems thinking approach is needed to address these challenging issues, both in work and academia. The social determinants of health should be part of all health professionals’ education, and education in other fields should include potential health impacts.
- Supporting pathways for a diverse workforce: SPPH have a strong focus on recruiting diverse applicants to build a diverse workforce. Between March 2020 and May 2021, applications to graduate-level public health degree programs increased by 40%, including increases in Black/African American and Hispanic/Latino applicants.[13] The This Is Public Health campaign, which raises awareness about education and career options in public health, helps recruit diverse applicants for SPPH through student ambassadors, graduate fairs, partnerships, interprofessional activities, and other events for students.[14]
- Data for decision-making: Public health education research conducted by ASPPH and its members serves as a catalyst to answer key research questions on public health education, including exploring pathways to the public health workforce. A study of first-destination employment of 53 000 graduates from ASPPH-member SPPH from academic years 2015 to 2018 found that 73% were employed, with another 15% moving on to further education. The top employment sector for those with a bachelor’s degree was for-profit corporations (38%); for master’s degrees, health care (27%); and for doctoral

degrees, academia (42%).[2] This type of research helps inform education programs to ensure they are providing the skills the public health workforce will need.

The excellent work presented by students in this issue demonstrates the value of public health education—both in the knowledge and skills the students have already developed and in the potential for them to advance the work of public health to continue to reduce inequities and improve health and well-being for all people. The losses because of the COVID-19 pandemic are many and profound. We must heed the lessons we have learned to ensure that we are prepared to respond to, and hopefully prevent, the crises of the future. This is our opportunity to rethink academic public health. AJPH

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PUBLICATION INFORMATION

Full Citation: Magaña L, Biberman D. Training the next generation of public health professionals. *Am J Public Health*. 2022;112(4):579–581.

Acceptance Date: January 19, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306756

CONTRIBUTORS

L. Magaña conceptualized and outlined the paper, wrote the initial draft, reviewed and edited subsequent drafts, and approved the final article for submission. D. Biberman provided feedback on the concept and outline and research support, and wrote and edited all but the first draft.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

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Educated Citizenry or Workforce Pipeline Development? Questions for the Future of Undergraduate Public Health in the United States

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See also Reflecting on Health Inequities, pp. 579–607.

The spring of 2020 will undoubtedly be associated with COVID-19 lockdowns, hospital surges, death, and political turmoil. But as COVID-19 began to fundamentally reshape the relationship between public health and the public in the United States, another public health milestone occurred: the spring of 2020 represented the first time that more undergraduate public health degrees were awarded in the nation than master's degrees. In 2020, 18 289 undergraduate public health degrees (UGPHDs) were conferred compared with 18 044 master's degrees (Figure 1).[1] This milestone at this critical moment offers an opportunity to assess the degree and its growth over the past two decades, and to pose key questions for its future.

A DUAL IDENTITY FOR UNDERGRADUATE PUBLIC HEALTH DEGREE

The Institute of Medicine's 2003 "Who Will Keep the Public Healthy?" report recommended for "all undergraduates to have access to education in public health."[2(p20)] It led to a dual identity for the undergraduate degree going forward: (1) to advance public health literacy and an "educated citizenry" to integrate public health into whatever fields graduates enter, and (2) to provide more intentional public health workforce preparation to ensure an adequate and prepared staff for the nation's governmental health agencies.[3,4]

From 2019 to 2020, conferrals of master's degrees in public health grew 1%, compared with 7% for UGPHDs. Prior to the COVID-19 pandemic (academic year 2019–2020), master's degrees in public health saw the first sustained year-to-year drop in applications since data have been recorded, whereas conferrals of UGPHDs continued to grow, although the pace of acceleration slowed substantially.[5] However, COVID-19–related interest in public health and a temperamental economy yielded an all-time high pool of graduate public health applicants beginning in March 2020, providing a reprieve from the expected stagnation of graduate applications.[3,5–7] Although demographic changes and economic pressures are still expected to reduce the number of high school graduates, undergraduates, and thus master's degree students in the medium term,[7] the immediate future of academic public health in the aftermath of the pandemic faces much uncertainty.[8,9]

Conferrals of UGPHDs now eclipse those for master's degrees, but only a small percentage of the governmental public health workforce—even among new entrants—has a bachelor's or master's degree in public health.[10] Data from the Associations of Schools and Programs of Public Health (ASPPH) show that a relatively small percentage of those with either undergraduate or graduate degrees in public health end up in governmental public health practice.[11] ASPPH data on undergraduates show that first jobs out of school were in for-profit organizations (38%), health care (27%), academic institutions (10%), government (10%), and all others (15%).

BIG QUESTIONS REMAIN

We offer some big questions for students, academics, and researchers to consider for the identity of the undergraduate public health degree.

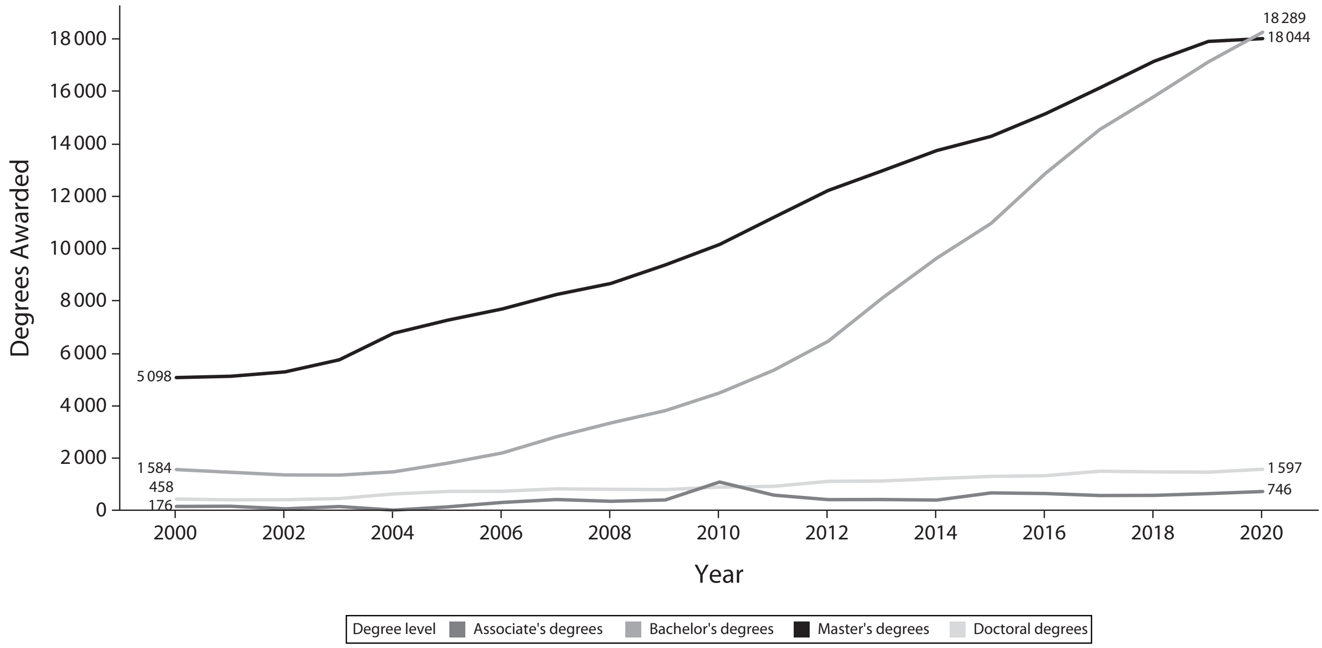

FIGURE 1— Growth of the Undergraduate Public Health Degree: United States, 2000–2020

Source. National Center for Education Statistics.[1] Includes Classification of Instruction program codes 51.22XX (Public Health), 26.1102 (Biostatistics), 26.1309 (Epidemiology), 44.0503 (Health Policy Analysis), and 51.0504 (Dental Public Health).

1. What are public health undergraduate programs preparing students to do?

Reports from the Institute of Medicine and ASPPH have long laid out a vision wherein master's-trained students represent the future leadership of the governmental public health workforce.[2,4] However, data indicate that most public health graduates at any degree level do not go into governmental public health, and particularly at the undergraduate level. Thus, the identity of the undergraduate degree becomes paramount, especially as vision documents for the field and accreditation requirements for the degree are aimed at preparing students for the governmental public health workforce. However, if most undergraduates go into the private sector or health care and not government, and with some going on to further education in health care or graduate public health,[12] shouldn't that affect how we prepare students for a future career? Can this milestone perhaps serve as a call for needed changes in the field to attract graduates with public health training to governmental public health?

2. Can undergraduate public health help combat systemic racism and improve health equity?

The twin pandemics of COVID-19 and systemic racism threaten the health and well-being of the public. Undergraduate public health may be well positioned to train a generation of graduates to bring hard and soft skills to antiracist efforts, although formal commitment to doing so from schools, programs, and faculty is in the nascent stages. A long-time focus within public health on social determinants and social justice theory, along with a newfound public interest in equity and health equity issues, have created substantial opportunity for public health graduates. These opportunities are consonant with both identities of the degree: to produce an educated citizenry in whatever fields graduates pursue and, by preparing a public health workforce within government, to effect change in the racism and equity space.

3. Will undergraduate public health help rebuild the public health workforce?

From the Great Recession up until COVID-19, best estimates indicate that state and local health departments lost a net 40 000 jobs.[13] Since COVID-19, a dramatic increase in the temporary and contract workforce has potentially offset these losses, although questions remain about whether a temporary workforce will become a permanent one going forward. In addition, voluntary separations from public health agencies are at an all-time high—the Great Resignation has changed the employment landscape in many fields across the United States.[14] The impact of this macroeconomic movement on public health remains uncertain. Yet a fundamental question emerges: will undergraduates be part of the rebuilding of the public health workforce? If so, will this require a curriculum retool to meet emerging governmental needs in the post–COVID-19 era? Implicit in this is the question, can health departments attract graduates away from the private sector and health care?[6]

4. Will there be a substitution effect for undergraduate versus graduate degrees in public health?

Substitution effects in hiring—for example, preferentially hiring a holder of a bachelor's degree rather than a master's—have long been observed, most notably in fields like education as a cost-cutting measure. Although recent evidence does not suggest widespread substitution effects in public health, especially in government agencies,[15] there remain open questions about whether an UGPHD looks as appealing as a master's degree from the perspective of an employer, such as those in health care or the private sector more broadly. If such a substitution effect does emerge, will it manifest more in one degree identity over the other? And ultimately, what might be the impact of such a substitution effect on the practice of public health (e.g., the depth of knowledge and skills), especially in specialized fields like epidemiology?

5. What is the value of an undergraduate public health degree?

The monetary benefits of a bachelor's degree broadly are demonstrable, although inequitable distribution of student loan debt has created disparities by race, ethnicity, and class. Yet the advantages of an UGPHD versus other undergraduate degrees are less well characterized. If the public health degree is considered under the Institute of Medicine's broad social goals of an educated citizenry, UGPHD outcomes might be compared with humanities or other field-based types of study such as sociology, anthropology, or political science. However, if UGPHDs are within the realm of workforce preparation as a specific discipline, such as nursing or other allied health degrees, outcomes may be less favorable. A final point in the consideration of value is that motivations matter to job satisfaction, perhaps as much as compensation.[6] As such, assessments of value to any degree should consider both the monetary and nonmonetary benefits of the degree and potential employment outcomes.

6. What is a reasonable upper bound on the expected number of undergraduate degrees in public health each year?

As conferrals of undergraduate degrees eclipse those of master's degrees, questions about an upper limit naturally arise and diverge across the two identities. Compared with other undergraduate humanities degrees, public health, at 18 000 degrees, is modest in size and has some room for growth. In 2020, for example, undergraduate degrees for sociology were at 29 000, and computer science and political science had 40 000 each; however, in the realm of workforce preparation there is a large gap for public health degrees compared with nursing (160 000) and business (170 000).[1]

The ratios of undergraduate to graduate degrees further accentuate the distinctions across the two degree identities and raise questions about intended professional trajectories. Among profession-focused degrees, in 2020, ratios for bachelor's versus master's degrees were 5 to 1 for nursing, 2.8 to 1 for computer science, and 1.4 to 1 for business degrees; however, for humanities-based degrees a distinctly different picture emerges, with ratios of 22 to 1 for sociology and 23 to 1 for political science degrees.[7] Although it seems functionally impossible to have 20 UGPHDs awarded for every one master's degree in public health, it may be plausible to see a ratio of 2 to 1 or even 3 to 1, contingent on employment outcomes and loan repayment options.[3,12]

CONCLUSIONS

Undergraduate public health education is clearly here to stay, and needs to be a core part of academic public health's plans for the future. It represents potential for much-needed strengthening of the field and capacity to improve the health and health equity of the public, in terms of both a better understanding of public health among the broader workforce and more public health–trained people to help rebuild the governmental public health workforce. AJPH

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PUBLICATION INFORMATION

Full Citation: Leider JP, Resnick B, Erwin P. Educated citizenry or workforce pipeline development? Questions for the future of undergraduate public health in the United States. *Am J Public Health*. 2022;112(4):582–585.

Acceptance Date: January 16, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306742

CONTRIBUTORS

All authors conceptualized, wrote, and edited the manuscript.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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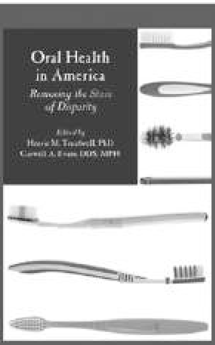

Ending the HIV Epidemic: What Will Happen to the HIV Testing Workforce?

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See also Reflecting on Health Inequities, pp. 579–607.

What will happen to the HIV testers when we get to zero? Most of the testers will be unemployed with no translatable skills. Simultaneously, federal and state health departments, and subsequently AIDS service organizations, have suffered significant cuts in funding.[1] From a recent survey by Southside Health Advocacy Resource Partnership (SHARP) in Chicago, we understand that most of these individuals are underemployed, queer Black people. The COVID-19 pandemic has highlighted that "Getting to Zero" will cause unemployment as AIDS service organizations (ASOs) terminate or repurpose staff for the pandemic response.[2] To avoid this, Getting to Zero efforts must prioritize a workforce investment strategy that ensures HIV testers have translatable employment now.

Starting as the theme for the 2011 World AIDS Campaign from the United Nations,[3] "Getting to Zero" has become the colloquial moniker for US Ending the HIV Epidemic plans. However, these plans are not prioritizing the welfare of the HIV workforce. Aside from declining incidence of HIV transmission,[4] an outcome of HIV prevention and treatment is the steady decline of funding for HIV services. Since 2012, HIV prevention services funding that enables ASOs to offer HIV tester occupations has decreased and remained stagnant over the last few years.[5] Predominantly, these occupations employ the populations most vulnerable to—and sometimes living with—HIV/AIDS. As the funding decreases, Getting to Zero will cause unemployment for people most vulnerable to, and living with, HIV. During the COVID-19 pandemic, some organizations reduced their number of HIV tester positions. The staff reduction indicates how ASOs are not investing in the long-term careers of their shrinking, underpaid workforce.

With HIV-tester certifications that mean nothing outside of HIV prevention and treatment, jobs that do not pay a living wage, and decreasing HIV funding, frontline staff will be unemployed when we achieve an end to the HIV epidemic. HIV tester certifications do not translate to any employment opportunities outside of HIV prevention and treatment. During a 2018 community survey ($n = 20$) by SHARP, we discovered that most of the HIV prevention and treatment workforce in the southside of Chicago were Black men who have sex with men, along with Black transidentified and gender nonconforming persons. These individuals are compensated $29 000 to $36 000 per year. According to the median income chart released by the Chicago Planning & Development Department, this is 50% to 60% of the area median income, and their standard of living is very low to low income.[6] This population has expressed concerns about their employment status.[7]

Getting to Zero efforts must start prioritizing investment in translatable employment strategies for HIV testers, now. ASOs must embrace a commitment to what I call "translatable employment": an occupation or professional certification that is useful in one field and translates to a useful credential in another. For instance, HIV testers should be licensed by their employers in phlebotomy, so that they have prospects for other employment in public health and other fields. From my experience, issues are not prioritized in HIV prevention and treatment unless funders (e.g., the Centers for Disease Control and Prevention, foundations) make them a priority. Because of the cause-and-effect relationship between funders and ASOs, workforce investment must be prioritized by funders for ASOs to make translatable employment a priority. Otherwise, the workforce that has made Getting to Zero possible will be left with zero jobs. AJPH

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PUBLICATION INFORMATION

Full Citation: Green NC. Ending the HIV epidemic: what will happen to the HIV testing workforce? *Am J Public Health*. 2022;112(4):586–587.

Acceptance Date: December 30, 2021.

DOI: https://doi.org/10.2105/AJPH.2022.306717

ACKNOWLEDGMENTS

I thank the following: the *AJPH* editor-in-chief for his consideration and acceptance of this comment; Darnell Motley, PhD, for review of the writing; Russell Brewer, PhD, for being a mentor; and

Keith Green, PhD, for being a mentor and inspiration.

CONFLICTS OF INTEREST

The author has no conflicts of interest to report.

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Digital Literacy, Health Inequities, and the COVID-19 Pandemic

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See also Reflecting on Health Inequities, pp. 579–607.

The COVID-19 pandemic has drastically changed the way primary health care is delivered. In comparison with March 2019, there was a 154% increase in telemedicine visits in March 2020, primarily driven by COVID-19 social-distancing policies.[1] Congress and insurance companies facilitated this increase by amending restrictions that had previously limited telemedicine use.[2] Although research suggests that telemedicine has the potential to decrease costs and increase access to health care, there are vulnerable groups at risk for experiencing telemedicine disparities if a health equity lens is not used to implement future telemedicine use.

The primary risk factor of COVID-19 mortality is age; therefore, many health care settings used telemedicine as an alternative to reduce potential exposure to older patients. Unfortunately, older adults are the least likely to use technology, such as telemedicine.[1] As an example, my parents were asked to switch their health care appointments to telemedicine throughout the COVID-19 pandemic. They did not own a computer, and the only device they owned with a camera was their smartphone. As low-income older adults, they did not have the money to purchase technology that was not a necessity before the pandemic. Fortunately, my classes started being delivered online during the COVID-19 pandemic and I was able to travel to them, so they had access to my laptop. We knew that eventually I would have to leave; therefore, we made the decision to purchase a laptop with a camera.

The access to technology problem was solved with the purchase; however, they did not know how to download and use videoconference applications. Throughout numerous days, I educated my parents on how to download different applications and use them until they felt empowered to be able to use them without me. My parents were able to independently attend their health care sessions through telemedicine, and we have weekly videoconference family gatherings now. However, public health and policymakers cannot hope that people will be able to access technology, have money to purchase up-to-date technology, and have people to help educate them on how to use technology.

Barriers to telemedicine implementation include lack of technology and digital literacy.[3] Although researchers have quickly attempted to study and publish about telemedicine, there has not been an equivalent amount of increase in digital literacy research. This is emphasized by a PubMed search of “digital literacy” between 2020 and 2021 that found only 573 publications compared with 14 597 publications for “telemedicine or telehealth.” Additionally, only three “digital literacy” studies have been registered on clinicaltrials.gov since January 1, 2020, whereas 560 “telemedicine or telehealth” studies have been registered.

It is imperative that public health study inequities associated with telemedicine to make sure that the increase of telemedicine does not widen the current health disparities. Previous evidence suggests that barriers to telemedicine can be overcome by interventions that increase perceived self-efficacy through education.[3,4] Additionally, the association of disability and poverty with telemedicine use should inform policymakers to ensure that technological devices with disability accommodations are covered as medical necessity.[5] There is a growing need for public health to ensure that the advantages of telemedicine are implemented in an equitable manner so that people like my parents are not left behind. AJPH

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PUBLICATION INFORMATION

Full Citation: Bejarano G. Digital literacy, health inequities, and the COVID-19 pandemic. *Am J Public Health*. 2022;112(4):588–589.

Acceptance Date: December 7, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306661

ACKNOWLEDGMENTS

The author thanks Gabriel A. Benavidez, MPH, for his contributions to the final version of this comment.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare with respect to the research, authorship, or publication of this comment.

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How the Pandemic Further Isolated the Incarcerated

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See also Reflecting on Health Inequities, pp. 579–607.

The silver handcuffs that encompassed the young Black woman's wrists restricted her from moving her visibly worn-out mask up her nose. She stated that she had not yet been able to obtain the COVID-19 vaccine and had not been tested in more than two weeks. As an emergency medical technician, Ankita Patil was dispatched to the local prison that was hidden in the corner of the town, and this was her first exposure to the inhumane conditions carceral settings enforce and conceal from the public.

Jails and prisons quickly became a hotspot for COVID-19 and involved the largest and most frequent outbreaks in the United States. The virus spread rapidly through carceral facilities as a result of difficulties in practicing social distancing and adhering to mask mandates, along with a lack of engineering controls (e.g., air conditioning). Occupational Safety and Health Administration (OSHA) workplace complaints rose by more than 15% between February and October 2020, with the majority revolving around unacceptable COVID-19 workplace conditions that essential workers had to endure[1] however, this metric did not extend to the voices of incarcerated populations, who have been vital to the functioning of our society but have not received proper protection.

As an occupational health student, Marjorie Naila Segule worked to make people feel safe returning to work and designed interventions to reduce workplace COVID-19 exposures. However, these interventions did not include incarcerated workers who were on the frontlines of the pandemic response working in morgues and cleaning hospital laundries where they were directly exposed to the virus.[1] These workers are often unable to exercise workplace protection and face numerous barriers when filing OSHA complaints. They are further forced to work with little to no pay and can be penalized if they decide to not work.

When the system is allowed to engage in "violent inaction," incarcerated individuals are left purposefully hidden.[2] The lack of data transparency in COVID-19 case reports and the personal protective equipment supplied to jails and prisons, coupled with sluggish legislation (e.g., the half-year gap in the tabling of the COVID-19 in Corrections Data Transparency Act), permits carceral facilities to mask the barbaric conditions faced by this vulnerable population. Further human rights violations incarcerated individuals faced during the pandemic (and continue to face) include increased solitary confinement owing to lockdowns,[3] canceled in-person visitations, and loss of physical mail from family members as cards were converted to PDFs.[4]

Many of us have seen our communities step up by asking for individuals to be released, advocating for vaccine prioritization, and working to address vaccine hesitancy in incarcerated settings.[5,6] Unfortunately, that is not enough. As public health students, we can aid in fixing this data opacity by mobilizing legislatures to pass the necessary reforms to properly report on the health and well-being of those who are incarcerated and designing the types of oversight needed to hold these carceral facilities accountable. We can further take our message to a global scale to ensure that those who are incarcerated in other countries are given the proper protection and resources to keep them safe during the COVID-19 pandemic. Although these steps will not be taken immediately and will be met with resistance, we must consistently hold these institutions accountable.

For many, the pandemic illustrated the need to pay more attention to the health of incarcerated individuals given that jails and prisons are a hotspot for infectious diseases such as COVID-19 and that the health of individuals who live and work in these settings can affect those of us who may not enter such facilities. Records on COVID-19 cases and deaths that occurred in carceral facilities have been lacking in quality, have been inaccessible to the public, or have not been updated despite the continuation of the pandemic. The true extent to which the country's most marginalized population has been affected by the pandemic and the inequities faced by these individuals may never be known. AJPH

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PUBLICATION INFORMATION

Full Citation: Patil A, Segule MN. How the pandemic further isolated the incarcerated. *Am J Public Health*. 2022;112(4):590–591.

Acceptance Date: December 7, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306660

CONTRIBUTORS

A. Patil led the drafting of the comment with support from M. N. Segule. Both authors participated in the development of the idea, reviewed the drafts, provided critical feedback and commentary, and reviewed the final version.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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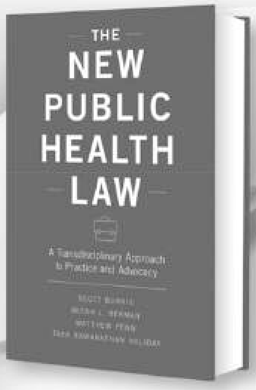

Reflecting on Health Inequities in a Global Pandemic: The Need for Disability-Conscious Public Health Strategies

Lydia R. Smeltz, BA, and Sandra L. Carpenter, BA

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See also Reflecting on Health Inequities, pp. 579–607.

“‘His body is so messed up!’ the nurse said, unaware that I was not sedated and could hear her perfectly,” a close friend shared as he described his recent experience in the intensive care unit during the COVID-19 pandemic. “Because I was on a ventilator, I couldn’t speak up to explain that I was born with cerebral palsy.” Encounters such as this one are shockingly common among the disability community, and raise doubts about how people with disabilities (PWD) are valued in medicine and society. Family friends relayed additional concerns about their children who have autism and other sensory needs. Because these children were unable to wear masks for extended periods, their perceived “noncompliance” frequently prevented them from accessing public spaces.

Although PWD make up 25% of the United States population, they often encounter barriers in health systems and social programs.[1] These barriers, including attitudes, inaccessible environments, and lack of accommodations, contribute to the marked health disparities experienced by PWD. Recently published research suggests there is strong physician bias against PWD.[2] The COVID-19 pandemic has exacerbated these health disparities and highlighted ableism, or prejudice and discrimination against PWD.[3] Ableism is an unrecognized public health issue, but it can be addressed through disability consciousness, a multidisciplinary approach that incorporates perspectives of PWD and fundamental teachings from disability studies and disability justice to compel change.[3] As medical students engaged in national discourse about the poor health of disabled people in our country, we advocate for disability-conscious public health strategies.

We are still lacking the fundamental tools necessary to enact effective policy change and address health equity for PWD, including disparity status for this minority group, comprehensive disability education for public health and health care students, and inclusive public health efficacy research. PWD remain unrecognized as a health disparity population despite a growing body of evidence that they experience differential, worse health outcomes that are avoidable and unjust.[4] Importantly, failure to recognize PWD as a disparity demographic impedes data collection that is necessary to assess outcomes and drive systems change. The COVID-19 pandemic has exacerbated health inequities for many of the 61 million Americans living with disability.[1] As one example, the most significant independent risk factor for contracting SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2, which can lead to COVID-19) is having an intellectual disability. Having an intellectual or developmental disability is also one of the most significant risk factors for COVID-19 mortality, second only to age.[5] Medical infrastructure remains largely inaccessible to PWD, which constitutes a growing public health problem. Thirty years after the passage of the Americans with Disabilities Act (ADA), the National Council of Disability’s 2021 report revealed the persistent scarcity and utilization of accessible medical diagnostic equipment.[6] The scope and severity of these issues are alarming, especially in the context of the aging nation and increasing prevalence of “long COVID,” now recognized as a disability under the ADA.[7] Without accessible health care clinics, screenings, and services, health care disparities will continue to worsen.

Health care trainees, such as ourselves, have become increasingly aware and concerned that ableism does not receive due public health attention. Although our didactic and clinical curricula include public health, humanities, and health systems perspectives, disability perspectives and teachings are largely absent. A 2017 survey estimated that less than 25% of medical schools provide any disability-focused training.[8] Disability curricula that do exist tend to be sparse, highly variable, and driven by student advocates, which raises concerns about their longevity.[3] Furthermore, the limited education we have received on disability contains bias that devalues the lives of PWD and reinforces ableist rhetoric. For example, outdated disability language and images are pervasive in lectures and study materials, which has frequently compelled us to advocate to faculty directly for their removal. This advocacy work can be singularly exhausting and leaves us with complex emotions, such as anger, sadness, and defeat, when we realize that disability is deprioritized at all levels of medical education.

In response, we, and many of our peers, have collaborated with faculty and disability activists to create disability-inclusive courses that attempt to fill this gap in training. Additionally, we have formed national disability advocacy groups, such as Medical Students with Disability and Chronic Illness—composed of health care trainees with disabilities or chronic illnesses and their allies—to oppose ableism in medicine and to cultivate the next generation of disability-conscious public health leaders. Our efforts seek to increase the prevalence of students and health professionals with disabilities in public health spaces and to educate nondisabled people about allyship and public health challenges unique to PWD. Interwoven through these efforts is the proactive inclusion of PWD and the amplification of their teachings, stories, and experiences.

Although we hope that disability-conscious education will translate into disability-conscious public health strategies, we need data to measure the true impact. Public health research lacks the robust data required to drive policy change for PWD. Research on the impact of COVID-19 has not routinely collected data on disability demographics.[9] It is impossible to employ or evaluate a data-driven approach when the data for one cohort is missing. Health care decision-making must seek out and incorporate the perspectives of PWD or risk developing policies and programs that are ineffectual or oppressive for PWD.

In response to the recognition of the differential effects of COVID-19 on minority communities and the need for targeted research, the US Government created the COVID-19 Health Equity Task Force.[10] The task force is an important step in addressing health inequities and mitigating future disparities. Furthermore, the Centers for Disease Control and Prevention compiled a list of recommendations for increasing the accessibility of the COVID-19 vaccine. However, recommendations will not affect practice without measures to ensure accountability. For instance, PWD report lower rates of vaccination compared with their nondisabled counterparts, despite reporting less vaccine hesitancy.[11] Research suggests that COVID-19–mediated barriers, including reduced transportation, inability to access the Internet, and physical inaccessibility of clinics, may be the reason for this discrepancy.[11] These barriers and countless others are echoed by the testimony of our community partners, our patients, and our friends. As we devise solutions to the public health problems of our time, these efforts must seek out and incorporate the perspectives of PWD to perform equitable health research and prepare for future crises.

Ableism is a public health issue that deserves immediate public health attention. Ableism is both a cause and an effect of inaccessible health systems, inadequately trained public health leaders and physicians, and exclusionary data collection. The COVID-19 pandemic accentuated the necessity for public health leaders to address inequities by employing a disability-conscious approach. Thus, the ongoing dialogue between health care students around the country, amplified by the testimony of the disability community, represents a critical moment. The prepandemic "normal" was full of barriers and inequities, but despite evidence of disparities that should compel change, the postpandemic world continues the injustice against PWD. Disability activists have often proclaimed "Nothing about us without us!" and we, as the next generation of public health leaders, must listen, learn, and act. To address the inequities highlighted by the pandemic, we advocate for public health education and research that proactively includes PWD and takes meaningful action to address ableism and promote health equity. Disability-conscious public health strategies are needed now more than ever. AJPH

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PUBLICATION INFORMATION

Full Citation: Smeltz LR, Carpenter SL. Reflecting on health inequities in a global pandemic: the need for disability-conscious public health strategies. *Am J Public Health*. 2022;112(4):592–594.

Acceptance Date: December 7, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306666

CONTRIBUTORS

L. R. Smeltz conceptualized the presented idea. S. L. Carpenter helped develop the idea. Both authors contributed to the writing and editing.

ACKNOWLEDGMENTS

We thank Christopher Lunsford, MD, for introducing us to the concept of disability consciousness and for his mentorship.

CONFLICTS OF INTEREST

There are no conflicts of interest from funding or affiliation-related activities to disclose.

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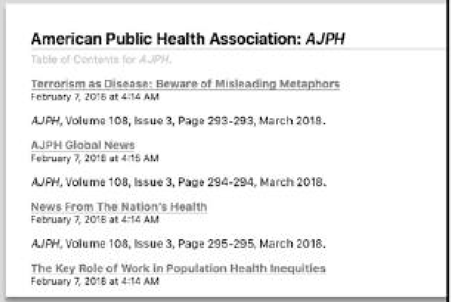

Public Health Students to Fight COVID-19 Worldwide, Not Just at Home

Kertu Tenso, MA

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See also Reflecting on Health Inequities, pp. 579–607.

Several high-income developed nations, including the United States, have now begun administering COVID-19 booster shots, whereas only a little more than 2% of people in low-income countries have received at least one vaccine dose.[1] This enormous and grim disparity perfectly illustrates how global health inequity has been further amplified during this pandemic.

It is safe to say that global health equity has not been the primary focus of most leaders of developed nations during this global pandemic. From the moment vaccines became available, wealthy countries have been hoarding vaccines—securing enough supply to vaccinate their populations several times over, even if it meant leaving poorer countries empty-handed.[2] As of January 2022, more than 4.8 billion of the world's population has received at least one dose of a COVID-19 vaccine.[3] However, only about 11% of the population in low-income countries have received at least one dose of the vaccine, compared to 78% percent of the population in high- and upper-middle-income countries.[3] In fact, it is estimated that low-income countries won't reach widespread vaccination coverage (60%–70% of the population) until 2023.[4]

"WHY SHOULD WE CARE ABOUT OTHER COUNTRIES?"

I am an international student from Estonia, and my family has been lucky enough not to experience these vaccine inequities. However, being a part of a diverse international student community in the United States, I have listened to my friends echo the feeling of living in another world. They are living and studying in a society where people are fighting against a free, lifesaving vaccine, and all the while they have friends and family back home who are literally dying because there are no vaccines to be had.

It is impossible to put ourselves in others' shoes, but the pain they convey is extremely frustrating. I hear many Americans say a version of "Why should we care about other countries? We are okay as long as we are safe, right?" Wrong.

First, there is the obvious reason—we have a moral obligation to help. Low-income countries have fewer resources and poorer infrastructure with which to tackle the pandemic, which will increase the already deep inequality between developing and developed countries, as well as the inequalities within these countries themselves.[5] The economic and social conditions in many developing countries is a direct legacy of Western imperialism. Is it fair to have the randomness of being born in a certain country decide whether someone receives a vaccine? I say no; health is a human right.

Second, poor vaccination rates in low-income countries could have a serious economic impact on the United States. It is estimated that this economic cost to the United States of vaccine nationalism is up to 1.38 trillion USD.[6] Until the virus is under control in all regions of the world, the global supply chains and demand will be impaired, having an impact on the United States as well. The economic cost through fractured supply will be felt in sectors that rely on buying from international markets, such as the retail, textile, and automotive industries, as well as through declining trade and export, all of which in turn have an effect on consumer prices and even our salaries.

Third, we should not overlook the fact that while Western countries have been preoccupied with their domestic needs, China and Russia have been furthering their global influence using vaccine diplomacy—a type of soft power that aims to improve a country's diplomatic standing through the use or delivery of vaccines. Before studying public health as a PhD student, I studied international relations and worked in embassies and intergovernmental organizations such as the World Health Organization and United Nations Human Rights Council, so I always look at the potential geopolitical ramifications of public health policy.

China's primary target has been Southeast Asia, which has already received nearly 500 million vaccine doses from China.[7] Both China and Russia had previously been expanding their influence in the Western Balkans through energy, loans, and investments, and now, at considerable concern to the European Union, Serbia is manufacturing Russia's and China's vaccines, and expanding its own geopolitical importance in the region.

Last but certainly not least, there is a very real possibility of additional vaccine-resistant variants emerging from poorly vaccinated countries, which could draw the developed world right back into the depths of an uncontrolled pandemic.

MAKING GLOBAL VACCINE EQUITY A REALITY

Now that I have established the need for a global response, I will discuss next steps for the United States.

The Biden administration recently made a pledge to bring 500 million more vaccines to low-income countries. This brings the total US contribution so far to approximately 1.1 billion doses. However, we need far more to be able to vaccinate roughly half of the world's population that has not yet received even a first dose.

The United States should further support COVAX—the global vaccine alliance that supports vaccine research, development, and manufacturing. Its primary focus is to ensure that low-income countries also get access to COVID-19 vaccines; however, it has been facing both funding and supply challenges and could use more backing from developed nations such as the United States.[8]

In addition, the United States can and should take a more proactive role in ensuring that vaccine development continues and manufacturing capacity is ramped up here. The White House could broker further deals between American vaccine manufacturers to share their technologies and collaborate on production. A successful example was set in March 2021, when the White House stepped in to broker a deal between a pharmaceutical giants Merck and Johnson & Johnson.[9]

But perhaps the most important thing to do right now would be to share the intellectual property used to manufacture the American vaccines with the rest of the world. Donating vaccines is great, but it is clearly not enough. It is crucial that we enable other countries to produce their own supply. Advocacy groups have been urging President Biden to pressure Johnson & Johnson to partner with drug manufacturers in the Global South, because they already have experience with producing the similar Russian Sputnik vaccine. Although the Biden administration supported the waiver on intellectual property earlier in 2021,[10] action has stalled, and the administration has not asserted any serious pressure on US pharmaceutical companies to take substantive actions to increase global production capacity.

We all want to return to a normal life as soon as possible. For this to happen, it is crucial to produce and deliver more vaccines. Otherwise, it is very likely that the majority of low- and middle-income countries will remain unvaccinated longer than necessary, allowing COVID-19 and its negative impacts to lay siege to those countries with effects that will spill back to the developed world. We, as public health students and scholars, can all do our part by (1) creating more awareness of this critical issue by spreading the word about vaccine inequity in our respective communities and social media platforms, (2) writing to policymakers to implore Congress and the President to do more, and (3) initiating and fostering collaboration between public health students and faculty in high-income and low-income countries. Although the keys to solving the problem are in the hands of high-level policymakers, it is important to remember the power that the public holds—particularly in relation to putting pressure on the government. Public health professionals and researchers can and should be at the forefront of this movement.

More than 5.5 million people globally, with more than 800 000 of those in the United States, have died of COVID-19. How many more people need to die for us to stop making vague commitments and develop a real strategy? The pandemic won't be over for anyone until it is over for everyone. AJPH

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PUBLICATION INFORMATION

Full Citation: Tenso K. Public health students to fight COVID-19 worldwide, not just at home. *Am J Public Health*. 2022;112(4):595–597.

Acceptance Date: December 15, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306681

ACKNOWLEDGMENTS

The author thanks Paul Shafer, PhD, for insightful advice and discussions.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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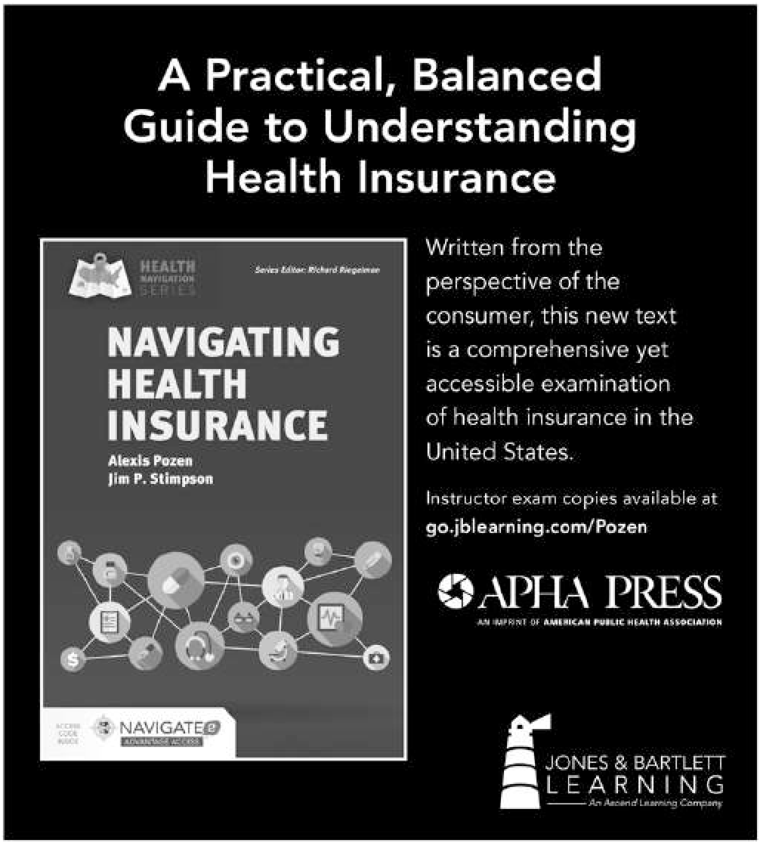

Successful Community Involvement During the COVID-19 Pandemic: A Student Perspective

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See also Reflecting on Health Inequities, pp. 579–607.

AJPH April 2022, Vol 112, No. 4

"We, as people concerned about health improvement in the world, do hereby commit ourselves to advocacy and action to promote the health rights of all human beings." These words, the beginning of the International Declaration of Health Rights, ushered in our journey as public health graduate students matriculating during a raging pandemic. Inundated with cutting-edge scientific research, mis- and disinformation, and both the privilege and responsibility of being future epidemiologists, we have identified community connection as an integral and often underappreciated piece of public health that can meaningfully reduce inequities.

EXISTING INEQUITIES EXACERBATED BY COVID-19

The COVID-19 pandemic framed a pivotal point in the perception of public health; many health inequities previously unknown to the general public were laid bare and in the news daily. From the widespread hysteria we experienced to the hoarding of essentials and the inequitable use of preventive interventions such as masking and stay-at-home orders, the COVID-19 pandemic highlighted the existing social and structural issues that keep health care inaccessible by the most vulnerable. These factors aggravated the disproportionate disease burden experienced by marginalized communities, perhaps most evident in the lack of community-level testing and vaccination centers catering to underserved neighborhoods, affecting frontline and service workers who could not spare the time to be tested or vaccinated.

The pandemic also compounded health and educational inequities because of differential access to remote health[1–3] and learning services. Many families did not have access to the technology, Internet connectivity, or physical spaces required to participate in new and virtual learning environments.[4,5] Our experience as graduate students at least partially mirrored these experiences as we struggled to participate in and learn from our own physical and remote communities at the whim of unreliable Internet connections and under the necessity of caring for friends and family. Our role as epidemiology students has also put us in a unique position to address COVID-19–related misinformation that grows in and close to our social circles, arising because of differential access to and comprehension of health information used to make personal and policy decisions.

SUCCESSFUL COMMUNITY-LEVEL INTERVENTIONS

Despite the seemingly endless inequity-exacerbating consequences of the pandemic, particular local and global examples of community-based public health and policy-level interventions instill hope in us that investments in communities and public health do in fact work to promote health and prevent disease.

At the beginning of the pandemic in the United States, the federal pursuit of decarceration, the implementation of stay-at-home orders, and the imposition of eviction moratoriums highlighted the importance of more than just epidemiology in mitigating a pandemic's disastrous effects.

Community-level partnerships were just as, if not more, important in protecting the public from COVID-19. We have witnessed this firsthand in our own communities. In Arizona, residents were eager to support community relief funds to assist essential in-person workers, an enthusiasm that was later reflected in an extraordinary volume of vaccination volunteer sign ups in early 2021. The ongoing work of community health workers (CHWs) or *promotores* is credited for much of the successful vaccination uptake in low-income and socioeconomically disadvantaged areas in the state. The Navajo Nation, which made a noteworthy return from having one of the country's highest case rates to vaccinating more than 80% of its population in just a few months, has relied strongly on the work of community leaders and CHWs to address the diverse needs of its communities.[6] The self-determination and bidirectional support mechanisms of the Navajo Nation's CHW response network have helped bridge gaps left by chronic underfunding and resulting health inequities present both before and during the pandemic; providing clinical care, connecting individuals to health resources, and promoting health education are just a handful of such examples.[7]

In Alberta, Canada, there was an increase in services provided to community members to address pandemic-related food insecurity. Local charities and religious and community associations rallied volunteers and donations to offer free food delivery and hampers to area residents quarantining or providing essential services, an effort generously supported by the rest of the community. Workplace and mobile vaccination clinics demonstrated tremendous success in communities in Alberta, predominated by the service sector and other essential providers.[8,9] The promulgation of low-barrier and flexible services made these regions some of the highest vaccinated in the province. At least part of the cause of lower vaccine uptake in rural communities was attributed to lack of access,[10] which, when addressed in these regions, helped reduce interregional variation in vaccination uptake rates. The provision of services tailored to the needs of this community, including linguistic and cultural accessibility, helped improve the uptake rates of these necessary public health interventions.

The most notable and successful responses to the COVID-19 pandemic share this common thread of a community-centered focus. Globally, the strict preventive measures taken by residents of and governments in Taiwan, Singapore, Australia, and New Zealand also shone as beacons of hope, persistence, and solidarity against a reality of mass death all too familiar. Even in our now-local Baltimore, public health communications, mobile health clinics, and pop-up vaccination sites—where music blasts and children play—at their core build on existing community ties to promote public health.

PROPOSED SOLUTIONS

In our training as epidemiologists, we have found that this valuable connection within and between individuals and groups is often relegated to the sidelines of our formal education. Our coursework, as it should, emphasizes quantitative analysis, causal inference, and a rigorous understanding of advanced methods to analyze and interpret public health data. Ever inspired by the people who compose the *public* of public health, however, we see the primary means of promoting equity as being through a deepened and genuine connection with our communities.

From an academic standpoint, community connection can be fostered through more required community-based coursework/practica for all public health students, developing a dedicated degree or concentration program for social epidemiology, or pursuing funding for more community-based research at the institution level. Public health students are a diverse and fluid body whose interests range from academia to government to industry and beyond. We must leverage this range to provide students with the training that applies classroom-based skills to real-life scenarios. As students, we see the pursuit of such opportunities as a key means to promote health equity and to become community liaisons working hand in hand with individuals and groups to address new and long-standing health inequities.

The adaptability of public health since and even before the start of the COVID-19 pandemic has been simultaneously taxing and admirable. We challenge the field to adapt once more, to truly and justly prioritize community, whether in data collection, policy development, coursework design, health communication, or intervention. Doing so provides deeper insight into the context behind the numbers many are eager to analyze and report and is supported by the hard-won public health achievements of the current pandemic. For sustained success during the inevitable health crises of the future, it is imperative that we not only maintain but also strengthen these relationships.

To truly "commit ourselves to advocacy and action to promote the health rights of all human beings," we must feel compelled to include them and their essential perspectives in this ever-important work. AJPH

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PUBLICATION INFORMATION

Full Citation: Sharma J, Menon G. Successful community involvement during the COVID-19 pandemic: a student perspective. *Am J Public Health*. 2022;112(4):598–600.

Acceptance Date: December 10, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306671

CONTRIBUTORS

J. Sharma and G. Menon both contributed equally to the conceptualization, drafting, writing, and editing of this work.

ACKNOWLEDGMENTS

We thank our mentors in public health who inspire us to effect change in the field.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Crafting Successful State-Level Public Health Interventions to Vaccinate Homeless Populations During COVID-19

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See also Reflecting on Health Inequities, pp. 579–607.

As a medical student, I (P. K. M.) was interested in approaching the COVID-19 public health crisis from an equity lens to ensure that vulnerable populations had access to vaccinations. I reached out and began working with a physician in Cook County who was a member of an Illinois Department of Public Health (IDPH) working group seeking to vaccinate homeless populations throughout the state. As Cook County and the Chicago Department of Public Health embarked on groundbreaking and comprehensive initiatives to reach their dense metropolitan homeless populations, the IDPH working group focus was on statewide interventions. In the end, we ensured that all shelters in Illinois had access to COVID-19 vaccines and provided education and outreach, support, and events for any shelters that needed help.

There are several lessons I have learned about addressing health care inequities from my work on the IDPH homeless vaccination initiative, as described in the sections to follow.

UNDERSTANDING THE LAY OF THE LAND

Our research on the state landscape and population needs allowed us to develop informed strategies for this large, complex state health initiative. Mapping social vulnerability, COVID-19 burdens, and homeless population densities and shelters highlighted key areas of focus. We researched higher-order regional entities involved in the care of homeless populations, such as continuums of care. We designed and distributed a COVID-19 needs assessment survey to shelters as a means of garnering insight into existing efforts, barriers, and challenges to inform our interventions.

ESTABLISHING AN INTERAGENCY WORKING GROUP

Another important strategy was facilitating collaboration between local (e.g., local health departments, shelters, health systems, community partners), regional (e.g., continuums of care), state (e.g., IDPH, Illinois Department of Children and Family Services, Illinois Emergency Management Agency), and national (Department of Housing and Urban Development) leadership. Coordination optimized efficiency and, importantly, created an opportunity to form lasting relationships for future public health initiatives.

WORKING WITH THE COMMUNITY

Rather than a "top-down" approach, such as sending in national guard units to set up one-off mass vaccination events, working from the ground up with local health departments and community-based organizations proved essential in developing effective community-directed interventions. Trusted community members were a key factor in vaccine uptake.

EDUCATION AND OUTREACH

Vaccine hesitancy was a major barrier to vaccination of homeless populations. The most common request for assistance in our shelter survey was educational materials for clients and staff. We provided flyers, presentations, and Web site materials from the Department of Housing and Urban Development and other organizations that were screened for literacy and content. One of the most effective strategies was having advocates engage with the community at housing projects, soup kitchens, and other local events. Word of mouth was important for community trust. Events were also posted on social media, and town halls were held to answer questions. In addition, we engaged in educational outreach to specific populations such as those with mental illnesses, those in domestic violence shelters, and the youth population. Education and outreach efforts for each of these populations were targeted toward their specific needs.

CARE BEYOND SHOTS

As medical students and trainees, we were passionate about connecting patients with health care resources beyond vaccination. Homeless populations often have multiple chronic conditions but limited access to health care and basic necessities. Partnerships with local health care entities such as Federally Qualified Health Centers and public health departments led to the provision of mobile medical units and informational materials and helped connect people with health care resources. Mobile units conducted blood pressure screening, naloxone training, and testing for HIV and other sexually transmitted diseases. Basic necessities addressing social determinants of health (e.g., food, water) and counseling resources for housing assistance and government programs were also provided on site. This approach provided holistic care and built trust between people and public health officials.

CONCLUSIONS AND REFLECTIONS

Through my experience working with IDPH, I learned about critical strategies for crafting successful public health interventions addressing health care inequities, as follows:

- Develop a diverse team and encourage collaborative brainstorming (such efforts should include students, who have a different perspective and are willing to learn and help; our team included residents, medical students, and public health students and interns).
- Ask community members directly what they need, what they are already doing, and barriers and challenges they are facing.
- Work with community partners and support local efforts, which fosters trust. Do not take a “top-down” approach.
- Bring together leadership from different organizations to facilitate communication and planning and to serve as an investment in future public health initiatives.
- Prioritize education and outreach.
- Provide resources that address the social determinants of health.

Reflecting on this project, I was surprised by the challenges in health care delivery to homeless populations. I noticed that shelters often did not have established relationships with their local health departments or health care systems (e.g., Federally Qualified Health Centers) and that there was a need for collaboration between community-based organizations, national partners, and regional or local partners. Within the context of this project, I learned how important it was to develop relationships between all of these partners to allow for communication of population needs (local level), resources available (local, state, and federal levels), and coordination of delivery (local, state, and federal levels). I gained an appreciation for the importance of a health care system that supports vulnerable populations by facilitating such partnerships; however, I also realized that this infrastructure needs to be further developed to provide sustainable long-term care for these populations. This is something I hope to focus on in my future career.

Working on this project opened my eyes to the value of engaging with community partners. Talking with community organizations highlighted the depth of knowledge they have about their community, what works within the community, and the resources available. For example, I was surprised to see the lack of buy-in from younger populations, who often stated that they were healthy and not worried about COVID-19. We would not have known how to best engage young people without insight from the community, which informed us of how to connect with a local rapper who could promote the importance of vaccination at her concerts and events. Community members also showed us local hang-out spots and encouraged us to include food and music at our events as a means of engaging young people to be part of this initiative.

My work with IDPH allowed me to engage with public policy and implement impactful interventions to provide health care to vulnerable populations. I felt that my insight and perspective on this interdisciplinary team were valued, and I learned from more experienced public health officials, physicians, and members of the community. As a medical student, I was particularly encouraged by the strong mentorship on this project and the leadership of physicians in public health. I will take the lessons I have learned to future public health initiatives that I am a part of. I encourage students who are interested in public health measures to reach out and work with public health officials. AJPH

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PUBLICATION INFORMATION

Full Citation: Mathur PK , Dolgin N. Crafting successful state-level public health interventions to vaccinate homeless populations during COVID-19. *Am J Public Health*. 2022;112(4):601–603.

Acceptance Date: January 3, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306719

CONTRIBUTORS

P. K. Mathur wrote the editorial with assistance from N. Dolgin.

ACKNOWLEDGMENTS

We acknowledge the leadership and support of Catherine Counard and Ngozi Ezike of the Illinois Department of Public Health.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

Beyond #StopAAPIHate: Expanding the Definition of Violence Against Asian Americans

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See also Reflecting on Health Inequities, pp. 579–607.

A woman in Brooklyn, NY, suffered chemical burns after acid was poured on her while she took out the trash.[1] An adolescent boy was sent to the emergency room after being attacked by bullies at a high school in San Fernando Valley, California.[2] Six women were murdered by a gunman at their place of work in Atlanta, GA.[3] These are just three examples out of more than 9000 anti-Asian hate incidences documented since the beginning of the COVID-19 pandemic.[4]

Since 2020, the United States has seen an immense rise in anti-Asian violence. Large US cities have seen major increases in hate incidents against Asian Americans, with occurrences increasing by 150% between 2019 and 2020.[5] In response, a public wave of support has erupted, with protests taking place across the country and the hashtag #StopAAPIHate being shared far and wide across the Internet.

And rightfully so. Hate incidents have major impacts on the health of marginalized communities. They not only can impact physical and mental health at the immediate individual level but also can cause downstream effects on the long-term health of communities. In the context of the COVID-19 pandemic, hate incidents could spread COVID-19 through close contact, further exacerbate mental health issues, and add additional burden to already strained health care systems. As such, stopping and preventing anti-Asian violence is a crucial issue for the public health field to grapple with.

Just like many Asian Americans, I can provide my own share of vivid anecdotes about slurs hurled from moving cars, microaggressions in the workplace, and physical harassment. I'm thankful for the renewed energy to combat violence against the Asian American community. However, as I reflect on my own lived experiences, along with those of my family and others in the diverse Asian diaspora community, I realize that there are many other root issues that get lost in the conversation when we speak solely of hate incidents. I am far more affected by the structural aspect of racism—the hidden and often unspoken systems that perpetuate their own forms of violence inflicted upon Asian Americans and all other oppressed peoples. This is where public health researchers and practitioners should look if they wish to truly address the health and well-being of Asian Americans.

We must contemplate—when we say #StopAAPIHate, what "hate" do we really mean? What hate are we willing to tolerate, and what are we not? The violence perpetrated by structural racism is just as violent as that caused by individual actors. Structural racism enacts a myriad of forms of violence, and each must be acknowledged, addressed, and contextualized in tandem to fully understand the scope of anti-Asian racism highlighted by the COVID-19 pandemic. I urge the public health community—students, researchers, practitioners, policymakers, and community members—to recognize and consider the forms of violence outlined below if they plan to research Asian American health equity or work with Asian American populations.

HISTORICAL VIOLENCE

The historical trauma of Japanese internment camps, the "yellow peril," the Chinese Exclusion Act, and post-9/11 Islamophobic violence will continue to impact the health and well-being of generations to come. Historical policies such as the Page Act, which barred Asian women from immigrating to the United States because of the belief that they were sex workers, link directly to present-day racist and misogynist violence perpetrated against Asian American women.[6]

SYSTEMIC VIOLENCE

This violence operates through social structures and institutions by denying people basic human needs. Systemic violence can include poverty and unemployment—Asian American women have had some the highest joblessness rates during the COVID-19 pandemic.[7] It can include the US health care system, which bars permanent residents from Medicaid and Children's Health Insurance Program eligibility until they've held a green card for five years.[8]

SLOW VIOLENCE

"Slow violence" is a term coined to describe the often unnoticed, slow-moving impacts of environmental pollution and racism.[9] It can include disparities in the built environment, such as highways that have notoriously been purposefully built in low-income areas, crossing through Chinatowns across the country.[10,11] It can include the effects of climate change, such as the fact that nearly all of those who died in New York City's basement flooding because of Hurricane Ida were Asian residents.[12]

STATE VIOLENCE

State violence includes police violence, which targets Asian Americans and Pacific Islanders. In recent years, Tommy Le, Angelo Quinto, and Christian Hall have been murdered by police.[13] There have been thousands of refugees and immigrants, particularly from Southeast Asia, who have been deported by US Immigration and Customs Enforcement, no matter the political party in power.[14] In particular, the recognition of state violence means moving away from carceral or police-based responses to hate and violence. It means embracing community-based solutions to preventing and addressing hate that follow the tenets of abolition and community care.

COLONIAL VIOLENCE

Inextricably linked to state violence, war and imperialism have irrefutably shaped Asia and the US perception of Asian Americans. Much of Asian American hate is rooted in Sinophobia, Orientalism, and xenophobia. In addition, the state of Hawai'i and islands in the Pacific such as Guam and the Marshall Islands were ruthlessly colonized and used for acts of war by the United States.

INTERNALIZED VIOLENCE

Internalized violence is the pain we inflict in our own community and upon ourselves. Internalized racism, colorism, anti-Blackness, sexism, homophobia, transphobia, classism, and xenophobia (and the intersection of all of these systems) must be acknowledged and confronted within the Asian American community. It is also crucial to recognize how these forces reflect how we might harm other marginalized groups around us.

As we consider the above forms of violence, we must adopt an intersectional framework to understand how other systems of oppression, such as classism, cisheterosexism, and ableism, compound and shape experiences of anti-Asian hate.

Beyond recognizing these oppressive systems, we must also examine our own academic institutions and how they may facilitate or hinder the public health field's response to anti-Asian racism. As a public health PhD student, I've received support at the program and school levels in speaking out against this recent surge of violence. However, I've also seen that research into the upstream structural issues faced by the Asian American community receives far less attention and investment. It often feels like an uphill battle to have these issues addressed by the public health field. This is a result of a variety of barriers—namely, deeply entrenched institutional racism in academia and nonprofit work, as well as the lack of funding (for research, students, and organizations), faculty mentors, course offerings, publishing opportunities, and community spaces for Asian American students to study Asian American health equity.

Ultimately, as Thom Davies states, "What society includes under the label 'violence' is a mirror to the value system of that society."[9] We must move beyond the most acute or newsworthy acts of hate to include the complex and varied forces that are normalized and entrenched in society. Expanding our conceptualization of violence and deepening our understanding of the racism and oppression faced by the Asian American community will allow us to truly stop Asian American and Pacific Islander hate. AJPH

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PUBLICATION INFORMATION

Full Citation: Fan CA. Beyond #StopAAPIHate: expanding the definition of violence against Asian Americans. *Am J Public Health*. 2022;112(4):604–606.

Acceptance Date: January 16, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306740

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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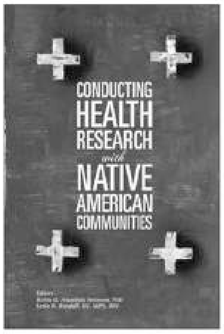

Coming Together: A Public Health Reflection on Global Health Inequities

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See also Reflecting on Health Inequities, pp. 579–607.

The day the world started to shut down, March 15, 2020, I remember being stuck at home engrossed by the reporting of a new disease, COVID-19. The entire world went through an unprecedented lockdown. Although it was an uncertain time, one statement that brought me comfort was "we're all in this together."

As the pandemic raged on, I questioned this sentiment. At the beginning, it seemed as if this were true: we stayed home, socially distanced, and wore masks. My perception of unity faded as I watched divisiveness emerge over simple prevention methods. Some pretended the pandemic was not happening, acting in their own best interest, and some even went as far as to declare that the pandemic was over.

I began to see who the COVID-19 statistics were disproportionately affecting, and they were all people who looked like me. How can we say "we're all in this together" when we abandoned our most vulnerable populations?

My time during the pandemic was spent between two countries: the United States and Nigeria.

In both countries, I witnessed how the COVID-19 pandemic exposed drastic social and health inequities. During my time in the United States, people of color faced higher mortality and morbidity from COVID-19 than their White counterparts. The difference in mortality stemmed from a multitude of factors. For example, people of color had increased rates of comorbidities such as heart disease, obesity, and asthma.[1] In addition to increased comorbidities, Black workers were overrepresented in frontline jobs.[2] A study assessing racial and ethnic differences in COVID-19–related job exposures in the United States showed that Black and Latino frontline workers were overrepresented in lower-income occupations as well, increasing their exposure to COVID-19.[3]

Furthermore, there is an underlying distrust between people of color and medical institutions stemming from historical injustices. This has given rise to vaccine hesitancy among minority communities. In November 2020, "the National Association for the Advancement of Colored People (NAACP) and partners reported that only 14% of Black survey respondents trusted the vaccines' safety and only 18% said they would definitely get vaccinated."[4(p.e12)] Engaging minority communities in decision-making can help improve these outcomes.

In contrast, Nigeria was severely impacted by the indirect effects of the COVID-19 pandemic. As I spent my summer working with the local cancer center, I saw firsthand how the pandemic exacerbated preexisting health challenges for Nigerians. This inadvertently resulted in worse patient outcomes, including reduced access to care caused by lockdowns and social distancing restrictions. What may have seemed to be an easy solution revealed itself to be a web of social problems.

Furthermore, I was troubled to see a great proportion of cancer patients dying weekly at the clinic as a result of COVID-19–related restrictions that prevented free community cancer screening efforts. These community outreach programs are essential in detecting early-stage cancer because the average Nigerian cannot afford annual screenings. In addition, lockdown restrictions between states and nightly curfews prevented people from traveling to receive cancer care. This led to a greater proportion of patients presenting with late-stage cancer, thus worsening patient outcomes.

To understand why Nigeria is impacted by the indirect effects of COVID-19, one must recognize the existing social, economic, and political challenges Nigerians face regarding the health care system. To understand why COVID-19 is disproportionately affecting people of color in the United States, one must recognize the sociodynamic elements that contributed to this issue. These structural and economic impacts are social determinants (defined as economic and social conditions that influence individual and group differences in health outcomes[5]). In each country, I witnessed how these economic and social inequities have intersected to influence health outcomes. Since March 15, 2020, close to 1 million people have died of COVID-19 across Nigeria and the United States.[6] Although it is easy to become desensitized to this figure, it is important to remember that there is a story of human life behind every number.

Lessons from my experiences in both the United States and Nigeria demonstrated that although identifying problems may be easy, solving them is not. The pandemic exposed that we are not in this together; however, we can be if we address social determinants and work alongside communities. To move forward from this pandemic, public health officials need to focus on healing communities and correcting inequities. To be a public health leader is to be an activist. Public health officials should not only show people that inequities exist but also implement corrective actions. This will ensure that we are all truly in this together. AJPH

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PUBLICATION INFORMATION

Full Citation: Uzoukwu NO. Coming together: a public health reflection on global health inequities. *Am J Public Health*. 2022;112(4):607–608.

Acceptance Date: January 18, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306741

ACKNOWLEDGMENTS

This work was supported by the *AJPH* student cohort. A special thank you to Gabriella Ogude for assisting with the editing of the editorial.

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

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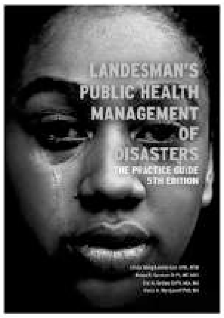

What Is Public Health? An Interview With Former Governor John Kasich

Alfredo Morabia, MD, PhD

ABOUT THE AUTHOR

Alfredo Morabia is the Editor in Chief of AJPH.

See also Benjamin, p. 613.

This is a transcript of my interview, conducted on January 11, 2022, with former Ohio governor John Kasich. I have added the subheadings.

Alfredo Morabia (AM): Thank you very much for accepting to be interviewed by the *American Journal of Public Health*. I'm Alfredo Morabia, the editor in chief of the journal. I was really intrigued the other day when I heard you in a webinar talking about public health and how the public understood what public health was. So, I wanted to ask you what, for you, does public health mean?

John Kasich (JK): Well, it's really pretty simple. It's doing the things in the community that keep the community healthy, and it can range across many different areas, which is what a lot of people don't understand. It's vaccinations, making sure that our restaurants are good and clean; it has to do with keeping an eye out that everything that affects the health of the community is being looked after, hopefully nothing left out. And so, it's a broad range and something important that at times we take for granted.

IT'S ONLY WHEN IT DOESN'T WORK THAT WE PAY ATTENTION

AM: Why do you think that a lot of people don't understand what public health is?

JK: I'm not sure anybody's ever been educated about it. Nobody articulates what it really means and why it's important. So, it's a term without a definition. If you don't tell people what something is, they gloss over it. It's not their fault. It's really the fault of people who are connected to public health. I'm not blaming the people who run public health, but the community at large does not talk much about it. When you go to a place like Flint [Michigan] and see the problems with the water—all of a sudden, people really understand public health. But as long as public health is working, we don't pay much attention. It's only when it doesn't work that we pay attention. The problem is that it is not always funded to the amount of money that is needed for public health officials to carry out their mandate; we have to make sure that we can always have enough resources to enable the quiet heroes in our communities to do their jobs.

AM: Many people seem to think that public health is actually health care for the poor; and they don't make the difference between public health, as you defined it, and medicine. How would you suggest we should explain that medicine is one thing and public health is something different?

JK: It is really in the areas where the public intersects with the public health community. We have to be able to explain what we're about, and it's most important that that comes from the bottom up. If you have street festivals, for example, why aren't public health people manning booths with volunteers who can talk to the public, maybe offer them some public health services to show people exactly what it is and why it matters. Because if we can show how important these officials are, then people will like and appreciate what public health officials do. It's bottom up and it's also for public health officials and their advocates to begin to get farther up into legislatures and of course into Washington [DC] and into Congress. It is a massive undertaking because nobody's done this before, but it would be a fun challenge to explain to people how your family and you are kept safe by public officials who get up every day and figure out how we can have safe communities.

WE SHOULD, ONCE A YEAR, HAVE A PUBLIC HEALTH DAY

AM: Do you think the name, "public health," is a problem in itself? Should it be named differently? Because the opposite of public health is private health. Do you think we should use a different term or keep it the same because of its history?

JK: I don't know. The problem is not so much in the name; it's in how we define it. We have to do a better job of defining what it is for people. In my hometown, usually on Friday afternoon, many families go into the city center, and this ought to be a place where people get told about what public health people do in an interesting way. Perhaps we should, once a year, have a Public Health Day where people can hear about it. It's just been very quiet. It really reflects the humility of people who are in public health, because they're not out there bragging about what they do; they just do their job in a quiet and effective way. But maybe we need to be louder.

PUBLIC HEALTH IS PREVENTIVE IN NATURE

AM: Traditionally, in this country, public health has been the prerogative of the states and not so much of the federal administration. Do you think this is something that should change, that we should have a stronger federal input?

JK: No, I don't think that things would get better if we just turned it over to the federal government. It is fundamentally a local issue. The federal government provides funding priorities, resources to combine with resources at the state and local levels. Accountability is very, very important and is something I feel strongly about. Here is the problem: When you just use the term "public health," people's eyes glaze over, even decision-makers, because there's always something else that's more urgent that needs to be funded. But when there is an acute problem in the community, then all of a sudden, everybody says, "Oh my goodness, we need to do something about it." Think about public health as something that is, in some sense, preventive in nature. We have to explain to a lot of the decision-makers that, when we're doing our budgets, we just have to make sure public health is in. When you buy insurance, you don't brag about it. But when you have a problem, the first thing you do is to take a look at your insurance provisions. If you didn't properly insure something, it's a disaster, but if you did, you get a sense of having done the job the right way. The same is true for public health. It has to become a priority. Just as you don't stop paying your insurance, we should keep the funding for something which fundamentally is an insurance called public health. If that makes sense to you.

PUBLIC HEALTH HAS TO BECOME A PRIORITY

AM: Certainly, that's a great analogy, actually. It's very convincing, and this leads me to think that currently instead of prevention, we use medical care and emergency centers as the first response when we have problems, and billions of dollars are wasted on medical care without any benefit for the patient. Do you think that some of that money should be reinvested in prevention and public health?

JK: Well, I don't know. If you want to talk about the problems of the United States health care system, we could be here for a century and probably talk about it and never quite figure it all out. Public health needs to be considered as a priority when city councils are doing their budgets, legislatures are doing their budgets, the federal government, Congress, do the budget along with the President. They just need to make sure that this area is adequately funded. Are there areas in the government where there's waste? Of course. Having been budget chairman and governor of a state, I know there are always areas where you can trim, combine, improve. The problem is there aren't many people running around saying that we have to take care of public health. That's the problem. It's a quiet area. We just need to explain it better and more emphatically. We need to have our heroes; we need to have our champions, particularly at the local level, and I'm hoping that as we head through 2022 that we'll have sort of an awakening of what it is that public health is all about. But it starts with the people who deliver it and their advocates, their volunteers, because we don't want to have a Flint-type situation in anybody's community.

AM: But, how can we do this? You say it's a quiet sector, but then you don't think that we should move funds from the medical sector toward prevention.

JK: I don't know what that means. Moving funds to Medicaid and Medicare? I don't think so. It's a separate priority and a separate line item, and there's money inside of all budgets that can be moved. In other words, can we spend a little less on X? Then we can spend more on Y. That's how budgeting works. What are the priorities? What really matters? Does every program work efficiently? We don't need to have a war inside of health care to have this as a higher priority. In fact, we need partners in the community in both the public and private sectors to talk about the fact that this is a terrific program that has to do with providing insurance for all of our communities to have safer, cleaner air, safer water, all of those kinds of things.

PITTSBURGH WAS CLEANED UP

AM: What would you say are the major achievements that public health has done over the last one or two hundred years? What would you use as an example that you think would be convincing?

JK: Clean water, cleaner air. I grew up as a kid in Pittsburgh [Pennsylvania], where the steel mills were belching really dangerous material. It is a long story, but the community at the urgings from the public health officials decided to clean this up. They didn't go to Washington to get it done. They just said we're going to have a higher standard in our community, and over a relatively short period of time, Pittsburgh was cleaned up. If you go and visit Pittsburgh today, it's a remarkable city because business leaders, community leaders, public health officials all worked together to make sure that the public is well served. For our food supply, when there is a story of salmonella or whatever, public health officials are on top of it quickly. Public health means safer food, cleaner restaurants. I'm not a historian when it comes to public health, but as a regular old citizen, I know that it has contributed terrifically. Our schools are in better shape and safer. It is an effort to promote safety for our citizens.

AM: Absolutely. And what would you say would be the main goal for public health in the coming years? Which objectives could rally people around public health?

JK: After the pandemic, if we recover from the current politicization, people are going to ask whether there were things we could have done better or sooner. Like in Flint. Are there things they could have detected earlier? We need to be able to communicate in creative ways about the historic gains, as you mentioned earlier, of what has been done and about the goals that are to be set locally to improve things. This does not have to be boring. Creative people can come in and capture the imagination of people as to how we can continue to make progress, that we don't have outbreaks, that we do have cleaner water. People are aware of the pandemic, but they are also increasingly conscious about the environment. We want a cleaner environment, we want cleaner air, we want cleaner water. That's good for everybody. The goal has to be to continue to up our game and provide excellence.

EQUALIZATION HAS TO BE A PRIORITY

AM: Public health needs to be all-inclusive to be effective, and it cannot divide the population and act for some groups and not for others. Do you think that the role of public health in reducing inequities is important?

JK: Health equity is a growing concern. In business today we see ESG: Environmental, Social, and Governance. More businesses are aware that we have to deal with the problem of health equity and of food deserts. We have to be concerned about groups of our fellow citizens who are not getting the same kind of treatment, the same kind of good conditions that we have in areas where people seem to have more power. There has to be a concerted effort to make sure there is some equalization. It has to be a priority that we don't have areas where people are not being treated as important citizens, as important parts of our communities.

AM: But in most other countries, this is done by a central ministry of health; there is some federal or central governmental authority to lead this change. What do you think?

JK: Well, I don't want to live in any other country. Some of them are just a fraction of the size of the United States, but the idea to turn this over to the federal government is not acceptable to me. I don't like that idea because it is a one size fits all, often, when it comes to the federal government. Priorities should be established by leaders at the state and local levels working together. I don't buy the idea that somebody is going to swoop in from Washington and care about me more than the people that I see at the grocery store. The federal government has a fundamental role in providing resources and some basic goals. But I don't want to turn public health over to Washington because in 10 years we will still be talking about how a one size fits all doesn't work. It's a philosophical difference, but being a former legislator, a former governor, a former congressman, giving more power to Washington doesn't make sense to me.

AM: What about the public health dashboard, tracking infections, food insecurity, etc.? Aren't these things part of the role of the federal government?

JK: Yes, the federal government's in a position to set some standards and to take a look at places where there are egregious violations or goals that are not being met. That's appropriate.

"HOW ARE WE DOING ON PUBLIC HEALTH?"

AM: Governor Kasich, is there anything else you'd like to add? I don't want to take too much of your time.

JK: What's important is that we're all in this together. It's really about finding people who are or can become advocates for public health and to turn them into important folks in our various levels of government: a congressman who goes to work and says we need to make sure that public health's taken care of in a real way, a member of the legislature who says how important it is, people at the city council level who ask, “How are we doing on public health?” We need to reward those people for their interest and efforts. Right now, if I were to try and go to recruit members of the legislature and get them interested in public health, it’d be real work. However, if all of a sudden, as great advocates of public health, they made a name for themselves, began to make a difference in the lives of people and were recognized for it, you’d have a winner, and that’s what we should focus on. AJPH

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PUBLICATION INFORMATION

Full Citation: Morabia A. What is public health? An interview with former governor John Kasich. *Am J Public Health*. 2022;112(4):609–612.

Acceptance Date: January 18, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306751

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

What Is Public Health? Telling Our Own Story

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Georges C. Benjamin is executive director of the American Public Health Association.

See also Morabia, p. 609.

There is an old African proverb that states, "Until the story of the hunt is told by the lion, the tale of hunt will always glorify the hunter." In this issue of *AJPH*, which is being issued in alignment with National Public Health Week, Former Governor John Kasich (R-OH) makes a compelling case for the need for a more lucid and effective effort to enhance the public's understanding of what public health is and how we all benefit. He expresses these views in the context of how we build support for rebuilding the nation's public health system after the greatest infectious threat to the public's health in more than 100 years—SARS-CoV-2, the virus that causes COVID-19. The COVID-19 pandemic has exposed not only the weaknesses in the organization, infrastructure, and core resources of our public health system but, more importantly, the loss of basic trust and public support for proven public health measures and the practitioners that use them. It has become clear during this pandemic that the general public, including many policymakers, are unclear what public health is, who does it, what is the legal basis for it and the role of its legal authority, how it is resourced, and, most importantly, what is its value.

The governor correctly points out that far too often, public health springs into action and mitigates the threat, but fails to take credit for the success. It is not a kitchen table issue and until recently had not generated controversies for having failed on health policy issues. This is because we remain invisible when our work is done successfully. When nothing bad happens, people accept the benefit but are usually unaware of the effort it took to protect them. They appreciate and value the positive outcome but don't credit the public health system for its benefit.

Governor Kasich makes a clear case that we have to communicate more clearly and directly, communicating our value in common terms that people value and understand. Such values include things such as, everyone wants the air to be safe to breath, their water safe to drink, and their food safe to eat. They absolutely want to live in safe environments where they live, work, play, and pray. People want to be as free of chronic diseases and injury, as well as infectious diseases, as possible. Although the general public values these outcomes, they don't often know who is responsible for ensuring they occur. In fact, it is quite common for people to take these protections for granted, and although they all want someone to protect them, they don't know that when they are protected it is because of public health's efforts.

The heroic work by the public health community during the pandemic resulted in the saving of an enormous number of lives. By using a science-based approach, the public health community pushed for policies and practices that put in place a range of nonpharmacological interventions like masks, and physical and societal closures to reduce the individual and societal impact of this disease. Using vaccine research conducted over the last 20 years and carefully constructed clinical studies, public health researchers found vaccines against SARS-CoV-2 to be safe and effective. To date, more than 210 million people have been fully vaccinated and are now much less likely to get severe disease or die from COVID-19. Millions of lives have been saved through these efforts, and yet somehow, we are struggling to tell our story. Disinformation and misinformation driven by political or corrupt motives have both undermined the effectiveness of sound public health advice and put at risk millions of people who have come to ignore the facts and ignore the truth. In addition, the motives of the health and public health community have been twisted in ways that have spurred hatred, and promoted anger and, in some situations, violence against the very professionals whose only motive is to keep people safe and healthy.

This year's theme for National Public Health Week is "Public Health Is Where You Are." During the year's celebration, we have the opportunity to tell our own story. We can use the time to tell this story loudly, clearly, and in terms people will understand. We can remind people that we share their core values of safe water, food, and air. We can assure them that we are here to support both their individual and their collective health. We need to let them know we are superheroes and that the science we study and use, the policies we put in place, and the legal authorities we utilize are

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our “super-powers” that we use only for good. That we believe in individual freedom, as they do, but also in the collective good. We have to be clearer that wearing a mask and getting vaccinated serve both individual and collective protection. That the safety they feel each and every day 24 hours a day when nothing happens is because we are at work 24/7 making sure health threats stay away. But when something bad happens we have their back. When we say “Public Health Is Where You Are,” we mean it! AJPH

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PUBLICATION INFORMATION

Full Citation: Benjamin GC. What is public health? Telling our own story. *Am J Public Health*. 2022; 112(4):613–614.

Acceptance Date: January 25, 2022.

DOI: https://doi.org/10.2105/AJPH.2022.306771

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

Air Pollution in American Indian Versus Non–American Indian Communities, 2000–2018

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Objectives. To compare fine particulate matter ($PM_{2.5}$) concentrations in American Indian (AI)-populated with those in non–AI-populated counties over time (2000–2018) in the contiguous United States.

Methods. We used a multicriteria approach to classify counties as AI- or non–AI-populated. We ran linear mixed effects models to estimate the difference in countywide annual $PM_{2.5}$ concentrations from well-validated prediction models and monitoring sites (modeled and measured $PM_{2.5}$, respectively) in AI- versus non–AI-populated counties.

Results. On average, adjusted modeled $PM_{2.5}$ concentrations in AI-populated counties were 0.38 micrograms per cubic meter (95% confidence interval [CI] = 0.23, 0.54) lower than in non–AI-populated counties. However, this difference was not constant over time: in 2000, modeled concentrations in AI-populated counties were 1.46 micrograms per cubic meter (95% CI = 1.25, 1.68) lower, and by 2018, they were 0.66 micrograms per cubic meter (95% CI = 0.45, 0.87) higher. Over the study period, adjusted modeled $PM_{2.5}$ mean concentrations decreased by 2.13 micrograms per cubic meter in AI-populated counties versus 4.26 micrograms per cubic meter in non–AI-populated counties. Results were similar for measured $PM_{2.5}$.

Conclusions. This study highlights disparities in $PM_{2.5}$ trends between AI- and non–AI-populated counties over time, underscoring the need to strengthen air pollution regulations and prevention implementation in tribal territories and areas where AI populations live. (*Am J Public Health*. 2022;112(4): 615–623. https://doi.org/10.2105/AJPH.2021.306650)

Short- and long-term exposure to particulate matter of aerodynamic diameter 2.5 micrometers or less ($PM_{2.5}$) increases the risk of cardiovascular and respiratory disease, among other health outcomes.[1–3] In the United States, socioeconomically disadvantaged communities are often exposed to higher $PM_{2.5}$ exposure levels and bear a disproportionate burden of disease, even at levels well below air quality standards set by the US Environmental Protection Agency (EPA).[4,5]

American Indian (AI) and Alaska Native communities may be particularly vulnerable to the health effects of air pollution.[6,7] These communities already face a large disease burden attributable to environmental pollution owing, for instance, to extensive mining and water contamination on reservations.[8,9] The decline in nitrogen dioxide, another criteria air pollutant, was larger in both absolute and relative terms in White versus AI populations between 2000 and 2010.[10] Little is known, however, about the extent of particulate air pollution exposure and its potential health effects among rural Native American communities, as most US studies of air pollution have been conducted in urban settings. In a cohort of all Medicare beneficiaries in the continental United States, increasing annual $PM_{2.5}$ exposure was associated with increases in all-cause mortality from 2000 through 2012, and this effect was higher among participants identified as Native Americans than the overall Medicare population.[11] These findings suggest that Native Americans may be more susceptible to adverse health effects from $PM_{2.5}$ exposure than the overall Medicare population but are limited by wide confidence intervals (CIs). Conclusions may not be generalizable to Native Americans not on Medicare, as Medicare coverage for AI and Alaska Natives is incomplete, especially on reservations and in rural communities.[11]

Monitoring data sparsity may contribute to gaps in air pollution regulation. As federal air quality monitors tend to be placed in areas of higher population density,[12] insight into $PM_{2.5}$ exposure burdens in AI and Alaskan Native communities is limited, in turn contributing to the paucity of air pollution epidemiological studies that include this population. In the contiguous United States, AI people live predominantly in the West and often reside in sparsely populated areas, including reservations, small towns, and rural areas. Limited data on ambient air pollution levels are currently available in these communities. The use of well-validated models with comprehensive spatial coverage may allow the assessment of possible disparities in $PM_{2.5}$ concentrations in areas lacking monitoring data.

We aimed to compare ambient $PM_{2.5}$ average concentrations and trends in AI-populated versus non–AI-populated counties in the contiguous United States from 2000 to 2018. To do so, we compared annual $PM_{2.5}$ levels predicted by a satellite-based chemical transport model, because of sparse data coverage via the monitoring networks. We also compared monitored $PM_{2.5}$ concentrations in counties with available monitoring data.

METHODS

We conducted our analysis at the county level, which serves as the most relevant unit of analysis to inform regulatory action. Public policies can be enacted at the county level, but implementation is not feasible at finer resolutions, such as the census tract or zip code level. There is currently no formal definition for AI counties. Thus, we used various sources to inform 3 classification schemes to characterize counties and county equivalents (henceforth referred to collectively as "counties") with a substantial AI population. We classified counties as "AI-populated" if they fit at least 1 of the following criteria: (1) had greater than 5% population that self-identified as AI or Alaska Native alone in the 2010 Census ("census" classification)[13]; (2) contained at least 20% of their areas in a federally recognized tribal entity, defined as federally recognized reservations, off-reservation trust lands, and Census Oklahoma Tribal Statistical Areas ("Tribal entity" classification)[14]; or (3) were previously classified as a rural AI county in a cluster analysis of US counties using *k*-means clustering ("rural cluster" classification).[15]

We included this binary AI county type classification (yes/no) as the primary predictor variable of interest in all models. Details on the number of AI- and non–AI-populated counties by classification are provided in Table A (available as a supplement to the online version of this article at http://www.ajph.org). We restricted our main analysis to the 48 contiguous states and the District of Columbia, totaling 3108 study counties.

Air Pollution Data

We estimated the $PM_{2.5}$ concentrations used in this analysis at the county level from both a satellite-based model and ground-monitoring data. Using $PM_{2.5}$ monitoring data allows researchers to capture ground truth concentrations where data are available, whereas modeled $PM_{2.5}$ provides more comprehensive spatial coverage across the entirety of the contiguous United States. We estimated annual county-level $PM_{2.5}$ from a satellite-based surface $PM_{2.5}$ model (henceforth referred to as "modeled $PM_{2.5}$"), which provided comprehensive nationwide annual mean concentrations at approximately a 1 kilometer × 1 kilometer grid resolution.[16] The model interprets satellite retrievals of aerosol optical depth using its geophysical relationship to $PM_{2.5}$, as simulated by the GEOS-Chem chemical transport model. The resulting geophysical $PM_{2.5}$ surface is then calibrated using ground-based monitors via a geographically weighted regression.[16,17] We estimated county-level modeled $PM_{2.5}$ concentrations for every study year by averaging the $PM_{2.5}$ concentrations in all grids with their centers contained in each US county.

To gain insights into $PM_{2.5}$ concentrations in counties with adequate monitoring, we obtained annual $PM_{2.5}$ concentrations measured by all available monitors (henceforth referred to as "measured $PM_{2.5}$"); to do so, we used a federal reference method or a federal equivalent method from the EPA Air Quality System Database and Interagency Monitoring of Protected Visual Environments Rural Monitoring program between 2000 and 2018. These monitors collected data on a daily, 3-day, or 6-day schedule. We excluded $PM_{2.5}$ monitors from analyses that had valid measurements for less than 75% of annually scheduled sampling days in our eligibility criteria when estimating county-level average measured $PM_{2.5}$. We assessed measured $PM_{2.5}$ in counties with more than 1 monitor by averaging the concentrations of all available monitors in the county boundaries for each study year.

Covariates

We obtained population density and median household income at the county level from the 2010 decennial US Census. We used these variables to estimate differences in air pollution estimates between AI- and non–AI-populated counties that were independent of how populated the counties were and their socioeconomic status. Given the highly skewed distribution of these variables (population density and income) across US counties, we used deciles of their distribution as categorical variables in the regression models.

Statistical Analysis

We used linear mixed effects regression to compare mean annual $PM_{2.5}$ concentrations in AI- versus non–AI-populated counties. Our main analysis included 2 regression models, with either modeled or measured $PM_{2.5}$ as the response variable. Both models included random intercepts for each state to account for potential within-state correlation of monitoring sites and nested random intercepts for counties in states to account for potential correlation of observations over time in counties.

We adjusted for covariates in a staggered manner. First, we included only year as a categorical predictor variable to account for possible nonlinear time trends in $PM_{2.5}$ concentrations, together with random intercepts by county and state in the model (model 1). We further adjusted for population density in model 2 and additionally for median household income in model 3. Finally, we additionally included interaction terms between county type and each year indicator in model 4. To test for the presence of significant interaction between county type and year, indicating changes in annual $PM_{2.5}$ trends over time by county type, we compared the model fit of models 3 and 4 and examined whether the interaction term for the factor year ($df = 18$) was statistically significant at a significance level of .05.

We conducted all statistical analyses using the R Statistical Software, version 3.6.3.[18] All data and code to run analyses are publicly available and can be accessed here: https://github.com/maggie-mengyuan-li/native-air-pollution.git.

Sensitivity Analyses

To evaluate the robustness of our results, we conducted several sensitivity analyses. Because other factors beyond income might be needed to account for differences in socioeconomic factors across counties more comprehensively, we adjusted for the Area Deprivation Index (ADI)—a marker of socioeconomic differences widely used in health care research—instead of household income, in models 3 and 4.[19,20] ADI uses 17 indicators of social and material conditions reflecting educational attainment, income and poverty, household composition, and vehicle and utilities access; higher values indicate greater neighborhood socioeconomic disadvantage.[21] We estimated mean ADI per county by aggregating from block group ADI national percentile rankings. We excluded counties in the Northeastern United States in model 3, specifically EPA regions[22] 1, 2, and 3, as this region included only 2 AI-populated counties in the main analysis (Table B, a [available as a supplement to the online version of this article at http://www.ajph.org]).

Given the lack of an official definition denoting AI-populated areas, we ran 3 separate versions of model 3 using each of the 3 criteria to classify AI-populated counties, 1 separate version for AI-populated counties defined only by the intersection of all 3 classification schemes, and 1 separate version denoting AI-populated counties that included all study counties in our main analysis and additional counties with any overlap with a federally recognized tribal entity. We ran a restricted version of model 4 that excluded adjustment for median household income and population density. We additionally adjusted for US climate region as defined by the National Oceanic and Atmospheric Administration in models 3 and 4 to account for potential confounding by geographic area. We restricted analyses using models 3 and 4 to rural counties, defined as micropolitan and noncore counties by the National Center for Health Statistics, as 82% of AI-populated counties were classified like this in the main analysis (Table A, a).[23] Finally, given the spatial autocorrelation of $PM_{2.5}$ across counties, we conducted sensitivity analyses including a spatial lag term in models 3 and 4 using a queen contiguity-based spatial weights matrix.

RESULTS

Using the classification criteria previously defined, we defined 6.4% (n = 199) of the 3108 total study counties as AI populated and the remaining 93.6% as non–AI populated (Table 1). Counties classified as AI populated were primarily located in the Midwestern, Southwestern, and Northwestern United States, with the remaining 14 in the

TABLE 1— Descriptive Statistics for American Indian (AI)- and Non–AI-Populated Counties Overall and Among Those With Monitors: United States, 2000–2018

Characteristic	All Counties		Counties With Monitors[a]	
	AI	Non-AI	AI	Non-AI
All counties				
No. of counties	199	2909	71	766
% AI population, mean (SD)	18.2 (19.9)	0.6 (0.6)	16.0 (15.1)	0.7 (0.8)
Modeled $PM_{2.5}$ concentration, μg/m^3, mean (SD)	6.3 (2.1)	8.4 (2.2)	6.0 (2.2)	8.6 (2.5)
Measured $PM_{2.5}$ concentration,[b] μg/m^3, mean (SD)	. . .	. . .	7.0 (2.7)	9.6 (2.8)
Population density, per mi^2, mean (SD)	41 (116)	276 (1790)	69 (180)	787 (3400)
Median annual household income,×$1000, mean (SD)	40.4 (7.6)	44.4 (11.6)	42.0 (7.2)	49.1 (12.6)
ADI,[d] 25th, 75th percentiles	60.5, 83.3	56.7, 79.4	50.9, 77.3	44.5, 70.9
Rural counties[c]				
No. of counties	163	1785	51	245
% AI population, mean (SD)	19.7 (20.7)	0.6 (0.8)	18.5 (16.3)	0.9 (1.0)
Modeled $PM_{2.5}$ concentration, μg/m^3, mean (SD)	6.2 (2.0)	8.0 (2.3)	5.8 (2.1)	7.2 (2.5)
Measured $PM_{2.5}$ concentration[b], μg/m^3, mean (SD)	. . .	. . .	6.5 (2.9)	8.3 (3.1)
Population density, per mi^2, mean (SD)	19 (24)	45 (99)	25 (28)	51 (51)
Median annual household income,× $1000, mean (SD)	39.1 (7.3)	40.0 (8.1)	40.3 (7.1)	42.5 (9.6)
ADI, 25th, 75th percentiles[d]	64.1, 84.2	65.7, 82.5	49.5, 78.1	52.7, 78.0

Note. ADI = Area Deprivation Index; $PM_{2.5}$ = fine particulate matter.

[a] Counties with at least 1 year with monitored $PM_{2.5}$ data over the study period.

[b] Measured $PM_{2.5}$ concentrations were only assessed in counties with monitors. Analyses involving measured $PM_{2.5}$ included only counties with monitors during the study period, whereas modeled $PM_{2.5}$ analyses included all counties.

[c] Micropolitan and noncore counties defined by the Centers for Disease Control and Prevention National Center for Health Statistics (i.e., nonmetropolitan counties).

[d] Higher values indicate higher levels of neighborhood disadvantage.

Southeast and Northeast (Figure 1). Of the 199 counties classified as AI populated, 11.5% fulfilled the federally recognized tribal entity criteria exclusively, 33.2% fulfilled the census criteria exclusively, 14.1% fulfilled all 3 classification criteria, 1.5% fulfilled both the rural cluster and census criteria, and 39.7% fulfilled the census and federally recognized tribal entity criteria (Figure 1).

Most counties included in our analysis were rural (Table 1). Of the 199 US counties classified as AI populated, 163 (82%) were rural, and of the 2909 US counties classified as non–AI populated 1785 (61%) were rural. On average, in counties classified as AI populated, 18.2% of the population was AI versus 0.6% in non–AI-populated counties.

The mean modeled $PM_{2.5}$ concentrations for 2000 through 2018 were 6.3 micrograms per cubic meter and 8.4 micrograms per cubic meter for AI-populated counties and non–AI-populated counties, respectively, whereas the corresponding measured $PM_{2.5}$ concentrations were 7.0 micrograms per cubic meter and 9.6 micrograms per cubic meter, respectively (Table 1). Distributions for population density, household income, and ADI by AI-populated county type and rurality are provided in Table 1.

Using linear mixed effects regression models, we observed significantly lower modeled and measured mean $PM_{2.5}$ concentrations in AI- versus non–AI-populated counties on average across the study period (Table 2). In our fully adjusted model with main effects only (model 3), modeled $PM_{2.5}$ was on average 0.38 (95% CI = 0.23, 0.54) micrograms per cubic meter lower, and measured $PM_{2.5}$ was on average 0.79 (95% CI = 0.33, 1.26) micrograms per cubic meter lower in AI- than in non–AI-populated counties (Table 2).

Overall, we observed that modeled and measured mean $PM_{2.5}$ concentrations decreased in all states over time, with high variability in the rate of decline across states (Figure A, light-colored thin lines [available as a supplement to the online version of this article at http://www.ajph.org]). Over the study period, $PM_{2.5}$ concentrations decreased more in non–AI-populated than in AI-populated counties across all states for both

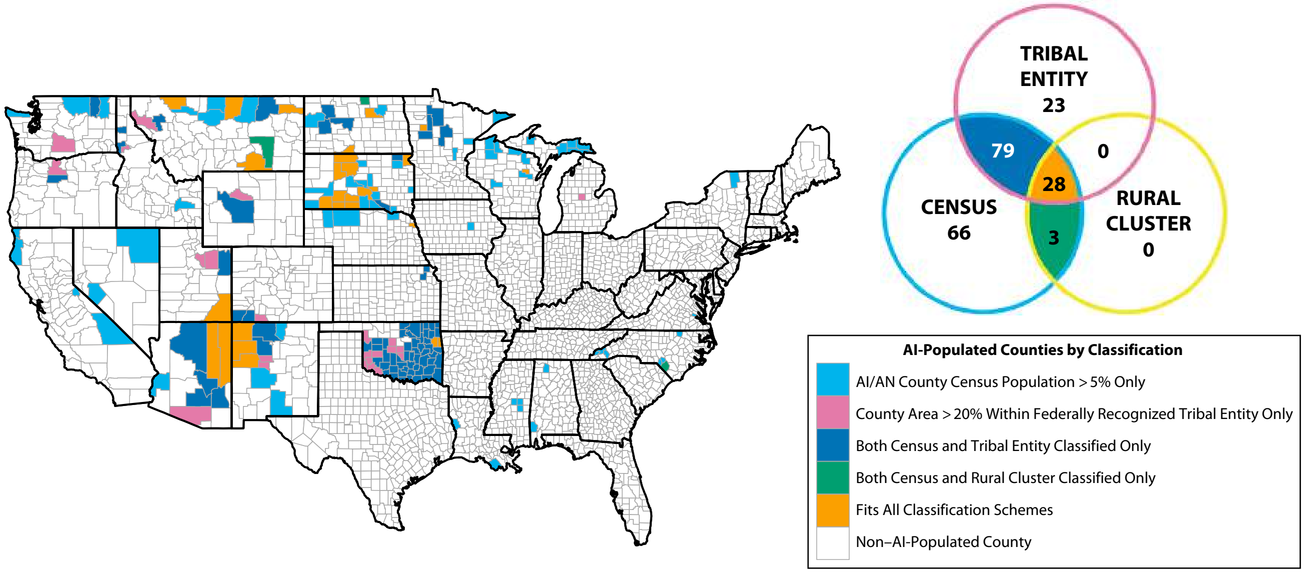

FIGURE 1— **Map and Venn Diagram of American Indian (AI)-Populated Counties Across the United States: 2000–2018**

Note. AN = Alaska Native.

modeled and measured $PM_{2.5}$ (Figure A, bold dashed lines). When we compared models 3 and 4, we detected the presence of a statistically significant interaction between county type and year ($P < .001$). We visually compared modeled and measured $PM_{2.5}$ levels using estimated values from model 4 across county types for a hypothetical county with a fixed population density and median annual household income (Figure A, bold solid lines). Using all input data and model 4, we predicted that across the study period, $PM_{2.5}$ concentrations in AI-populated counties decreased by 2.13 and 2.37 micrograms per cubic meter (22.7% and 23.3% relative decline) on average for modeled and measured $PM_{2.5}$, respectively; in non–AI-populated counties, the corresponding declines were 4.26 and 5.05 micrograms per cubic meter (39.2% and 42.0%), respectively (Figure A).

Given the observed interaction, modeled and measured $PM_{2.5}$ (both estimated and observed annual means) were significantly lower in AI- than in non–AI-populated counties at the beginning of the study period, but this difference decreased in magnitude over time (Figure A). Adjusted mean concentrations were 1.46 (95% CI = 1.25, 1.68) micrograms per cubic meter lower for modeled $PM_{2.5}$, and 1.83 (95% CI = 1.24, 2.43) micrograms per cubic meter lower for measured $PM_{2.5}$ in AI-populated counties versus non–AI-populated counties in 2000 (Figure 2). Partway through the study period, mean $PM_{2.5}$ concentrations in AI-populated counties became significantly higher than in non–AI-populated counties after 2012 for modeled $PM_{2.5}$ and 2016 for measured $PM_{2.5}$ (Figure 2). By 2018, adjusted modeled concentrations were

TABLE 2— **Mean Difference in Modeled and Measured $PM_{2.5}$ Concentrations (μg/m^3) in American Indian (AI)-Populated vs Non–AI-Populated Counties: United States, 2000–2018**

	Model 1,[a] Mean Difference (95% CI)	Model 2,[b] Mean Difference (95% CI)	Model 3,[c] Mean Difference (95% CI)
Modeled $PM_{2.5}$	−0.56 (−0.74, −0.38)	−0.36 (−0.52, −0.21)	−0.38 (−0.54, −0.23)
Measured $PM_{2.5}$	−1.65 (−2.18, −1.13)	−0.70 (−1.17, −0.22)	−0.79 (−1.26, −0.33)

Note. CI = confidence interval; $PM_{2.5}$ = fine particulate matter.

[a] Adjusted only for year and random intercepts for counties in states.
[b] Additionally adjusted for population density.
[c] Additionally adjusted for population density and median household income.

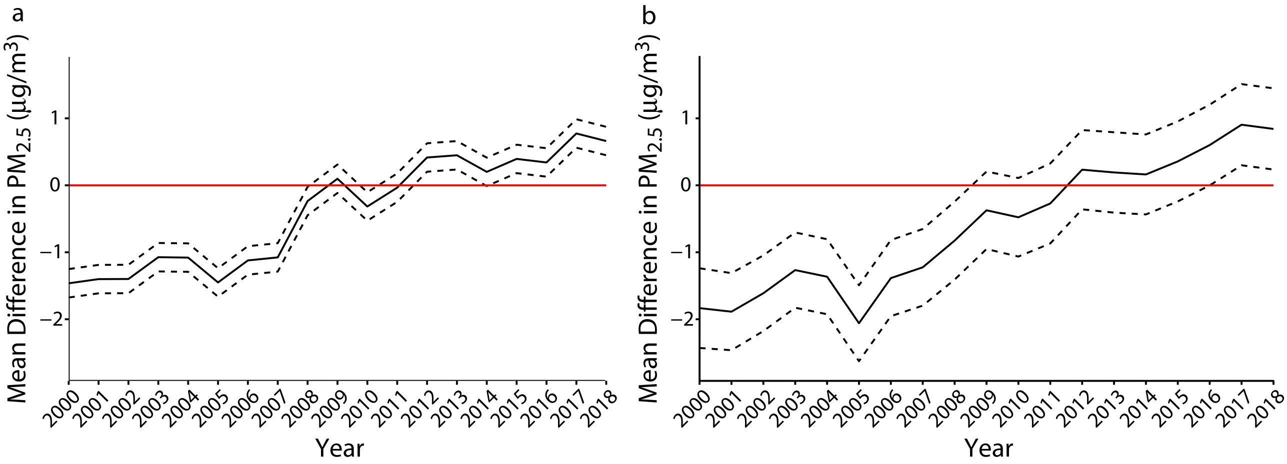

FIGURE 2— **Adjusted Mean Difference in $PM_{2.5}$ Concentrations Between American Indian (AI)- and Non–AI-Populated Counties That Are (a) Modeled, and (b) Measured: 2000–2018**

Note. PM2.5 = fine particulate matter. The solid line shows the effect estimates (county type coefficient + interaction coefficient with time) of being classified as an AI-populated county over the study period. The dashed lines show the 95% confidence intervals from model 4. The red line represents no difference in adjusted average $PM_{2.5}$ concentrations between AI and non–AI-populated counties.

on average 0.66 (95% CI = 0.45, 0.87) micrograms per cubic meter higher, and adjusted measured concentrations were on average 0.84 (95% CI = 0.24, 1.45) micrograms per cubic meter higher in AI-populated counties than in non–AI-populated counties (Figure 2).

Overall, our findings comparing $PM_{2.5}$ concentrations averaged over time in AI- versus non–AI-populated counties did not change considerably when we adjusted for ADI instead of household income, excluded counties in the Northeast, defined AI-populated counties using each criteria separately and the intersection of all 3 criteria, included additional counties with any overlap with federally recognized tribal entities in our definition of AI-populated counties, additionally adjusted for climate region, and restricted analyses to rural counties (Table C [available as a supplement to the online version of this article at http://www.ajph.org]). Our findings comparing $PM_{2.5}$ trends over time in model 4 remained consistent when we adjusted for ADI instead of household income and excluded household income and population density, additionally adjusted for climate region, and restricted to rural counties (Figure B [available as a supplement to the online version of this article at http://www.ajph.org]). When including a spatial lag in models 3 and 4, modeled $PM_{2.5}$ was on average much lower in AI-populated counties compared with our main analysis results (Table C). Mean concentrations were substantially lower in AI- than in non–AI-populated counties at the beginning of the study period, but the mean difference by county type was attenuated over time, with no difference or even a potential increase in annual $PM_{2.5}$ levels in AI- versus non–AI-populated counties by the end of the study period (Figure B).

DISCUSSION

We compared differences in modeled and measured $PM_{2.5}$ concentrations between AI- and non–AI-populated US counties from 2000 to 2018. Although we observed that $PM_{2.5}$ concentrations were lower in AI-populated counties at baseline and on average across the study period, this gap between AI- and non–AI-populated counties decreased over time. We observed higher $PM_{2.5}$ concentrations in AI-populated counties than in non–AI-populated counties after approximately 2015. In sensitivity analyses using spatial lag linear mixed models, we observed substantially lower $PM_{2.5}$ levels on average across the study period in AI-populated counties. Trends over time also showed lower concentrations in AI-populated counties near the beginning of our study period, although this difference was attenuated by the end of the study period.

We observed a larger difference on average over the study period in annual $PM_{2.5}$ concentrations between AI- and non–AI-populated counties for measured versus modeled $PM_{2.5}$. EPA monitors are not uniformly distributed and tend to be in more populous counties and more densely populated areas in a county, which also tend to have higher pollution levels than other areas in the same county; thus, the measured $PM_{2.5}$ analysis may not fully represent capturing true differences in county-level average $PM_{2.5}$ concentrations by AI-populated county type. The model, by contrast, provided $PM_{2.5}$-predicted concentrations at a uniform spatial resolution, consistent with lower countywide average $PM_{2.5}$ compared with measured concentrations at monitoring stations. Modeled data, however, can also be affected by measurement error, if the model yields less accurate predictions in areas where fewer monitors are available.

The varying trend in mean $PM_{2.5}$ concentrations over time between AI-populated and non–AI-populated counties may reflect the spatial heterogeneity of changing $PM_{2.5}$ levels across the continental United States in the past several decades. One study ranked US Census tracts by $PM_{2.5}$ concentrations in 1981 and 2016 and found that census tracts in states bordering the Great Lakes and the Northeastern United States dropped in $PM_{2.5}$ percentile rank relative to other areas; meanwhile, the Central and Imperial valleys of California, southwestern Arizona, and areas of Oklahoma, Arkansas, and Texas experienced increases in the relative ranking of $PM_{2.5}$ between 1981 and 2016.[24] However, we found similar results after adjusting for climate regions; future analyses restricted to specific regions should be considered to understand drivers of within–climate region differential $PM_{2.5}$ trends in AI- versus non–AI-populated counties.

Given that exposure to $PM_{2.5}$ is a modifiable risk factor for cardiovascular disorders and other adverse health outcomes even at levels below the current national ambient air quality standards,[25] it is important to characterize exposure patterning over space, particularly in areas with socioeconomically disadvantaged populations. The history of US settler colonialism has contributed to the displacement of tribes and forced acculturation of Native children to Western educational and sociocultural systems.[26,27] These factors have exacerbated levels of poverty, poor health, and chronic diseases in this population.[28] To this day, access to quality health care is still a challenge for AI people. Most rely on Indian Health Services as their primary health care provider. Lack of funding has forced Indian Health Services to regularly operate in a “state of emergency,” with a per capita spending on personal health care at half the national average expenditure.[29] With potentially higher estimated $PM_{2.5}$ concentrations in AI-populated counties than in other counties observed in recent years, or at least diminished differences by county type over time, it is imperative to recognize that these trends may further increase health disparities between AI people and other populations.

Cardiovascular disease, one of the outcomes positively associated with exposure to $PM_{2.5}$, is the leading cause of death in AI populations and occurs at significantly higher rates than in White populations.[30,31] Studies in the Strong Heart Study cohort—the largest and longest-running longitudinal study assessing cardiovascular outcomes and their risk factors in AI communities in Arizona, Oklahoma, and North and South Dakota—showcase the high burden of cardiovascular disease, which is associated with a high prevalence of diabetes and obesity.[32–35] Because the role of air pollution in the cardiovascular health of AI people, to our knowledge, has not yet been evaluated, using the Strong Heart Study and similar cohorts can serve as invaluable resources for future investigations of health impacts associated with air pollution in AI populations.

Limitations

There are a few limitations to this analysis. Given the many modes of defining AI populations,[7] demarcating AI- or non–AI-populated counties can only estimate, but not fully capture, the extent of where AI people reside. We adjusted for population density and median household income and ADI as indicators of socioeconomic status to characterize differences in $PM_{2.5}$ levels in AI- versus non–AI-populated counties independently of these factors. However, we cannot exclude the possibility of potential residual confounding. The lack of $PM_{2.5}$ monitors in the sparsely populated rural United States restricts our ability to assess measured $PM_{2.5}$ in most AI- and non–AI-populated counties. These monitors are not uniformly distributed in space, and the somewhat arbitrary delineation of county boundaries makes the measured $PM_{2.5}$ analysis prone to bias because of zonation effects of the modifiable areal unit problem.[36] Although the use of $PM_{2.5}$ models provides comprehensive spatial coverage across the United States, there is likely some error associated with these predictions. Future studies should incorporate different prediction models to perform analyses that can further validate these findings. By aggregating $PM_{2.5}$ estimates and conducting our analyses at the county level, we cannot generalize our findings to differences in individual exposure levels between AI- and non-AI people.

Our study was limited to the contiguous United States, notably excluding Hawaii and Alaska. Native Hawaii and Alaska Native populations tend to be more uniformly distributed across these states,[37,38] as opposed to AI communities being relatively concentrated geographically in the lower 48 states. This difference between these 2 states and the rest of the United States requires a separate analysis. Potentially, future studies at finer spatial resolutions in these areas may be able to elucidate the pollution disparities between these Alaska Natives and Native Hawaiians and non-Native communities. Finally, our study assessed only total $PM_{2.5}$; future studies should evaluate potential differences in concentrations of $PM_{2.5}$ components and other pollutants in AI- versus non–AI-populated counties.

Conclusions

The differential rates of $PM_{2.5}$ decline and attenuated $PM_{2.5}$ differences over time between AI- and non–AI-populated counties necessitates further investigation. Our findings suggest that socioeconomically disadvantaged communities experience disproportionate burdens of environmental hazards, such as ambient air pollution, contributing to adverse downstream health effects.[39] The substantially larger decrease in $PM_{2.5}$ concentrations in non–AI- versus AI-populated counties highlights a need to enhance enforcement of air quality regulations and restrictions to $PM_{2.5}$ emissions on tribal territories, surrounding regions, and other areas with large populations of AI people. Given current research gaps, AI populations are likely underrepresented when the EPA is considering national ambient air quality standards. Greater resources should be allocated to creating mutual learning opportunities among researchers, federal and state agencies, and local tribal governments to spur further research to ensure that the national ambient air quality standards are indeed protecting everyone. Efforts should also prioritize the establishment of more permanent funding streams and institutional infrastructure to promote developments of successful long-term regulatory efforts in tribal communities.

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PUBLICATION INFORMATION

Full Citation: Li M, Hilpert M, Goldsmith J, et al. Air pollution in American Indian versus non–American Indian communities, 2000–2018. *Am J Public Health*. 2022;112(4):615–623.

Acceptance Date: November 30, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306650

CONTRIBUTORS

M. Li collected, analyzed, and visualized the data and led the writing of the article. M. Li, A. Navas-Acien, and M.-A. Kioumourtzoglou conceptualized the initial project idea and performed the research design and statistical analysis. M. Hilpert advised on the exposure assessment elements of the study design. J. Goldsmith advised on statistical analysis, data visualization, and results interpretation. J. L. Brooks advised on the study design approach for county type classifications. J. A. Shearston conducted a comprehensive review of the data cleaning and analysis code. S. N. Chillrud, T. Ali, J. G. Umans, L. G. Best, and J. Yracheta contributed to the discussion of results. A. van Donkelaar and R. V. Martin provided input on the methods and discussion of results. A. Navas-Acien and M.-A. Kioumourtzoglou assisted with results interpretation and article writing. M.-A. Kioumourtzoglou assisted with data collection and statistical analysis. All authors reviewed and provided comments on the final version of the article.

ACKNOWLEDGMENTS

Support for this work was provided by the National Institute of Environmental Health Sciences, National Institutes of Health (NIH; grants T32 ES007322, P30 ES09089, R01 ES030616, and P42 ES010349).

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

CONFLICTS OF INTEREST

The authors declare no potential or actual conflicts of interest.

HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because data were obtained from secondary sources.

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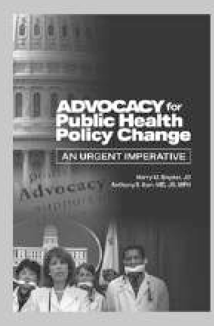

Structural Racism and Inequities in Incidence, Course of Illness, and Treatment of Psychotic Disorders Among Black Americans

Supriya Misra, ScD, Onisha S. Etkins, PhD, Lawrence H. Yang, PhD, and David R. Williams, PhD

See also Shim, p. 538.

Psychotic disorders (e.g., schizophrenia, schizoaffective disorder) are a leading cause of morbidity and premature mortality and an overlooked health inequity in the United States. European data indicate inequities in incidence, severity, and treatment of psychotic disorders, particularly for Black communities, that appear to be primarily attributable to social adversities. The dominant US narrative is that any observed differences are primarily a result of clinician bias and misdiagnosis.

We propose that employing the framework of structural racism will prompt European and US research to converge and consider the multifaceted drivers of inequities in psychotic disorders among Black Americans. In particular, we describe how historical and contemporary practices of (1) racialized policing and incarceration, and (2) economic exploitation and disinvestment, which are already linked to other psychiatric disorders, likely contribute to risks and experiences of psychotic disorders among Black Americans.

This framework can inform new strategies to (1) document the role of racism in the incidence, severity, and treatment of psychotic disorders; and (2) dismantle how racism operates in the United States, including defunding the police, abolishing carceral systems, and redirecting funds to invest in neighborhoods, housing, and community-based crisis response and mental health care. (*Am J Public Health*. 2022;112(4):624–632. https://doi.org/10.2105/AJPH.2021.306631)

Psychotic disorders are leading causes of morbidity and premature mortality and an overlooked health inequity in the United States.[1,2] Psychosis refers to disconnection from shared reality via hallucinations and delusions; delusions are fixed false beliefs and are maintained even when evidence against them is presented; and hallucinations are auditory, visual, or tactile perceptions occurring without the corresponding stimulus.[3] Psychotic disorders (e.g., schizophrenia, schizoaffective disorder) are a heterogenous syndrome that includes psychosis and affects behaviors, cognitions, and emotions. Although rarer than other psychiatric diagnoses, psychotic disorders are often more severe and debilitating.[1] European data indicate persistent inequities in incidence,[4] severity,[5] and treatment,[6] particularly for Black communities, with accumulating evidence that, in addition to potential misdiagnosis, these inequities are attributable to more prevalent and cumulative experiences of social adversities such as discrimination and trauma.[7,8]

US surveillance data suggest lower rates of psychiatric disorders among non-White racialized groups but typically exclude psychotic disorders. The 3 large-scale psychiatric epidemiological studies (Epidemiologic Catchment Area Survey of Mental Disorders,[9] National Comorbidity Survey,[10] and National Comorbidity Survey-Replication[11]) suggest that there are higher rates of psychotic disorders among Black communities, but challenges remain in accurately assessing psychotic disorders in these large epidemiologic studies, in which the interviewers are not clinicians.[11] A recent meta-analysis found that Black

Americans have 2.4 times greater odds of schizophrenia than do White Americans.[12] Earlier US research investigated whether social factors explain racial differences in psychotic disorders,[13] but the dominant narrative today is that observed racial differences are primarily attributable to clinician bias and misdiagnosis,[6,12–14] despite evidence suggesting otherwise.[12,15]

HISTORICAL CONTEXT

The current emphasis on clinician bias and misdiagnosis is partly attributable to the unique legacy of slavery and institutionalization in the United States, wherein psychotic diagnoses and antipsychotic medications were used as tools of control over Black people. During slavery, Black people were thought to have lower rates of mental illness.[16] However, after emancipation, Black people were identified as having higher rates of psychotic disorders because of racist beliefs about the loss of behavioral control.[13] The diagnosis became further racialized during the civil rights movement, when prisons started classifying Black people, especially men protesting in the movement, as psychotic to justify transferring them to inpatient hospitals.[17]

Toward the end of the civil rights movement, the health care system started to acknowledge the role of clinician bias and misdiagnosis and sought to change it. This bias includes overdiagnosis (i.e., no disorder present) and misdiagnosis (i.e., a different diagnosis is more appropriate), which can lead to worse outcomes because of failures in delivering appropriate care, prescription of powerful medications with serious side effects, and associated stigma.[14] These shifts coincided with a national policy of deinstitutionalization intended to move individuals with mental illness out of long-term inpatient facilities and into community care. However, insufficient community infrastructure combined with ongoing structural disadvantage resulted in criminalization of mental illness along racial lines, with many individuals with mental illness moved directly from asylums to the streets or to jails and prisons.[17] Black individuals are disproportionately represented in unhoused and incarcerated populations, and the US criminal legal system is the largest provider of mental health care in the country.[18]

STRUCTURAL RACISM FRAMEWORK

We propose that the framework of structural racism will promote convergence of European[19] and US evidence, and we suggest future directions for research and action for Black Americans. Racism occurs at multiple levels,[20] and structural racism refers to how society and its systems cause avoidable and unfair inequities in access to power, resources, capacities, and opportunities for racialized groups perceived as inferior in the context of White supremacy (i.e., treated by society as non-White).[21,22] Racism affects health via several established pathways, including institutional domains such as employment, education, housing, and health care; adverse cognitive and emotional processes; allostatic load and pathophysiological processes; diminished healthy behaviors and increased unhealthy behaviors; and physical injury from racially motivated violence.[21,23]

For psychotic disorders, this cumulative stress can contribute to more proximal risk factors, such as epigenetic modifications, altered neurobiology, and perinatal complications[24]; furthermore, these experiences can have effects across the life course and across generations. Situating these experiences in larger structures highlights new avenues for identification and intervention. This could help identify which patterns are attributable to clinician bias and misdiagnosis and which reflect differences in incidence and severity.

We identified common domains of structural racism that affect mental health in the United States and sought to connect them to evidence of inequities in psychotic disorders in Europe to propose how structural racism might uniquely contribute to inequities in psychotic disorders among Black Americans. We propose that structural racism—as expressed through historical and contemporary practices of (1) racialized policing and incarceration, and (2) economic exploitation and disinvestment, which are already linked to increased risk of psychiatric disorders—likely also contributes to unique risks, experiences, and consequences of psychotic disorders among Black Americans. This builds on a recent review of existing US research on the social environment and psychosis[24] by focusing on unique structural harms endured by Black Americans to indicate new strategies to (1) document the role of racism in the incidence, severity, and treatment of psychotic disorders; and (2) dismantle how racism operates in the United States, including defunding the police, abolishing carceral systems, and redirecting funds to invest in neighborhoods, housing, and community-based crisis response and mental health care.

RACIALIZED POLICING AND INCARCERATION

Racialized policing and police brutality are not new to the United States. From 18th-century slave patrol vigilantes to 21st-century police killings captured on cell phones, the disproportionate abuse and murder of Black people by police is ingrained in the racist history of the United States.[25,26] Racialized policing did not begin with the creation of the modern-day police force, but rather is a predecessor of a systemic infrastructure born of White supremacy; thus, assessing its health impacts requires the lens of structural racism.[25,27]

A systematic review of studies on police violence and mental health among Black Americans published between 1994 and 2019 found only 11 relevant studies.[25] Although research remains relatively scant, the literature indicates that experiencing negative police interactions (e.g., being asked for identification, being frisked or searched, experiencing physical force) are associated with poor mental health among Black people, including increased risk for posttraumatic stress disorder (PTSD), anxiety, suicidal ideation, and other psychiatric disorders.[25,28] Witnessing police violence can also result in poor mental health among Black people.[21] Although no studies to date have assessed the impact of experiencing or witnessing negative police interactions on psychotic disorders, police violence is associated with subthreshold psychotic experiences (i.e., psychosis symptoms that do not meet full diagnostic criteria).[29,30] For example, a study found that "paranoid beliefs" (i.e., distrust and fear of anticipated harm) were associated with expecting negative police interactions in the future. However, after adjusting for past negative police interactions, the association was no longer significant. This suggests that what is classified as paranoid beliefs could be shaped by realistic expectations of negative interactions based on past experiences.[31]

As a consequence of racialized policing, Black Americans are more likely to experience negative interactions with the criminal legal system. Racial bias occurs at every stage of the criminal legal system, from arrest and sentencing to incarceration and reentry.[32] The racialized criminalization of people with mental illness warrants closer examination, especially as more individuals with severe mental illness reside in jails and prisons than in psychiatric facilities.[18] In addition to the disproportionate number of individuals with preexisting mental illnesses that come into contact with the criminal legal system, interactions with the criminal legal system can exacerbate preexisting conditions and increase risk of developing mental illness symptoms and diagnoses,[33] including psychotic disorders.[34] The psychological impacts extend to nonincarcerated individuals who live in neighborhoods with high rates of incarceration.[35] Once in the system, harsher treatment (e.g., more frequent solitary confinement) also worsens mental health and increases likelihood of psychotic symptoms.[36] Hence, individuals in the criminal legal system have higher rates of mental illnesses before entry, and the system also increases risk of or exacerbates mental illnesses following entry.

Black people with psychotic disorders experience more police contact and greater likelihood of involuntary admission into inpatient psychiatric care than do White people.[37,38] In addition to being traumatic, frightening, and stigmatizing, involuntary patient admissions are associated with a cascade of negative outcomes, including further coercion in inpatient care, more involuntary readmissions, more frequent and longer hospitalizations, disengagement and avoidance of services, and dissatisfaction with services.[38] Together, these findings call for a closer look at how structural racism—as manifested by racialized policing, criminal legal system contact, incarceration, and coercive pathways into care—contributes to the experiences of psychotic disorders among Black Americans.

ECONOMIC EXPLOITATION AND DISINVESTMENT

Structural racism has shaped neighborhood conditions, leading to the unequal patterning of opportunities for socioeconomic attainment for Black Americans. Racial residential segregation, a form of structural racism intended to physically separate racial groups by directly or indirectly enforcing residence,[39] has resulted in disinvestment and the serial displacement of Black Americans from desirable neighborhoods and housing. Racial residential segregation has been enforced by legislation, housing policies, and economic institutions, even after the Civil Rights Act of 1968 made discrimination in renting and housing sales illegal.[39] Furthermore, Black Americans are more likely to experience displacement from and discriminatory exclusion in well-resourced neighborhoods and "entrapment" in neighborhoods with less capital (economic, social, and human) owing in part to this racialized structuring of housing and property markets.[40]

The legacy of racial residential segregation is restricted economic mobility and generational wealth for non-White racialized groups in the United States.[41] This helps explain why, at every level of education, Black people have lower income levels than do White people.[41] In fact, a national study showed that removing residential segregation would eliminate racial disparities in income, education, and unemployment.[42] The associations between low socioeconomic status and poor mental health, including psychotic disorders,[43] are well documented; however, US data show that socioeconomic status only partially mediates the association between race and psychotic disorders.[15] The consequences of racial residential segregation are more nuanced than individual socioeconomic disadvantage; evidence suggests that the mental health impacts may further differ by neighborhood poverty levels, whereby segregation is positively associated with distress among Black Americans in high-poverty neighborhoods but not low-poverty ones.[44]

Racial residential segregation has created neighborhoods with fewer resources, more harmful environmental exposures, and worse access to and quality of health care, all of which affect mental health.[21,39] This neighborhood deprivation is associated with risk of psychotic disorders.[45] Studies primarily from Northern Europe have found that living in urban areas, particularly during childhood, is associated with increased risk of psychotic disorders. However, these effects are heterogenous elsewhere and appear to depend on specific aspects of city living, such as economic stresses,[46] social connections (e.g., lower social cohesion),[47] and environmental exposures (e.g., air pollution).[48] Although recent US data on urbanicity and psychotic disorders are not available, 1 study found that an urban upbringing was associated with lower risk of psychotic symptoms for Black Americans,[49] which differs from European findings. More studies are needed to understand what "urbanicity" encompasses and its influence on psychotic disorders among Black Americans.

Racial residential segregation also means that Black individuals often live in communities with similar racial compositions. It has been posited that living in neighborhoods with greater "ethnic density" (i.e., high percentages of residents from the same racialized group) can be both positive (e.g., social connection) and detrimental (e.g., low-quality housing) for mental health.[50] One US study found a protective association between Black ethnic density and depressive symptoms, but the direction changed when ethnic density reached 85%, suggesting a threshold effect.[51] Data from Europe suggest protective but heterogenous effects of ethnic density on psychotic disorders,[52,53] but studies are limited in the United States. One study on psychotic symptoms suggested that the protective effect of ethnic density emerged only after accounting for neighborhood deprivation.[54] These relationships are clearly nuanced[55] and warrant further study for Black Americans.

Racial residential segregation and its economic consequences also contribute to housing instability because of decades of racialized policies combined with ongoing racialized practices, such as predatory mortgage lending, foreclosures, and evictions that disproportionately affect Black people.[39] In a retrospective study of low-income renters in Milwaukee, Wisconsin, forced removal from rental properties was associated with job loss, demonstrating a link between housing insecurity and employment.[56] A study of 2245 counties across all 50 states found the association between foreclosures and mental health to be stronger in counties with a higher proportion of Black residents than counties with the lowest proportion.[57] One study found that displaced residents experienced more mental health emergency department visits than did those who remained in a gentrifying neighborhood.[58] Another study found that those who were housing insecure were twice as likely to experience 14 days or more with poor mental health than were those who were housing secure.[59] Regarding psychotic disorders, 1 study found that severe neighborhood disruption (e.g., feeling unwelcome or pushed out) was associated with an increased risk of subthreshold psychotic experiences[60]; however, no US studies have assessed how housing insecurity affects the onset or severity of psychotic disorders.

At the most extreme, housing instability and serial displacement result in extended periods of living without housing, commonly known as "homelessness." Black people are 13.4% of the US population but 40% of unhoused populations[61]; they have 1.4 greater odds of being unhoused in their lifetime than do White people.[62] Racial inequities in being unhoused are linked to lower income, greater incarceration histories, and greater risk of traumatic events.[62] Qualitative data confirm the role of structural racism—including in criminal legal system discrimination, employment discrimination, exposure to violence, premature death, and limited family wealth[63]—in both precipitating and perpetuating being unhoused. Following deinstitutionalization in the 1980s, homelessness greatly increased, transforming the image of a person without housing to coincide with someone with severe mental illness.[64] Although psychotic disorders are relatively rare compared with other psychiatric diagnoses, they are one of the most common diagnoses among unhoused populations. A recent meta-analysis estimated a pooled prevalence of 21% for psychotic disorders among unhoused populations globally, more than 50 times the prevalence in general populations.[65]

To address the role of structural racism in the distribution and course of psychotic disorders among Black Americans, we must consider the historic and contemporary experiences of economic exploitation and disinvestment that, through residential segregation, contribute to neighborhood deprivation, housing instability, serial displacement, and homelessness.

FUTURE DIRECTIONS

We urgently need to broaden our conceptualization and assessment of the multiple domains and contexts in which structural racism operates and to empirically assess its impact on psychotic disorders in the United States. Despite robust evidence on racial inequities in psychotic disorders, much of this research occurs in homogenous settings with relatively recent migration patterns that do not reflect the historical context and ongoing consequences of slavery and structural racism in the United States. Given the historical harms caused to Black Americans under the guise of psychiatric care, the dominant focus on biomedical explanations and uniform incidence appears egalitarian. However, calls are increasing for using a structural racism framework to understand the risk of psychotic disorders.[19,24] It is critical to disentangle whether higher rates are primarily attributable to clinician bias and misdiagnosis, as commonly believed, or are also attributable to racialized policing and incarceration and economic exploitation of and disinvestment in Black Americans. These latter factors have been linked with other psychiatric disorders and likely share similar pathways via cumulative stress, which leads to alterations in psychological, neurobiological, and physiological systems. Given the systemic nature of racism and how multiple components operate synergistically, it is worth (1) giving more attention to how we document the contribution of racism to psychotic disorders, and (2) dismantling how racism operates via multilevel and multisystem interventions.

Document Racism’s Role in Psychotic Disorders

We recommend a reprioritization of research on psychotic disorders from primarily a biomedical lens to understand individual risk and clinical treatment to a structural racism lens to systematically monitor psychotic disorders, assess the role of socioenvironmental factors alongside more proximal mechanisms, and prioritize inclusion of Black people at every point in the mental health care system and related structures. Importantly, this means denouncing biological race and explanations of genetic difference in the absence of any evidence as well as being explicit about naming racism when discussing racial differences.[66] Researchers will need to invest time, effort, and resources to build trust with diverse Black communities, particularly those affected by policing, incarceration, residential segregation, and housing instability. This can be strengthened by collaborating with Black communities, including those with lived experience of mental illness,[67] at all levels of leadership to articulate research needs and priorities and guide the feasibility and sustainability of such efforts. Prioritizing leadership from within affected communities can help equalize the disproportionate power of structural racism while also considering the additional burdens being placed on those for whom the pervasive harms of racism are already obvious.

Epidemiological studies are limited, with no consistent surveillance of psychotic disorders in the United States, although the upcoming Mental and Substance Use Disorders Prevalence Study is intended to address this gap and will include incarcerated and unhoused populations.[68] To date, promising US studies have primarily used general population samples with subthreshold psychotic experiences and relied on (1) existing data sets to assess for racial inequities,[69] (2) added measures to studies like the Survey of Police–Public Encounters,[70] and (3) self-report data among convenience samples (e.g., college students) on factors such as racial discrimination,[71] traumatic experiences,[72] and ethnic density.[54]

Future studies can build on these approaches to operationalize dimensions of structural racism, such as incarceration (e.g., relative proportion of Black people to White people incarcerated) and residential segregation (e.g., redlining index of Black–White disparity in mortgage loan denial).[73] In addition to expanding measures, studies need to include people diagnosed with psychotic disorders; population-based case–control designs have been used with some success in Europe (e.g., the EUropean Network of National Schizophrenia Networks Studying

Gene-Environment Interactions[74]). Finally, we note that psychotic disorders and PTSD can co-occur, and complex PTSD can include psychotic symptoms.[75] It is possible that this is more common among Black Americans given shared pathways, but we are unaware of any studies examining racial inequities in this co-occurrence.

More studies are needed to address inequities in the course and severity of psychotic disorders, including the differential efficacy of potential interventions. Growing clinical and community-based efforts show that early detection and treatment are beneficial across the life course, but it is unclear whether these benefits are equitable. For example, nascent efforts have attempted to identify individuals at "ultrahigh risk" for psychosis (i.e., before developing a psychotic disorder). The first (to our knowledge) study to examine racial differences at this early stage, in London, United Kingdom, found that Black individuals were overrepresented as ultrahigh risk but that after early intervention services there were no racial differences in those who transitioned to psychotic disorders after 2 years.[76]

This suggests that even with increased risk, there are targeted opportunities to intervene and reduce inequities in incidence. However, the current consensus is that early intervention programs have significant inequities in program engagement and outcomes.[77] For example, the National Institute of Mental Health–funded RAISE (Recovery After an Initial Schizophrenia Episode) project, which tested a coordinated specialty care model after first-episode psychosis, identified racial disparities not only at baseline[78] but also in subsequent treatment outcomes.[79] Similar patterns were observed in New York City's early intervention program OnTrackNY, including for vocational outcomes of education and employment.[80]

For practical reasons, many studies occur at the individual level, but we recommend that researchers use theory-driven approaches that contextualize the individual within larger societal, structural, and systemic factors. Without explicitly naming the power structures that drive inequities, individual-level research on psychotic disorders is at risk for falling into the realm of victim blaming. The underlying biology of psychosis is undoubtedly important, but rather than a biomedical lens that reduces all differences solely to genetics and neurobiology, it is important to highlight how biology is shaped by individuals interacting in multilayered environments that are undergirded by systems of power and oppression.[81]

Additionally, Black feminist scholars and activists have used intersectionality theory to examine how experiences differ at the unique intersection of multiple systems of power that are simultaneously experienced; their results have recently been integrated into public health research.[27] One example is the intersection of racism and sexism; although sex differences in psychotic disorders are well established,[82,83] research on the experiences of Black women with psychotic disorders is scarce compared with research on Black men or White women. In particular, the gendered racialization of psychotic disorders in the United States shifted conceptions of the typical patient from White women to Black men,[17] overlooking the experiences of Black women.[84]

When analyzing the role of structural racism in psychotic disorders in the United States, there are many other intersecting systems of power that also need to be considered simultaneously (e.g., cissexism, heterosexism, ableism, capitalism). Qualitative and mixed methods can be powerful approaches to elicit information about experiences at the intersections of systems of power.[85] Using these strategies to build the evidence base will inform allocation of resources to public health strategies that go beyond biomedical interventions and target structural change.

Dismantle How Racism Operates

Although documenting harms is necessary, multilevel and multisystem interventions that lead to transformative change are required to rectify the long-term harms of structural racism. For the criminal legal system, this means defunding the police and abolishing carceral systems, redirecting funds toward housing and community-based mental health services, and reclassifying what often falls under the purview of the legal system to other health and social services.[86,87] This will require sustained efforts to create, fund, and use community-based mental health first responder programs and alternative models for longer-term mental health care. For example, the CAHOOTS (Crisis Assistance Helping Out on the Streets) program in Eugene, Oregon, redirects mental health emergency calls to unarmed health professionals and finds that they rarely need police backup, thus decreasing police interactions and potential harm for individuals with mental illness.[86] As we work toward abolition, pre- and postarrest diversion programs to receive mental health services rather than criminal charges and transition programs for people who were formerly incarcerated may mitigate some harms. Assertive community treatment is 1 strategy whereby formerly incarcerated individuals receive team-based mental health care that includes support for housing, employment, and benefits.[88]

Investing in neighborhoods that experience the greatest structural disadvantage requires social and economic policies that reallocate resources and build on the strengths of existing community institutions (e.g., schools, religious institutions, businesses). Additionally, policies regulating rent and evictions and supporting affordable, stable, and quality housing can play a large role in determining housing security and stable mental health.[89] Some health care systems have offered housing vouchers or invested in developing affordable housing to address this issue. One randomized study found that unhoused adults who were offered long-term housing and case management had fewer emergency department visits and hospitalizations.[89] Unlike typical programs that segregate supportive housing and have mandated requirements, the Housing First framework posits that providing housing for individuals with severe mental illness to live integrated in the community with agency and support leads to greater improvement in mental health.[90] Similarly, programs that support education, vocational training, and employment also improve functional outcomes but need more study in racialized groups. These interventions show how alternative, collaborative forms of health care can address inequities by targeting the mechanisms of structural racism.

CONCLUSIONS

Psychotic disorders are an understudied health inequity in the United States. Despite higher prevalence among Black Americans, these differences are often dismissed as solely attributable to clinical bias and misdiagnosis. Although this certainly occurs, the evidence reviewed shows that social adversities are also driving forces behind racial inequities in psychotic disorders. We suggest that structural racism—particularly (1) racialized policing and incarceration, and (2) economic exploitation and disinvestment—also contributes to inequities in incidence, severity, and treatment of psychotic disorders. Although we focus on Black Americans, these findings can be extended to other racialized populations harmed by these structures, including Black immigrants, other immigrant and refugee populations, other communities of color, and other populations that experience structural marginalization and disadvantage. This framework can be used to identify new strategies to document the role of racism in psychotic disorders and to dismantle how racism operates. This includes initiatives such as defunding the police, abolishing carceral systems, and redirecting funds to invest in neighborhoods, housing, and community-based crisis response and mental health care.

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PUBLICATION INFORMATION

Full Citation: Misra S, Etkins OS, Yang LH, Williams DR. Structural racism and inequities in incidence, course of illness, and treatment of psychotic disorders among Black Americans. *Am J Public Health*. 2022;112(4):624–632.

Acceptance Date: November 16, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306631

CONTRIBUTORS

S. Misra conceptualized this project. S. Misra and O. S. Etkins wrote the first draft of the article. L. H. Yang and D. R. Williams provided critical review and insight. All authors helped to conceptualize ideas and write and revise the article.

ACKNOWLEDGMENTS

Preparation of this article was supported, in part, by the W. K. Kellogg Foundation (grant P3039294-2021).

The authors would like to thank Paroma Mitra, MD, MPH, for reviewing an earlier draft of this article.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

This project did not involve human participants and does not meet the definition of research required for institutional review board review.

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The Annual Homeless Point-in-Time Count: Limitations and Two Different Solutions

Jack Tsai, PhD, and Jemma Alarcón, MD, MPH

See also Raymond, p. 544.

The point-in-time (PIT) homeless count conducted annually in communities across the United States is a major metric reported to the federal government that has a number of limitations.

With the PIT count in 2021 being optional because of the COVID-19 pandemic and potential increases in homeless-related needs in the aftermath of the pandemic, there are opportunities for renewed efforts to improve how the United States enumerates homelessness, determines needs of communities, and tracks progress in ending homelessness throughout the nation. This article describes 2 divergent solutions: (1) improve the PIT by standardizing methodologies across jurisdictions and supplementing counts with other data sources or (2) replace the PIT with a new system.

There are strengths and limitations of both solutions. Advocates for either solution agree that there are important funding considerations to take into account and advancing technologies to utilize. As the nation continues to ramp up public health efforts, homelessness is a public health crisis that could benefit from improved epidemiological and data science methods. (*Am J Public Health*. 2022;112(4): 633–637. https://doi.org/10.2105/AJPH.2021.306640)

On a single night in January every year, communities across the United States attempt to count the number of unsheltered and sheltered homeless individuals. Since 2007, these community counts have been combined to produce the annual point-in-time (PIT) homeless count reported in the US Department of Housing and Urban Development (HUD) Annual Homeless Assessment Report to Congress.[1] The PIT count is used to inform government leaders about the state of homelessness and is a main performance measure for communities. PIT counts are used in decisions regarding federal policies, allocation of resources and services, and research.

Because of the COVID-19 pandemic, HUD made the unsheltered PIT count in 2021 optional for communities, and many did not participate. This hiatus provides an opportunity for a reset to consider how the nation approaches assessing homelessness in the United States.

The PIT count is a cross-sectional survey conducted by Continuums of Care (CoCs) and reflects the number of homeless people at 1 point in time within CoCs. The count informs stakeholders about the number of people who need help in each CoC, and can be used to estimate costs of providing that help and tracking whether the size (and associated price tag) of homelessness is growing or decreasing. To improve data-driven processes for enumerating homelessness, however, policymakers and stakeholders need to be educated about the limitations associated with the PIT count.[2,3] Two divergent solutions have been proposed, with some advocating for improving and supplementing the PIT count and others advocating for replacing the PIT count with other methods.

SOLUTION 1: IMPROVEMENT AND SUPPLEMENTATION

The first proposed solution is to improve and supplement the PIT count.

Standardize Methodologies Across Jurisdictions

There is wide variability in how PIT counts are conducted between and within CoCs over time. Community sizes and conditions vary significantly. Conducting a count in New York City presents different challenges and opportunities than doing this work in Helena, Montana. Thus, HUD allows for variations in the ways PIT is conducted (i.e., through census counts, sampling, or a combination of the two). There are also different sampling and extrapolation methods used. For example, some communities employ stratified geographic sampling (e.g., the Rossi method)[4] for unsheltered PIT counts, whereas other communities do not use any special sampling method.

A recent report from the Government Accountability Office urged HUD to improve guidance related to PIT and include data quality checks.[3] Not all CoCs have a shared understanding of how to implement PIT methodologies, and HUD is working toward implementing practices more uniformly across CoCs. However, this work will require steady improvements over time and may require the support of research and data collection experts engaged conceptually and logistically in this federal-level work. Transparency and public sharing of PIT methodologies by CoCs would be helpful toward this end.

Another important issue is that state and CoC leaders involved in PIT counts change over time. Technical assistance and guidance need to be provided regularly, with particular vigilance given to orienting and training new leadership involved in the PIT count.

Expand and Supplement the Count

Maintaining and improving on PIT would allow for historical analysis of PIT counts over the past 2 decades and build on existing infrastructure. Instead of treating the PIT count as a sole source of information, the count can be supplemented with several other approaches.

Per capita data. Presenting counts within the context of general population data sheds further light on the severity of the problem. Suppose 2 communities each have 1000 people experiencing homelessness. If this number represents 33% of people in Community A but 0.01% of people in Community B, the severity of the homeless challenge varies greatly between the 2 communities. Per capita data can be useful in understanding homelessness in both communities and understanding trends as well as successful and unsuccessful strategies over time. Currently, within the Annual Homeless Assessment Report, HUD calculates current-year per capita data at the national and state level, but this could be expanded to calculations at the CoC level. Not only do the population sizes of communities change, but the size of subpopulations of interest (e.g., women, racial/ethnic minorities, veterans) change as well, and per capita data can be reported alongside PIT counts of these subpopulations.

Homeless Management Information System data. Data on encounters and service use of homeless individuals are captured by CoCs in the Homeless Management Information System (HMIS). The Longitudinal Systems Analysis,[5] introduced in 2018, uses data from the HMIS to provide longitudinal data on incidence, frequency of service use, and other characteristics of homeless individuals in CoCs.

Service-based and postenumeration surveys. After PIT counts of the unsheltered population are conducted, service-based surveys can be conducted at various social service locations (e.g., soup kitchens, day shelters, libraries) to identify unsheltered homeless individuals who were not included so they can be added to the PIT count to produce a more comprehensive total count. Postenumeration surveys, which have been performed by the US Census since 1980,[6] can also be conducted for PIT counts, selecting a sample of regions to assess the accuracy of PIT counts and making corrections accordingly.

Other sampling methods. Biobehavioral surveys, which have been developed to study hard-to-reach populations, may provide tools to improve on how to enumerate homeless counts.[7] Among the different methods included, time–location sampling would be helpful. This strategy utilizes venues known to be frequented by the target population at specific times (e.g., homeless shelters in the evenings, soup kitchens during lunch time). Another sampling method of interest is “respondent-driven sampling,” a peer-driven, chain-referral sampling method; the challenge with this method is that it can only be used if the target population is socially networked, and if its members can recognize and recruit one another.

Epidemiological surveys. National epidemiological surveys of the general population can estimate the number and prevalence of people who have ever experienced homelessness. Such surveys have been conducted using telephone interviews,[8] in-person structured interviews,[9] online representative surveys,[10] and longitudinal surveys.[11] These surveys are unlikely to capture current homelessness, but could capture past homelessness (e.g., homelessness in the past year or lifetime).

These surveys are expensive to conduct but could be worth conducting every 5 to 10 years as benchmark reports on the prevalence of homelessness to supplement the PIT count.

Administrative public service records. There are also various administrative public service records at state and local levels—such as through housing authorities, public schools, Medicaid, Temporary Assistance for Needy Families programs—that could presumably be merged with HMIS data to provide a rich, combined data source for homeless estimates. However, there are not only major logistical data-sharing challenges between institutions, but there are also privacy concerns that need to be considered, particularly because homeless individuals may already have institutional distrust.

SOLUTION 2: REPLACEMENT

Cross-sectional and epidemiological surveys can be useful for understanding the estimates of homelessness in the United States as they present the ability to identify changes over time and relative concentrations of homelessness between different geographies. However, these surveys are limited in scope and scale for individual communities, states, and the nation. With a high margin of error and without utility to develop and execute actions to address the problem, these approaches do not provide communities and local, state, and federal governments real-time and actionable insights into the crisis. Over the past few years, many communities have begun to use "by-name lists" (BNLs) that offer a comprehensive list of every individual experiencing homelessness in CoCs, using uniform data quality standards that is updated in real time.[12] Using information collected and shared with their consent, each person on the list has a file that includes their name, homeless history, health, and housing needs. BNLs may not only be useful in enumerating homeless individuals, but they can provide data about incidence and actionable information between partnering agencies, such as referrals and placement into permanent housing.

A successful case example of this is the CoC in Rockford, Illinois, which worked with community partners and system experts to change its homeless response system in 2015 by developing real-time, person-specific BNLs to capture every person experiencing homelessness in their community. They built a unified team with a shared aim of population-level outcomes, and used data and quality improvement to target resources and services to dramatically reduce veterans' homelessness and chronic adult homelessness. Since then, the community has sustained its BNL system and continues working to prevent new episodes of homelessness.

The nation's response to COVID-19 may help inform a new approach to addressing homelessness. In 2020, over a matter of weeks, every community in the United States began to report on the active number of COVID-19 cases at every level of geography, providing community, state, and federal agencies real-time visibility into prevalence. This approach can be replicated to provide real-time visibility into homelessness; with infrastructure in place in many communities, it would require only a fraction of the cost of COVID-19 reporting. With real-time visibility into homelessness, every level of government and the community would be able to understand the prevalence of homelessness and develop actions to address this crisis.

STENGTHS AND LIMITATIONS OF PROPOSED SOLUTIONS

There are important strengths and limitations to consider for both solutions, which are briefly summarized in Box 1. Certainly, there may be many more strengths and limitations for both solutions that have not been described. Because Solution 1 would be building on existing PIT infrastructure, the strengths and limitations are more knowable. For Solution 2, although there are successful case examples, the strengths and limitations are more speculative, and it may be easy to underestimate the challenges that could arise with implementing a new system.

FUNDING, RESEARCH, AND INNOVATIONS

With both solutions, proponents agree that there is a need for funding, research, and incorporation of new technologies. There is lack of specific funding for CoCs to enumerate homelessness and no cost value placed on accuracy of counts. Greater involvement of governmental public health agencies in homelessness and cross-funding of initiatives could help lead to more attention and accountability on this matter. Many CoCs rely on well-intentioned but undertrained volunteers, leading to inconsistent implementation of PIT methodologies. Some communities have good methodologists, but more are needed to help devise complex sampling strategies

BOX 1— Strengths and Limitations of Solutions for the Homeless Point-in-Time (PIT) Count

	Solution 1: Improve and Supplement the PIT	Solution 2: Replace the PIT
Strengths	• Uses existing community investment and infrastructure • Capitalizes on existing and developing data sources • Provides continuity and comparison for counts over time	• Potentially provides a more comprehensive count • Ability to provide just-in-time information • Successful case examples available
Limitations	• Data-sharing challenges and fragmented environment of agencies and communities • Privacy and legal concerns among vulnerable individuals • Inability to provide just-in-time information	• Data-sharing challenges and fragmented environment of agencies and communities • Potentially high up-front costs • Requires reinvestment of communities and new infrastructure

and utilize multiple data sources. Certainly, more rigorous studies are needed on estimation methods. There have been some successful models of community–university collaborations for the PIT count that have leveraged university resources, involved students in civic work, and enhanced community relations.[13–15] Universities may provide viable opportunities to further develop, evaluate, and promote new estimation and data-driven approaches on how best to count and serve homeless individuals.[16] Various think tanks and research firms can also be called upon to support innovation in this area, but federal as well as private funding is needed.

Advances in computing power, digital photography and video, and artificial intelligence provide new options to enumerate homelessness. Satellite images and machine learning have been used to predict poverty[17]; street cameras may be used to identify homeless encampments and hotspots[18]; drones and helicopters equipped with thermal imaging equipment are being used to identify homeless individuals[19]; and there is potential to capture homelessness using mobile phone technologies, particularly among homeless youth.[20] With rapid technologies being developed, the current national momentum to support public health, and growing public concern about homelessness, there are unique opportunities for us to strive toward better accounting and tracking of homelessness in a post–COVID-19 era. AJPH

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PUBLICATION INFORMATION

Full Citation: Tsai J, Alarcón J. The annual homeless point-in-time count: limitations and two different solutions. *Am J Public Health.* 2022;112(4):633–637.

Acceptance Date: November 22, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306640

CONTRIBUTORS

J. Tsai conceptualized the article, consulted with stakeholders, and wrote the article. J. Alarcón helped conduct research for the article and write the article.

ACKNOWLEDGMENTS

There was no specific funding for this work. J. Tsai is employed by the US Department of Veterans Affairs. J. Alarcón received funding from the New York Academy of Medicine and the National Medical Foundation to examine the point-in-time count.

Special thanks to Katherine Gerard, LICSW, Shawn Liu, LCSW, Dennis Culhane, PhD, and Beth Sandor, BA, for providing input on earlier drafts.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

This work did not involve human participant research, so no institutional review board approval was needed.

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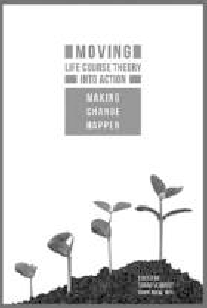

Cannabis Use Among Young Adults in Washington State After Legalization of Nonmedical Cannabis

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Objectives. To examine changes in prevalence of cannabis use and of cannabis use disorder symptomatology among young adults from 2014 to 2019 in Washington State, where nonmedical (or “recreational”) cannabis was legalized in 2012 and retail stores opened in July 2014.

Methods. We used 6 years of cross-sectional data collected annually from 2014 (premarket opening) to 2019 from 12 963 (∼2000 per year) young adults aged 18 to 25 years residing in Washington. Logistic regression models estimated yearly change in prevalence of cannabis use at different margins and related outcomes.

Results. Prevalence of past-year, at least monthly, at least weekly, and daily use of cannabis increased for young adults, although increases were driven by changes among those aged 21 to 25 years. There was also a statistically significant increase in prevalence of endorsing at least 2 of 5 possible symptoms associated with cannabis use disorder.

Conclusions. Among young adults in Washington, particularly those of legal age, prevalences of cannabis use and cannabis use disorder symptomatology have increased since legalization. This trend may require continued monitoring as the nonmedical cannabis market continues to evolve. (*Am J Public Health*. 2022;112(4):638–645. https://doi.org/10.2105/AJPH.2021.306641)

Over the past 2 decades, cannabis use prevalence has increased among young adults in the United States. Data from the National Survey on Drug Use and Health (NSDUH) showed an increase in the prevalence of any past-year cannabis use among young adults aged 18 to 25 years from 29.8% in 2002 to 35.4% in 2019.[1] This increase is concerning because cannabis use among young adults is associated with adverse short- and long-term consequences, including cognitive deficits,[2] poorer academic outcomes,[3–6] impaired driving,[7] worse mental health,[8] and addiction.[9] In 2019, 5.8% of those aged 18 to 25 years met diagnostic criteria for past-year cannabis use disorder (CUD).[9]

As of August 2021, 18 states and Washington, DC, have legalized cannabis for nonmedical (or “recreational”) use, and, in November 2012, Washington State was 1 of the first 2 states to legalize it.[10] Although cannabis use and possession for people older than 21 years were permitted 30 days after the election, the first state-licensed retail cannabis stores did not open until July 2014. Thus, there was a period of 19 months when use and possession were legal, but there were no legal means of buying or selling nonmedical cannabis. In addition to the illicit market, there was access through weakly regulated medical dispensaries.[11,12] It was not until 2015 that strong state-level regulation phased out the original medical cannabis dispensaries and incorporated the medical market into the regulated system.[13] Initially, even after July 2014, the number of nonmedical (or “retail”) stores was small and prices could not compete with the illegal and medical cannabis markets.[14] Prices of pretax cannabis flower in retail stores dropped, however, from as high as $30 per gram in 2014 to less than $7 per gram in late 2017.[15] Along with dropping prices, the number of retail outlets in the state increased.[13] Also, the variety of cannabis products increased, with a larger proportion of sales in the form of edibles, tinctures, and concentrates used in vaping.[14,16]

The inception and growth of the nonmedical cannabis market may have led to increased cannabis use and related problems, although studies comparing states with and without legalized nonmedical cannabis have yielded mixed results. In an examination of 2008–2018 data from a survey of undergraduate 4-year college students, 1 study found that prevalence of both "any" and "frequent" past-month cannabis use increased among students in states with legal nonmedical cannabis compared with use among students in other states.[17] A study using 2008–2016 NSDUH data reported that legalization was associated with statistically significant increases in "any" and "frequent" cannabis use and meeting criteria for CUD among adults 26 years and older, but not among young adults aged 18 to 25 years.[18] Differences between young adults younger or older than 21 years were not assessed, and the absence of legal access for those 18 to 20 years may partially account for the lack of evidence of increase in those aged 18 to 25 years. Evidence on changes in cannabis use among adolescents has been mixed,[18–21] including from studies that have specifically examined changes in adolescent cannabis use among Washington State high school students.[20,21]

We assessed changes from 2014 to 2019 in cannabis use among young adults in Washington State using repeated statewide cross-sectional data. We analyzed change across these cohorts in past-year use, at least monthly use, at least weekly use, and daily use of cannabis and changes in prevalence of 2 or more symptoms typically associated with cannabis dependence or CUD. In addition, we examined whether trends in these cannabis-related outcomes differed by whether young adults were aged 21 years and older or younger than 21 years.

METHODS

We collected data as part of the Washington Young Adult Health Survey, a project funded by the Division of Behavioral Health & Recovery in Washington State's Health Care Authority, to evaluate impacts of alcohol privatization and cannabis legalization among young adults in Washington. We administered 6 annual cross-sectional surveys, each with approximately 2000 respondents, between 2014 and 2019. We recruited participants from across Washington, with all geographic regions of the state represented. We recruited a new sample of study participants in each year through direct mail and online advertising. Although we did not separately track source of recruitment for cohorts 1 to 3, the proportion of participants coming from the direct mail to known Washington residents was similar across time (e.g., we recruited 59.0% of participants in cohort 4 from direct mail, 56.9% of participants in cohort 5, and 59.4% of participants in cohort 6).

The direct mail outreach was facilitated through access to Washington State Department of Licensing contact information, and a random sample of licensed drivers aged 18 to 25 years received a letter inviting their participation for each cohort. Online advertising strategies included using social media sites such as Facebook and Instagram, other online sites such as Craigslist, and a dedicated study Web site. Participants who responded to the online advertisements completed a screening survey to determine whether they met inclusion criteria of age (18–25 years) and residence in Washington State.

Participants provided digital consent and completed an online screening survey. Study staff then verified eligibility and identity through a follow-up telephone call, after which we directed them to the online baseline survey. In 2014, we collected data between late April and early August, with 69.3% of data completely collected before the opening of the first cannabis retail outlets in July. Although the remaining 30.7% were completed after stores had opened, the impact of stores opening likely did not change how most remaining participants accessed cannabis. Only 18 retail outlets opened statewide during July 2014, and only 31 had opened by August. By comparison, in July 2015 there were 163 retail outlets. Field periods in 2015 to 2019 were roughly the same length and generally launched in June and closed by November each year (except 2019, which launched in August and closed in December). The Web-based surveys contained questions on substance use, related risk factors, attitudes and acceptability, perceived norms, and health behaviors. The survey took approximately 20 minutes to complete, and participants received a $10 e-gift card as compensation.

The analytic sample consisted of 12 963 individuals who completed the survey for the first time in 2014 through 2019, provided information on sociodemographic covariates, and provided data on at least 1 of the prevalence outcomes examined. The number of participants at each survey wave ranged from 1675 in 2015 to 2493 in 2016. Geographic distribution and sociodemographic characteristics of the sample are shown in Table 1.

TABLE 1— Weighted and Unweighted Distribution of Study Participant Characteristics: Washington State, 2014–2019

Characteristic	Weighted, % or Mean ±SD	Unweighted, No. (%) or Mean ±SD
Female sex	48.6	8715 (67.2)
Race/ethnicity		
Non-Hispanic White	66.5	8359 (64.5)
Non-Hispanic Asian	7.7	1470 (11.3)
Non-Hispanic other race	15.0	1376 (10.6)
Hispanic, any race	10.8	1758 (13.6)
Geographic region		
East	24.9	2749 (21.2)
Northwest	44.8	6718 (51.8)
Southwest	30.3	3496 (27.0)
Age, y	21.5 ±2.3	21.6 ±2.3
Attending 4-y college	30.5	4116 (31.9)
Employed full-time	36.0	4432 (34.9)
Study year		
2014	. . .	2101 (16.2)
2015	. . .	1675 (12.9)
2016	. . .	2493 (19.2)
2017	. . .	2341 (18.1)
2018	. . .	2412 (18.6)
2019	. . .	1941 (15.0)

Note. The study population was n = 12 963.

Measures

Cannabis use. We adapted survey items regarding cannabis use from the Monitoring the Future survey and the Drinking Norms Rating Form.[22] Respondents were asked a question about frequency of recreational cannabis use in the past year. Response options ranged from 0 for never to 9 for every day. We based 4 binary measures of cannabis use prevalence on the answer to the past-year recreational use item: any use, at least monthly use, at least weekly use, and daily use.

Cannabis use disorder symptomatology. As we were creating the survey, terminology associated with substance use disorders changed from separate diagnostic criteria for "cannabis dependence" and "cannabis abuse" in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[23] to "cannabis use disorder" in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*.[24] The NSDUH assesses symptomatology with 18 items, historically split into 12 items that address "dependence" and 6 items that assess "abuse."[25] Participants in this study responded to 9 items adapted from the 12 questions associated with what was previously "cannabis dependence." We used the 9 items to assess the presence of 5 symptoms in the past 12 months:

1. spending considerable time obtaining, using, or getting over the effects of cannabis (1 item);
2. attempting to set limits on use (2 items);
3. increased tolerance (1 item);
4. affects emotional or psychological and physical health and whether use continued despite these effects (3 items); and
5. wanting or trying to reduce or stop use (2 items).

For analyses, we categorized individuals as having either 2 or more symptoms (1) or none or 1 (0). Although we did not capture the full range of CUD symptoms, given that *DSM-5* criteria require the presence of at least 2 of 11 symptoms, those with 2 or more symptoms in this study would likely have elevated symptomatology, aligning with what is considered a "mild" disorder per *DSM-5* criteria.

Covariates. Demographic characteristics that we used for analyses included covariates for biological sex (0 = male, 1 = female), age in years, region of the state (east, northwest, southwest), race/ethnicity (4 categories: non-Hispanic White, non-Hispanic Asian, Hispanic, and non-Hispanic other [including American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Black/African American, and multiracial]), whether participants were attending a 4-year college, and whether they were employed full-time.

Analytic Plan

To examine changes in prevalence of cannabis use and related outcomes, which were all dichotomized, we used logistic regression models. Models included data from a total of 12 689 participants with nonmissing covariate or outcome data (97.9% of the total sample). We included survey year as the primary covariate of interest and specified it in separate models (1) as a linear term to assess a linear trend from 2014 to 2019, and (2) using indicator variables to test how prevalence for a given year differed compared with 2014. All models included covariates for biological sex, indicator variables for race/ethnicity (White [reference], Asian, other race, Hispanic any race), indicator variables for geographic region (east [reference], northwest, southwest), age, attending 4-year college, and full-time employment status. To examine whether changes over time varied by age, we used the Wald test to assess interaction terms for survey year × age, where age was dichotomized as younger than 21 years (0) or 21 years or older (1).

Because of overrepresentation in the study sample of women, those of non-Hispanic Asian and Hispanic race/ethnicity, and those living in the northwest region of the state (where the Seattle metropolitan region is located) relative to the general young adult population in Washington State, we created poststratification weights that we applied to all analyses. We created strata according to sex, geographic region, and race/ethnicity. We derived weights by dividing the proportion of young adults in Washington State in that stratum according to 2010 US Census data by the proportion of young adults in the study sample in that stratum. Thus, we gave less weight to strata that were overrepresented in this sample relative to the general population and more weight to strata that were underrepresented. We used R version 3.6 (R Foundation for Statistical Computing, Vienna, Austria) for analyses using the survey package for applying poststratification weights[26] and the ggplot2 package for data visualization.[27]

RESULTS

Table 1 shows weighted and unweighted demographic characteristics of the study sample. When examining the changes in prevalence of any past-year, at least monthly, at least weekly, and daily cannabis use, we observed a statistically significant increasing linear trend from 2014 to 2019 for each category of cannabis use frequency (all $Ps \le .021$ for linear trend for study year; Figure 1). Based on models including indicator variables for year, the model-predicted prevalence of any past-year use of cannabis increased from 39.8% in 2014 to 43.3% in 2019, and prevalence of at least monthly use increased from 19.3% to 22.0%. Model-based odds ratios (ORs) for yearly change in the odds for each outcome and unadjusted weighted prevalence estimates by year are available in Tables A–C (available as a supplement to the online version of this article at http://www.ajph.org). We observed a statistically significant cohort × age interaction for any past-year ($F_{1,12\,688} = 5.48$; $P = .019$) and at least monthly ($F_{1,12\,688} = 4.71$; $P = .030$) use, such that the increasing trend was restricted to those aged 21 years or older (Figure 2).

The prevalence of endorsing at least 2 of 5 possible CUD symptoms also increased over time (Figure 3; Tables A–C present the ORs). The model-predicted prevalence estimates of endorsing at least 2 disorder symptoms were 5.7% in 2014 and 8.6% in 2019. There was no statistically significant cohort × age interaction ($F_{1,12\,633} = 1.54$; $P = .22$).

DISCUSSION

We have provided an initial examination of trends in cannabis use prevalence among young adults aged 18 to 25 years following legalization of nonmedical cannabis use for adults aged 21 years or older in Washington State. Five years of data after retail outlets opened showed that the prevalence of any past-year, at least monthly, at least weekly, and daily cannabis use has increased among young adults aged 18 to 25 years. Unlike national data, the data showing this trend showed no signs of plateauing during the study period (2014–2019). A significant cohort × age interaction suggested that the increase was primarily driven by those older than 21 years.

These findings highlight the potential importance of prevention efforts accompanying changes to the legal status of cannabis. For example, our results

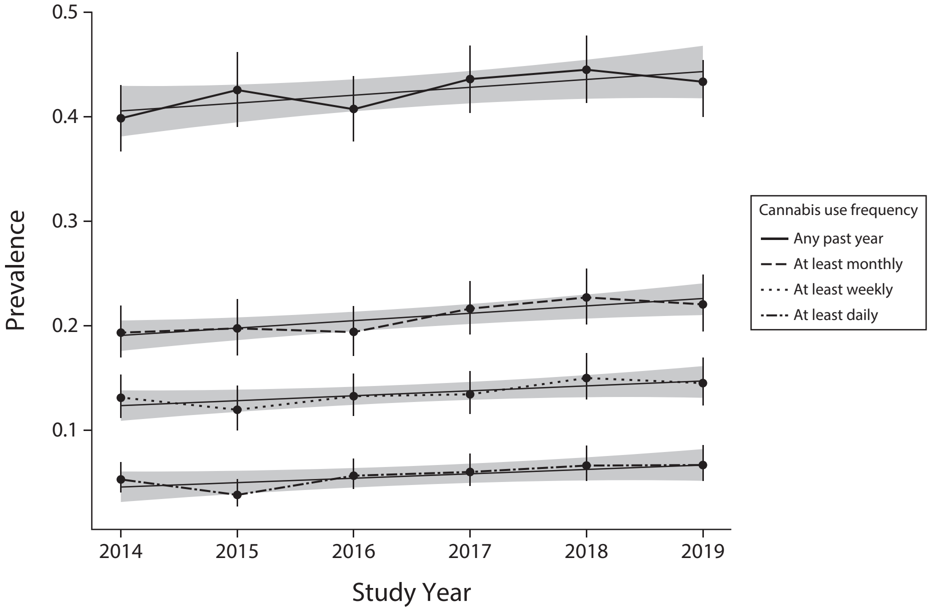

FIGURE 1— Model-Predicted Prevalence of Cannabis Use With Linear Trend Lines at Different Margins Among Young Adults: Washington State, 2014–2019

suggest that cannabis use among young adults older than 21 years has increased after legalization, so prevention and intervention efforts could be needed in this changing legal climate. Furthermore, future studies could explore community-level influences on prevalence of use, such as the increasing presence of cannabis retail outlets as well as the economic shifts (e.g., the decreasing prices of legal cannabis products) and changes in illegal markets over time.

Generally, we saw less change in cannabis use among younger adults (i.e., those aged 18–20 years), who may have been less affected by the expansion and evolution of the retail market after 2014 because of the inability to legally purchase nonmedical cannabis in stores. In fact, with the clear regulations of the medical market that arrived in 2015 and that included a state-regulated system of medical cannabis patients,[11] access to medical cannabis became more challenging for people younger than 21 years. Among high school seniors who participated in Washington's Healthy Youth Survey,[28,29] the percentage who said cannabis would be "very easy" to get declined from 2012 (42.2%) to 2018 (37.8%), which may have been related to the shutdown of Washington's previously poorly regulated medical market in 2016.[11]

Additionally, after the legalization of nonmedical cannabis (i.e., Initiative 502) was enacted, coalitions (e.g., the Washington Healthy Youth Coalition), prevention professionals, and state organizations (e.g., Office of Superintendent of Public Instruction) implemented or supported implementation of prevention programs that intended to reduce youth cannabis use. Moreover, many college campuses incorporated cannabis prevention content with incoming first-year students, and cannabis prevention was the focus of many presentations and trainings statewide. Although we did not assess the impact of these prevention efforts, it is possible that the absence of an increase by those younger than 21 years could have been the result of these intensive (and intentional) prevention efforts.

Importantly, the prevalence of CUD symptomatology has also increased since legalization was implemented. Given the association between CUD-related symptoms and increased frequency of use,[2] the increases in prevalence of CUD symptomatology that we saw are not surprising when examined alongside the increased prevalence of frequent use. Indeed, it should be noted that the prevalence of frequent use (daily or weekly) was high among both age groups at all time points, and the prevalence of daily use among those aged 21 years or older had risen from 6.3% in 2014 to 10.2% in 2019.

Another explanatory factor could be the increasing THC (tetrahydrocannabinol, the main psychoactive compound in cannabis) potency of cannabis products sold in the legal market,[16,30] including increasing market share of manufactured cannabis products such

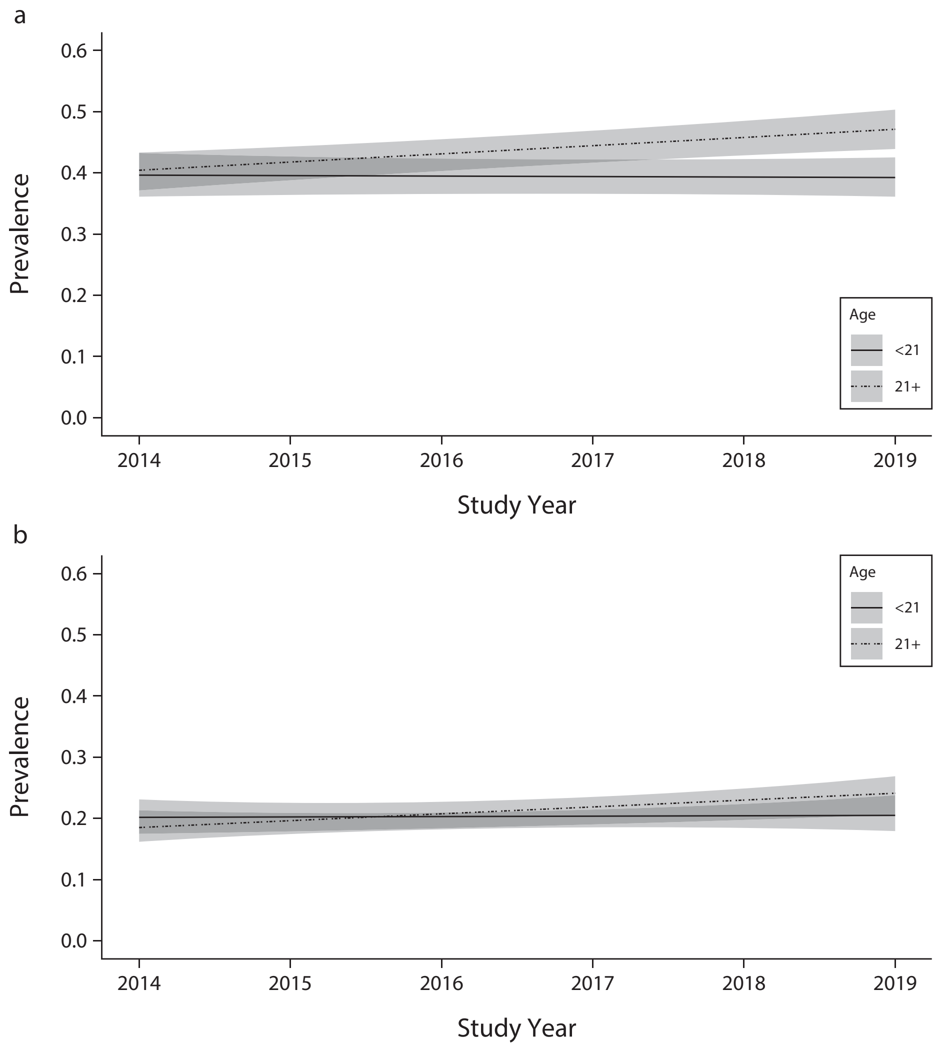

FIGURE 2— Model-Predicted Linear Trend in (a) Any Past-Year Cannabis Use, and (b) at Least Monthly Use by Age: Washington State, 2014–2019

as concentrates, edibles, and vaping products, which are often higher in THC.[14] In addition, the potency of cannabis flower (the product that still accounts for the majority of sales) has increased over time nationwide,[31] and even more so in Washington State,[30] and more than 92% of all flower sales are of strains with more than 15% THC.[16] Greater THC potency may increase the risk of CUD symptoms beyond the frequency of use, and this could be examined in future studies.[9]

Furthermore, the "approachability" of more novel dab pens and vape pens could provide more convenient ways to use cannabis, and future studies could explore the degree to which these products play a part in changes in cannabis use. Collectively, the increased availability, lower price, and greater potency of cannabis may have led to increased cannabis use and related problems, and future studies can continue to explore the possible relationships among these variables.

Limitations of this study include examining trends in only 1 state where cannabis has been legalized for nonmedical use. We were unable to make comparisons with cannabis use trends in states where cannabis has not been legalized. Some of the general trends we see in our data are similar to trends in national data reviewed earlier and may have less to do with legalization and implementation of the retail cannabis market and more to do with national trends rooted in greater tolerance of cannabis use. Another limitation is that

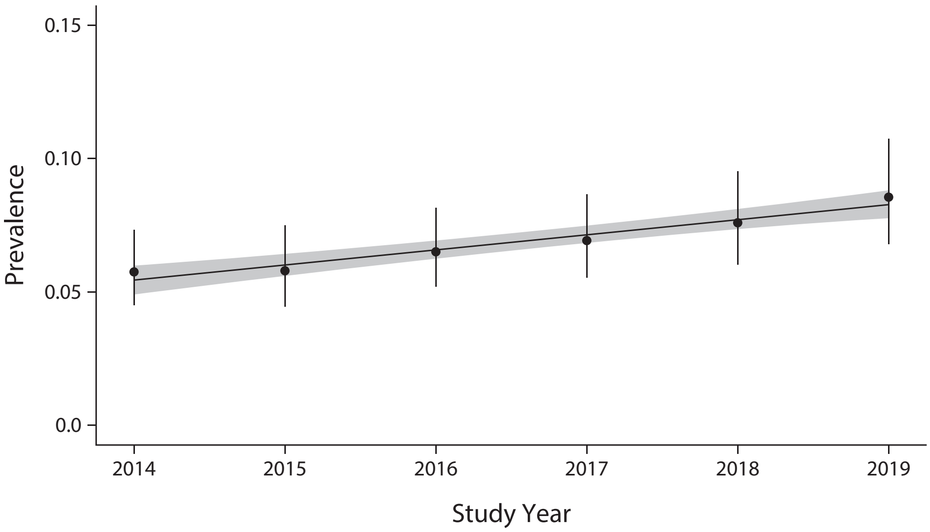

FIGURE 3— **Model-Predicted Prevalence With Linear Trend Line of at Least 2 Past-Year Cannabis Use Disorder Symptoms Among Young Adults: Washington State, 2014–2019**

although recruitment strategies were similar across years, our recruitment approach may not have yielded a representative sample relative to Washington State. For example, women were overrepresented in this study. However, our analyses applied poststratification weighting to make distribution of key demographic characteristics similar to the general young adult population in Washington.

Because the survey's space constraints meant we could not use many full measures, we adapted the assessment of symptomatology associated with CUD from the items of the NSDUH, and future studies could use a more thorough assessment that addresses all potential criteria associated with CUD. Additionally, it would have been helpful to have data from 2012 (when Initiative 502 was being considered) and 2013 (when legalization had been enacted but stores had not yet opened), and it is a limitation that conclusions are constrained to the window following 2014. Finally, although many of our items are self-reports of past-year behavior, the length and timing of the assessment periods across cohorts were not constant over time.

Despite limitations, our findings point to an increasing prevalence of cannabis use, including daily use, among young adults older than 21 years following the legalization of cannabis. For many young adults, this was not solely an increase in frequency, given the increase in endorsing symptomatology that can be associated with CUD. Based on these findings, we encourage continued monitoring of cannabis use and misuse, prevention efforts to reduce harmful misuse of cannabis, and making treatment readily available for young adults whose cannabis use reaches the point of a substance use disorder. Screening could be 1 strategy to identify high-risk or hazardous use in this age group, and brief interventions have been shown to reduce use, time spent high, and consequences.[32] Particularly if referral to treatment is warranted or even requested, this could have an impact on young adults who may be struggling with cannabis use and any unwanted effects. AJPH

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PUBLICATION INFORMATION

Full Citation: Kilmer JR, Rhew IC, Guttmannova K, et al. Cannabis use among young adults in Washington State after legalization of nonmedical cannabis. *Am J Public Health*. 2022;112(4):638–645.

Acceptance Date: November 22, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306641

CONTRIBUTORS

J. R. Kilmer oversaw data collection and contributed to all sections of the article. I. C. Rhew oversees data analysis for the Young Adult Health Survey, conducted all analyses and data visualizations, and was largely responsible for the presentation of the Results section. K. Guttmannova wrote parts of the Introduction, Results, and Discussion sections. K. Guttmannova and C. B. Fleming contributed to

analytic strategy and decisions. C. B. Fleming wrote parts of the Introduction and Methods sections. B. A. Hultgren added to the Methods and Results sections. B. A. Hultgren and M. S. Gilson contributed to analytic strategy. M. S. Gilson and J. Dilley wrote part of the Discussion section and provided overall article feedback. R. L. Cooper is the research coordinator for the Young Adult Health Survey, recruited participants, and was the primary contributor to the Methods section. M. E. Larimer is a co-investigator on the Young Adult Health Survey and provided data collection oversight and overall article feedback. All authors reviewed and edited the article.

ACKNOWLEDGMENTS

This research was supported by National Institute on Drug Abuse, the National Institutes of Health ([NIH] grant R01DA047996; principal investigator [PI] K. Guttmannova) and the Division of Behavioral Health and Recovery, Washington State Health Care Authority ([HCA] contract 1265-62496; PI: J. R. Kilmer). B. A. Hultgren's time working on this article was supported by National Institute on Alcohol Abuse and Alcoholism (NIAAA), NIH (grant K01AA027771; PI: B. A. Hultgren). Part of M. S. Gilson's contribution was supported by the NIAAA (training grant T32AA007455; PI: M. E. Larimer).

General trends from the Young Adult Health Survey (particularly rates of past-year prevalence) have been presented to coalitions, stakeholders and partners in Washington State, and young adults (when discussing perceived and actual norms).

We thank Sarah Mariani, Sandy Salivaras, and Washington's Division of Behavioral Health and Recovery for their support of the Young Adult Health Survey.

Note. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Washington State HCA.

CONFLICTS OF INTEREST

The authors report no potential or actual conflicts of interest from funding or affiliation-related activities.

HUMAN PARTICIPANT PROTECTION

All initial measures and procedures, as well as all modifications that followed, were reviewed and approved by the University of Washington institutional review board.

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Spatial Distribution of Hateful Tweets Against Asians and Asian Americans During the COVID-19 Pandemic, November 2019 to May 2020

Alexander Hohl, PhD, Moongi Choi, MS, Aggie J. Yellow Horse, PhD, Richard M. Medina, PhD, Neng Wan, PhD, and Ming Wen, PhD

See also Hswen, p. 545.

Objectives. To illustrate the spatiotemporal distribution of geolocated tweets that contain anti-Asian hate language in the contiguous United States during the early phase of the COVID-19 pandemic.

Methods. We used a data set of geolocated tweets that match with keywords reflecting COVID-19 and anti-Asian hate and identified geographical clusters using the space-time scan statistic with Bernoulli model.

Results. Anti-Asian hate language surged between January and March 2020. We found clusters of hate across the contiguous United States. The strongest cluster consisted of a single county (Ross County, Ohio), where the proportion of hateful tweets was 312.13 times higher than for the rest of the country.

Conclusions. Anti-Asian hate on Twitter exhibits a significantly clustered spatiotemporal distribution. Clusters vary in size, duration, strength, and location and are scattered across the entire contiguous United States.

Public Health Implications. Our results can inform decision-makers in public health and safety for allocating resources for place-based preparedness and response for pandemic-induced racism as a public health threat. (*Am J Public Health*. 2022;112(4):646–649. https://doi.org/10.2105/AJPH.2021.306653)

AJPH April 2022, Vol 112, No. 4

Since the first confirmed case of COVID-19 in the United States on January 19, 2020,[1] anti-Asian racist and xenophobic rhetoric has surged on social media,[2,3] followed by acts of discrimination and harassment against Asians and Asian Americans in the United States. Between March 19 and May 13, 2020, 1843 hate incidents were reported to the Stop AAPI (Asian American and Pacific Islander) Hate reporting center.[4] The surge of anti-Asian hate is deeply rooted in the Yellow Peril ideology, which racializes Asians as a threat to US and Western culture,[5] including reimagining Asians as a diseased public health threat.[6] What remains unexplored is the spatial concentration of anti-Asian sentiment on social media. Although the online environment of social media is aspatial, spatiotemporal information from social media can provide critical insights about relationships between online sentiment and physical localities,[7] and may reflect spatial differences in social and cultural norms and historical contexts of hate activities.[8]

This study aims to assess the spatial and temporal distributions of tweets containing hateful language toward Asians and Asian Americans in the United States from November 2019 to May 2020, by identifying geographical clusters across US counties. To our knowledge, this is the first spatiotemporal assessment of anti-Asian hate on social media during the early phase of the pandemic.

METHODS

We purchased 4 234 694 geolocated tweets from Twitter. We included tweets in English, located in the contiguous United States, that matched a list of COVID-19 keywords (e.g., “covid2019,” “SARSCoV2”; Table A, available as a supplement to the online version of this article at http://www.ajph.org) and that were sent between November 1, 2019, and May 15, 2020. We excluded tweets with imprecise location information (i.e., tweets that could only be matched at the state level). We classified the remaining 3 274 614 tweets into hateful or nonhateful based on presence of additional keywords related to anti-Asian hate in the tweet body (e.g., “kungflu,” “Wuhanvirus”; Table B, available as a supplement to the online version of this article at http://www.ajph.org), and assigned them to US counties. An example of a hateful tweet is, “The true spelling of the coronavirus is #Wuhanvirus.” The keywords represent anti-Asian hate in general as well as in the context of COVID-19; we sourced them from hatebase.org and 2 studies on similar topics.[3,9] We chose this approach over more sophisticated machine learning classifiers because of simplicity and training data requirements. In addition, we assessed the accuracy of our classifier against a set of 500 manually labeled tweets. The county-level counts of hateful and nonhateful tweets correspond to case–control data that can be modeled using the Bernoulli distribution.

To identify spatiotemporal clusters of anti-Asian hate, we employed the space-time scan statistic (STSS) with Bernoulli model.[10] The STSS finds the most likely cluster of hateful tweets using spatial and temporal scanning windows (maximum window size: 5% of population at risk, 50% of study duration) with significance level $P < .05$. We visualized the spatial distribution of anti-Asian hate as a choropleth map of the relative risk (RR, the proportion of hateful tweets inside a region divided by the proportion outside). Lastly, we supplemented the map with circular clusters identified by STSS.

RESULTS

The keyword-based tweet classification resulted in 10 823 tweets (0.31%) that included anti-Asian hate language. Their temporal distribution indicated (1) low hate from November 2019 to January 2020 (0%–0.1% of daily tweets hateful); (2) low total number of daily tweets, but a high percentage of hateful tweets in January 2020 (1.5% out of 2884 daily tweets hateful); (3) a second peak in mid-March 2020 (1% out of 90 075 daily tweets hateful); and subsequent decline. An accuracy assessment of our classifier resulted in interrater agreement of 94% and accuracy of 90%.

The STSS identified 15 clusters of anti-Asian hate (Figure 1—for example, cluster 9, which included 21 counties in Connecticut, New York, and Massachusetts and had an RR of 3.39, which means the proportion of hateful tweets inside cluster 9 was 3.39 times higher than outside (Table C, available as a supplement to the online version of this article at http://www.ajph.org). We found the highest RRs in small clusters consisting of 1 county each (cluster 1, RR = 312.13; cluster 2, RR = 14.24; cluster 7, RR = 30.05; cluster 8, RR = 138.71). Therefore, cluster 1 (Ross County, Ohio) was the strongest cluster. Although these clusters exhibited a low total number of tweets (62, 3793, 364, and 46, respectively), cluster 3 (RR = 3.17) topped this category (63 349). Given the extreme variations in size, location, and proportion of hateful tweets, cluster statistics varied considerably.

DISCUSSION

In this study, we classified geolocated tweets into hateful or nonhateful against Asians based on a set of keywords. We described the spatiotemporal distribution of anti-Asian tweets and identified statistically significant clusters (Figure 1, Table C). The main strength of our approach is the ability to delineate areas and time periods that exhibited strong anti-Asian language. In addition, Figure 1 illustrates statistically significant clusters of increased anti-Asian tweets as well as within-cluster variation.

Significant clusters included rural places, as well as high–population density cities in the United States. It is worth noting that our clusters at least partially included the most populous urban regions, often together with their surrounding suburban and rural areas. In summary, clusters are scattered and there is no identifiable pattern of anti-Asian hate along urban–rural and geographic gradients. Further analysis including demographic and socioeconomic factors may explain cluster locations. Our findings differ from similar studies,[3,9] which identified a spike in the number of anti-Asian tweets starting in March 2020, but not in January 2020. Whereas their results focused on absolute number of tweets, our graphs and analyses are based on hateful tweets normalized by nonhateful tweets, rather than bare counts.

A limitation of our approach is our keyword-based classifier. A tweet stating “It is wrong to blame China” would be falsely classified as hateful; use of machine learning–based classifiers may address this problem.[9] Another limitation stems from the use of geolocated tweets, which have biases regarding

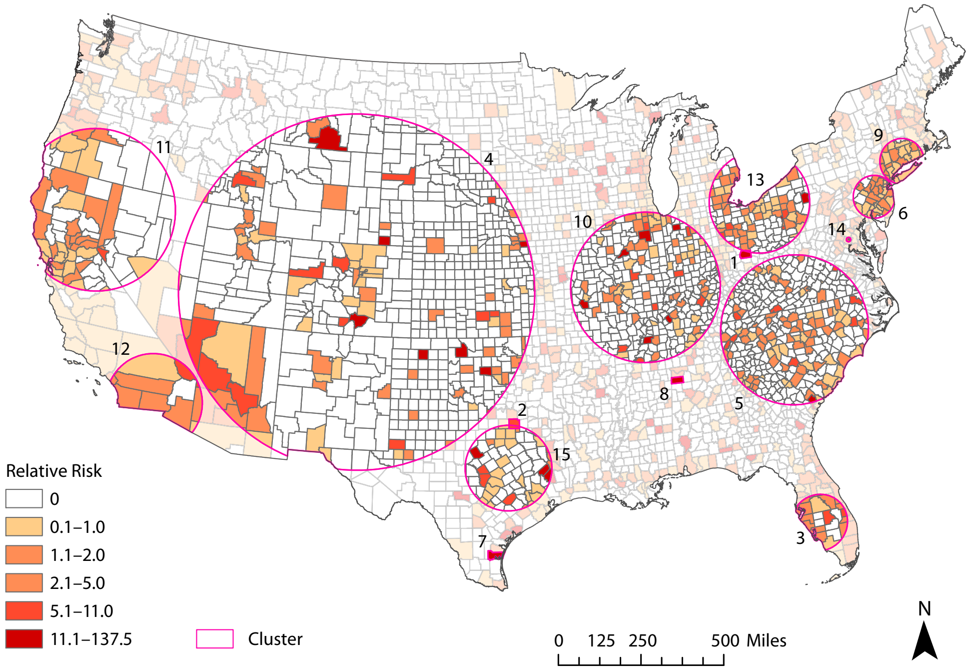

FIGURE 1— **The Spatial Distribution of Hateful Tweets Against Asians and Asian Americans: United States, November 2019–May 2020**

Note. Map of the relative risk (RR), augmented by clusters identified by the space-time scan statistic.

spatial distribution, demographics, and topics.[11] Lastly, our study is exploratory in nature, and the results serve as a pointer towards areas that exhibit anti-Asian sentiment, which should be further analyzed in follow-up studies.

PUBLIC HEALTH IMPLICATIONS

The ability to clearly delineate areas (clusters) of anti-Asian hate allows for designing and implementing place-based targeted response measures, such as awareness campaigns, adjustments of communication strategies, hate crime prevention, and public safety resource allocation. A next step is to better understand the relationship between anti-Asian hate sentiment and hate incidents. The STSS has proven to be suitable for monitoring hateful tweets because of its 4 outputs: the geographic extents of clusters, duration, strength (RR), and statistical significance. Such monitoring can be conducted in real time as new data become available.[12]

Hate, xenophobia, and extremist White nationalism within the United States have grown in recent years. Conspiracy theories are rampant and work to create “enemies,” such as the scapegoating of Asians and Asian Americans during the COVID-19 pandemic. This is an example of hate campaigns toward groups of people, and the results of our study may contribute to removing negative associations from Asian Americans during the ongoing public health threat.

Although racism has been recognized as a public health threat,[13] further research is needed to assess how anti-Asian hate in social media affects individual and community health. The deleterious effects of hateful racist and xenophobic language on the mental health of Asians and Asian Americans have been documented for COVID-19,[14] but whether such effects are long lasting is unknown. Health departments may take additional steps to prevent and mitigate hate-related health needs (e.g., by increasing culturally and linguistically appropriate counseling services or trauma support for individuals in affected areas). This place-based approach can be especially helpful for Asians and Asian Americans in areas with small local Asian populations without appropriate services available otherwise.

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PUBLICATION INFORMATION

Full Citation: Hohl A, Choi M, Yellow Horse AJ, Medina RM, Wan N, Wen M. Spatial distribution of hateful tweets against Asians and Asian Americans during the COVID-19 pandemic, November 2019 to May 2020. *Am J Public Health*. 2022; 112(4):646–649.

Acceptance Date: December 4, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306653

CONTRIBUTORS

A. Hohl was the lead author. M. Choi provided important data processing and analysis. A. J. Yellow Horse, R. M. Medina, N. Wan, and M. Wen provided strategic and editorial oversight of the work. All authors gave vital contributions to this article and the work it describes.

ACKNOWLEDGMENTS

This work was supported by the Immunology, Inflammation and Infectious Diseases Initiative and the Office of the Vice President for Research of the University of Utah.

We thank graduate students Serena Madsen, Ronae Matriano, Katherine Chipman, Makaio Kimbrough, and Marco Allain for their indispensable assistance.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

This research was declared exempt from University of Utah, Salt Lake City institutional review board review per protocol IRB_00132748.

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Prevalence of E-Cigarette Use and Its Associated Factors Among Youths Aged 12 to 16 Years in 68 Countries and Territories: Global Youth Tobacco Survey, 2012–2019

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See also Seaman, p. 541.

Objectives. To describe the recent global prevalence of e-cigarette use and to investigate its associated factors among youths aged 12 to 16 years in 68 countries and territories (hereafter "countries").

Methods. We analyzed 485 746 youths aged 12 to 16 years from the population-based cross-sectional Global Youth Tobacco Survey conducted in 67 countries between 2012 and 2019 and the 2019 National Youth Tobacco Survey in the United States. We defined past-30-day e-cigarette use as using e-cigarettes on 1 or more days during the past 30 days.

Results. The global prevalence of past-30-day e-cigarette use among youths was 9.2%, ranging from 1.9% in Kazakhstan to 33.2% in Guam. Maternal smoking (adjusted odds ratio [AOR] = 1.40; 95% confidence interval [CI] = 1.29, 1.52), paternal smoking (AOR = 1.13; 95% CI = 1.07, 1.19), secondhand smoke exposure (AOR = 1.74; 95% CI = 1.64, 1.84), youth cigarette smoking (AOR = 7.18; 95% CI = 6.84, 7.54), and youth other tobacco use (AOR = 3.88; 95% CI = 3.62, 4.15) were positively associated with e-cigarette use.

Conclusions. E-cigarette use was moderately frequent among youths aged 12 to 16 years globally. Several important factors were associated with youth e-cigarette use.

Public Health Implications. Our findings highlight the need for countries worldwide to develop policies to address e-cigarette use among youths. (*Am J Public Health*. 2022;112(4):650–661. https://doi.org/10.2105/AJPH.2021.306686)

The use of tobacco products, particularly combustible cigarettes, is the current second-leading cause for global deaths, accounting for nearly 9 million deaths (∼15% of all deaths) in 2019.[1] Electronic cigarettes (e-cigarettes) do not use or burn tobacco leaves but heat e-liquid to vaporize aerosol containing flavorings dissolved in glycerin and propylene glycol.[2] A National Academics of Science, Engineering, and Medicine report suggested that e-cigarettes may be less harmful to health than combustible cigarettes because of not emitting combustible tobacco smoke, and they might be used as a substitute for combustible cigarettes for adult smokers.[3] A most recent Cochrane review with moderate-certainty evidence reported that e-cigarettes containing nicotine (i.e., electronic nicotine delivery systems [ENDS]) suggested potential benefits as a smoking cessation aid compared with usual care or no treatment, whereas further evidence is needed to investigate the potential adverse effects of e-cigarettes on human health.[4]

Accumulative evidence has shown that e-cigarette use has acute adverse effects on endothelial dysfunction and cerebral and vascular oxidative stress.[5,6] However, the long-term safety of e-cigarettes has not been yet comprehensively quantified, and limited evidence has shown that e-cigarette use may have detrimental effects on pulmonary and cardiovascular systems.[7] ENDS may have additional adverse effects on memory, attention, and learning skills.[8] Other ingredients in e-cigarettes, such as flavoring additives and propylene glycol, may also have adverse effects on health.[9] The use of e-cigarettes might lead to consumption of combustible cigarettes among individuals who did not smoke combustible cigarettes previously, particularly among adolescents and young adults,[10–12] whereas the evidence is limited because of self-reported e-cigarette use instead of biochemical verification. In addition, e-cigarettes can also favor the consumption of other addictive substances such as alcohol and marijuana.[8,13] Therefore, considering the potential and uncertain adverse effects of e-cigarettes on health, monitoring the prevalence of e-cigarette use among youths is helpful to suggest opportunities for interventions and actions for policymakers at the national and local level.

It is reported that e-cigarette use (defined as use 1 day or more during the past 30 days) has increased from 0.6% in 2011 to 4.9% in 2018 among US middle-school students and from 1.5% to 20.8% among high-school students,[14] with a concomitant decrease in the prevalence of combustible cigarette smoking (middle-school students: 4.3% to 1.8%; high-school students: 15.8% to 8.1%). The use of e-cigarettes has also largely increased among older youths aged 16 to 19 years from 2017 to 2019 in Canada (8.4% to 17.8%) and England (8.7% to 12.6%).[15,16] However, limited data exist about e-cigarette use among youths in many other countries worldwide, particularly in low- and middle-income countries.

In this study, we estimated the recent prevalence of e-cigarette use among youths aged 12 to 16 years in 68 countries and territories (hereafter referred to as "countries") that had conducted a Global Youth Tobacco Survey (GYTS) and in the United States, which had a similar survey (National Youth Tobacco Survey [NYTS]). We also examined the association between selected influencing factors (including parental smoking, survey year, World Bank income level, youth cigarette smoking, youth other tobacco use, and secondhand smoke exposure) and e-cigarette use in youths.

METHODS

The most recent data on e-cigarette use among youths aged 12 to 16 years were extracted from the school-based GYTS conducted in 67 countries. The GYTS protocol was developed by the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC). Sampling followed a same 2-stage sampling strategy in all countries based on randomly selecting schools in each country considering the national or subnational populations in the first phase, and randomly selecting classes from the selected schools in the second phase. All included participants from each country voluntarily filled out a standard and anonymous questionnaire. Data from the GYTS are publicly available from the CDC Web site (https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html). For this study, we used all available GYTS data in the 67 countries that had conducted the GYTS between 2012 and 2019 (because data on e-cigarette use were available since 2012). All surveys were approved by the participating countries.

Because the GYTS was not conducted in the United States, we used similar data from the US NYTS done in 2019. The NYTS is a national survey of tobacco use and related factors among youths, with similar methods as the GYTS. In particular, the question and possible answers on e-cigarette use were identical in the GYTS and NYTS. Details on NYTS methodology are available electronically at https://www.cdc.gov/tobacco/data_statistics/index.htm. All participating youths and their parents gave informed consent for participation in the GYTS in all included countries and in the NYTS. A total of 485 746 youths aged 12 to 16 years with complete data on all variables of interest from the GYTS and the NYTS were included in the current study.

Definition of E-Cigarette Use and Tobacco Use

Past-30-day e-cigarette use in youths was defined as using e-cigarettes on 1 or more days during the past 30 days. Participants were asked to respond to the question "During the past 30 days, on how many days did you use e-cigarettes?" with the corresponding possible answers comprising "0 day," "1 to 2 days," "3 to 5 days," "6 to 9 days," "10 to 19 days," "20 to 29 days," and "All 30 days." The other frequency categories of e-cigarette use were defined as using e-cigarettes on 3 or more, 6 or more, and 10 or more days during the past 30 days. The e-cigarette use on 21 or more days or on 51 or more days of entire life was defined according to the question "How many days have you used an e-cigarette in your entire life?"

with corresponding responses of "0 day," "1 day," "2 to 10 days," "11 to 20 days," "21 to 51 days," and "51 to 100 days."

Past-30-day cigarette smoking in youths was assessed with the question "During the past 30 days, on how many days did you smoke cigarettes?" and smoking was defined as using cigarettes on 1 or more days during the past 30 days. Other tobacco use was assessed with the question "During the past 30 days, have you ever used any form of tobacco products other than cigarettes (e.g., chewing tobacco, snuff, dip, cigars, cigarillos, little cigars, or pipe)?" with answers of "Yes" or "No." Secondhand smoke exposure was assessed with the following 2 questions: "During the past 7 days, on how many days have people smoked in your home, in your presence?" and "During the past 7 days, on how many days have people smoked in your presence, in places other than in your home?" and defined as exposure to secondhand smoke at home or in other places on at least 1 day during the past 7 days. Parents' smoking status was assessed with the question "Do your parents smoke tobacco?" The corresponding possible answers were "Neither," "Father only," "Mother only," and "Both."

We extracted the policies on e-cigarette use in each included country and territory from the Web sites of the Institute for Global Tobacco Control supported by Johns Hopkins Bloomberg School of Public Health (i.e., https://globaltobaccocontrol.org/en/policy-scan/e-cigarettes/countries?country=263; https://www.tobaccocontrollaws.org/legislation). We obtained country income level from the World Bank classification according to the conducted year of GYTS survey.

Statistical Analysis

We calculated prevalence estimates and 95% confidence intervals (CIs) in each country by using the primary sampling units, strata, and sampling weights provided in the participating countries in the dataset. We used the χ^2 test to test differences in prevalence estimates between groups (i.e., sex, age group, and WHO region). We used multivariable logistic regression analyses considering the primary sampling units, strata, and sampling weights to examine the associations of sex, age group, parental smoking, youth cigarette smoking, youth other tobacco use, World Bank income level, survey year, and secondhand smoke exposure with youth e-cigarette use. There was no multicollinearity between all included variables, including the outcome (Table A, available as a supplement to the online version of this article at http://www.ajph.org). Therefore, all variables were included in the logistic regression model for analysis.

We conducted data analyses with SPSS version 16.0 using the Complex Samples module (SPSS Inc, Chicago, IL). We calculated total and subgroup-specific prevalence estimates by using meta-analysis with a random-effects model conducted with Stata version 11.0 (StataCorp LP, College Station, TX), because of the high heterogeneity ($I^2 > 50\%$) between countries by using the following command: "metan r ser, random label (namevar=study)," where "r" represents the prevalence of each country and "ser" represents standard error. We considered a 2-sided P level of less than .05 or nonoverlapped 95% CIs to be statistically significant because 95% CIs could be simultaneously provided independent of the change in sample size.[17,18]

RESULTS

The study included 485 746 youths aged 12 to 16 years (males: 50.1%) from the 68 included countries and territories (Macao is the special administrative region of China; Guam is an overseas territory of the United States; Gaza and West Bank are territories of Palestine) with data on e-cigarettes between 2012 and 2019. If a country had conducted more than 1 survey in the interval, we considered the latest survey, which was the case for 5 countries (Georgia, Romania, San Marino, China [without raw data], and the United States). Of these 68 countries (from Finland in 2012 to the United States and China in 2019), 4 (5.9%) were located in the WHO African region, 22 (32.4%) in the American region, 10 (14.7%) in the Eastern Mediterranean region, 19 (27.9%) in the European region, 1 (1.5%) in the Southeast Asian region, and 12 (17.6%) in the Western Pacific region; 15 of 68 countries (22.1%) had implemented policies on ENDS and electronic nonnicotine delivery systems (ENNDS) before the survey year of e-cigarette use in the country (Table 1).

As shown in Table 2 and Figure A (available as a supplement to the online version of this article at http://www.ajph.org), 9.2% (95% CI = 8.2%, 10.2%) of youths aged 12 to 16 years in 68 countries reported having used e-cigarettes on 1 or more days during the past 30 days, 3.9% (95% CI = 3.4%, 4.4%) on 3 or more days, 2.2% (95% CI = 1.9%, 2.5%) on 6 or more days, and 1.4% (95% CI = 1.2%, 1.6%) on 10 or more days. The prevalence of past-30-day e-cigarette use on 1 or more days was higher among male youths (11.7%; 95% CI = 10.5%, 13.0%) and

TABLE 1— **Characteristics of Global Youth Tobacco Surveys Among Youths Aged 12–16 Years in 68 Countries and Territories, Using the Most Recent Data in Each Country: 2012–2019**

Country or Territory	Representativeness	Survey Year	Sample Size	Male Youths, %	Availability of Policy for E-Cigarettes[a]
Africa					
Ghana	National	2017	5 253	50.7	No
Mauritania	National	2018	3 273	50.0	No
Mauritius	National	2016	3 944	48.7	No
Seychelles	National	2015	2 384	49.9	No
Americas					
Antigua and Barbuda	National	2017	1 961	51.0	No
Argentina	National	2018	1 329	49.2	Yes
Belize	National	2014	1 714	48.4	No
Bolivia	National	2018	4 365	50.0	No
Chile	Subnational	2016	10 898	49.3	No
Cuba	National	2018	4 043	50.9	No
Dominican Republic	National	2016	1 222	47.7	No
Ecuador	National	2016	5 051	49.8	No
El Salvador	National	2015	2 984	50.0	No
Grenada	National	2016	2 014	49.8	No
Guatemala	National	2015	3 943	51.9	No
Guyana	National	2015	1 538	49.7	No
Jamaica	National	2017	1 383	44.5	No
Nicaragua	National	2014	3 938	49.0	No
Panama	National	2017	2 544	50.1	Yes
Paraguay	National	2014	6 453	49.6	No
Peru	National	2014	3 497	50.4	No
Saint Lucia	National	2017	1 456	51.0	No
Saint Vincent and the Grenadines	National	2018	1 294	49.5	No
Suriname	National	2016	1 772	47.8	Yes
Trinidad and Tobago	National	2017	3 420	48.4	No
United States[b]	National	2019	13 642	52.2	Yes
Eastern Mediterranean					
Iraq	National	2014	1 600	53.6	No
Morocco	National	2016	3 704	43.6	No
Oman	National	2016	2 015	49.0	Yes
Qatar	National	2018	1 844	46.3	Yes
Tunisia	National	2017	2 390	50.2	No
UNRWA Gaza (Palestine)[c]	Regional	2013	1 664	50.4	No
UNRWA Jordan	Regional	2014	1 305	51.2	No
UNRWA Lebanon	Regional	2013	1 400	45.6	No
UNRWA West Bank (Palestine)[c]	Regional	2014	1 332	41.0	No
Yemen	National	2014	1 857	60.5	No

Continued

TABLE 1— Continued

Country or Territory	Representativeness	Survey Year	Sample Size	Male Youths, %	Availability of Policy for E-Cigarettes[a]
Europe					
Albania	National	2015	4 483	52.7	No
Bulgaria	National	2015	3 970	51.9	No
Croatia (Hrvatska)	National	2016	3 201	49.9	No
Czech Republic	National	2016	3 914	51.4	No
Finland	National	2012	4 769	50.5	No
Georgia	National	2017	1 266	50.6	No
Greece	National	2013	4 515	51.7	No
Kazakhstan	National	2014	2 043	49.7	No
Kosovo	National	2016	4 925	51.5	No
Latvia	National	2014	4 256	49.8	Yes
Malta	National	2017	1 225	55.3	No
Poland	National	2016	4 996	51.2	Yes
Republic of North Macedonia	National	2016	5 081	52.5	No
Romania	National	2017	5 294	51.2	Yes
Russian Federation	Subnational	2015	6 490	50.6	No
San Marino	National	2018	594	55.5	No
Serbia	National	2017	3 780	49.5	Yes
Slovakia	National	2016	3 955	49.9	No
Ukraine	National	2017	3 978	50.8	Yes
Southeast Asia					
Thailand	National	2015	1 863	51.1	Yes
Western Pacific					
Cambodia	National	2016	2 784	48.2	Yes
Cook Islands	National	2016	479	48.2	No
China	National	2019	273 206	51.8	No
Fiji	National	2016	2 274	48.5	Yes
Guam[d]	National	2017	1 736	52.2	No
Kiribati	National	2018	1 882	47.6	No
Laos	National	2016	5 625	50.2	No
Macao (China)[e]	Regional	2015	1 635	50.3	Yes
Marshall Islands	National	2016	2 233	44.2	No
Papua New Guinea	National	2016	1 854	50.6	No
Samoa	National	2017	1 467	48.7	No
Vanuatu	National	2017	1 547	47.1	No
Total			485 746	50.1	

Note. UNRWA = United Nations Relief and Works Agency for Palestine Refugees in the Near East.

[a] Data are from https://www.tobaccocontrollaws.org/legislation.
[b] The survey in the United States, which was not a Global Youth Tobacco Survey, is described in the text.
[c] Gaza and West Bank are territories of Palestine.
[d] Guam is an overseas territory of the United States.
[e] Macao is the special administrative region of China.

TABLE 2— Prevalence of Past-30-Day E-Cigarette Use Among Youths Aged 12–16 Years by Use Frequency, Sex, Age Group, and WHO Region in 68 Countries and Territories: 2012–2019

Group	No. of Countries or Territories	≥ 1 Day, % (95% CI)			≥ 3 Days, % (95% CI)			≥ 6 Days, % (95% CI)			≥ 10 Days, % (95% CI)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	68	9.2 (8.2, 10.2)	11.7 (10.5, 13.0)	6.6 (5.9, 7.2)^{a}	3.9 (3.4, 4.4)	5.1 (4.4, 5.7)	2.4 (2.1, 2.8)^{a}	2.2 (1.9, 2.5)	3.0 (2.6, 3.4)	1.3 (1.1, 1.5)^{a}	1.4 (1.2, 1.6)	2.0 (1.7, 2.3)	0.8 (0.7, 0.9)^{a}
Age group, y													
12–14	68	8.0 (7.1, 8.9)	10.2 (9.0, 11.4)	5.8 (5.1, 6.5)^{a}	3.0 (2.6, 3.4)	4.1 (3.6, 4.7)	1.8 (1.5, 2.0)^{a}	1.7 (1.4, 1.9)	2.4 (2.0, 2.7)	1.0 (0.8, 1.1)^{a}	1.1 (0.9, 1.2)	1.4 (1.2, 1.7)	0.7 (0.5, 0.8)^{a}
15–16	68	11.2 (9.8, 12.6)^{b}	13.8 (12.0, 15.5)^{b}	8.0 (6.9, 9.1)^{a,b}	4.9 (4.2, 5.6)^{b}	6.2 (5.3, 7.1)^{b}	3.0 (2.5, 3.5)^{a,b}	2.8 (2.3, 3.2)^{b}	3.5 (3.0, 4.1)^{b}	1.5 (1.2, 1.8)^{a,b}	1.8 (1.5, 2.1)^{b}	2.5 (2.0, 2.9)^{b}	1.0 (0.8, 1.2)^{a,b}
WHO region													
Africa	4	9.9 (6.0, 13.9)	12.7 (6.8, 18.6)	6.4 (3.6, 9.2)^{a}	4.4 (2.3, 6.6)	6.0 (3.2, 8.7)	2.7 (0.7, 4.6)^{a}	2.8 (1.2, 4.3)	3.5 (1.7, 5.3)	1.7 (0.4, 3.1)^{a}	1.8 (0.7, 2.8)	2.1 (1.0, 3.3)	1.3 (0.2, 2.4)
Americas	22	7.8 (6.2, 9.5)	9.3 (7.4, 11.1)	6.4 (4.8, 8.0)^{a}	3.3 (2.5, 4.2)	4.1 (3.1, 5.1)	2.5 (1.8, 3.2)^{a}	1.9 (1.4, 2.5)	2.4 (1.8, 3.0)	1.3 (0.9, 1.7)^{a}	1.3 (1.0, 1.6)	1.7 (1.2, 2.1)	0.8 (0.6, 1.1)^{a}
Eastern Mediterranean	10	10.6 (7.9, 13.4)^{c}	16.2 (11.7, 20.7)^{c}	5.9 (4.2, 7.6)^{a}	3.7 (2.6, 4.8)	6.0 (4.2, 7.8)^{c}	1.6 (1.1, 2.2)^{a,c}	2.0 (1.4, 2.5)	3.2 (2.2, 4.2)	0.9 (0.6, 1.2)^{a}	1.1 (0.8, 1.4)	1.7 (1.2, 2.1)	0.5 (0.4, 0.7)^{a,c}
Europe	19	9.3 (7.3, 11.3)	11.6 (9.3, 13.9)	6.6 (5.2, 8.1)^{a}	4.3 (3.4, 5.3)	5.7 (4.4, 6.9)^{c}	2.6 (1.9, 3.2)^{a}	2.6 (2.0, 3.2)^{c}	3.6 (2.8, 4.4)^{c}	1.3 (0.9, 1.7)^{a}	1.7 (1.3, 2.1)	2.6 (1.9, 3.3)^{c}	0.8 (0.6, 1.1)^{a}
Southeast Asia	1	3.3 (2.4, 4.6)	4.7 (3.5, 6.3)	1.9 (1.0, 3.6)^{a}	1.1 (0.8, 1.6)	2.0 (1.3, 2.9)	0.2 (0.1, 0.9)^{a}	0.9 (0.5, 1.4)	1.4 (0.9, 2.4)	0.2 (0.1, 0.9)^{a}	0.4 (0.1, 1.0)	0.7 (0.3, 1.9)	0.0^{a}
Western Pacific	12	10.8 (8.1, 13.6)^{c}	13.5 (10.1, 16.9)^{c}	8.1 (5.9, 10.2)^{a}	4.6 (3.0, 6.2)	5.6 (3.6, 7.5)	3.2 (2.1, 4.2)^{a}	2.4 (1.7, 3.2)	3.0 (1.9, 4.1)	1.5 (0.9, 2.1)^{a}	1.6 (1.0, 2.2)	2.2 (1.3, 3.1)	1.0 (0.6, 1.4)^{a}

Note. CI = confidence interval; WHO = World Health Organization.

[a] There was a statistically significant difference between sexes.

[b] There was a statistically significant difference between age groups.

[c] There was a statistically significant difference across WHO regions (Americas as Ref).

older youths aged 15 to 16 years (11.2%; 95% CI = 9.8%, 12.6%) than among female youths (6.6%; 95% CI = 5.9%, 7.2%) and younger youths aged 12 to 14 years (8.0%; 95% CI = 7.1%, 8.9%) with a *P* level of less than .001 and nonoverlapped 95% CIs. The prevalence was higher in regions of the Western Pacific and Eastern Mediterranean than in the Americas.

As shown in Table 3, the prevalence was higher in youths who smoked cigarettes (vs those who did not), in those who smoked other tobacco products (vs those who did not), and in low-income and high-income countries (vs middle-income countries). The prevalence of past-30-day e-cigarette use on 1 or more days during the past 30 days among youths varied across countries, ranging from 1.9% in Kazakhstan to 33.2% in Guam (Figure B and Table B, available as supplements to the online version of this article at http://www.ajph.org). Similar patterns were found in other frequency categories of e-cigarette use (≥ 3 days, ≥ 6 days, and ≥ 10 days during the past 30 days, Tables 2 and 3). In addition, in nearly all included countries, cigarette smokers were more likely to use e-cigarettes than noncigarette smokers (Table C, available as a supplement to the online version of this article at http://www.ajph.org). Among youths who were e-cigarette users (on ≥ 1 day during the past 30 days), 19.2% and 12.1% had used e-cigarettes on 21 or more days and 51 or more days, respectively, during their entire life (Table D, available as a supplement to the online version of this article at http://www.ajph.org). In addition, youths with more days of past-30-day e-cigarette use were more likely to be sustained users of e-cigarettes over a longer period (e.g., on ≥ 21 or ≥ 51 lifetime days; Table E, available as a supplement to the online version of this article at http://www.ajph.org).

As shown in Table 4, male youths (vs female youths; adjusted odds ratio [AOR] = 1.73; 95% CI = 1.65, 1.80), older youths aged 15 to 16 years (vs younger ones aged 12 to 14 years; AOR = 1.07; 95% CI = 1.03, 1.12), mother alone smoked (vs neither; AOR = 1.40; 95% CI = 1.29, 1.52), father alone smoked (vs neither; AOR = 1.13; 95% CI = 1.07, 1.19), both parents smoked (vs neither; AOR = 1.76; 95% CI = 1.66, 1.87), youth past-30-day cigarette use (vs no; AOR = 7.18; 95% CI = 6.84, 7.54), youth other tobacco use (vs no; AOR = 3.88; 95% CI = 3.62, 4.15), low income level (vs middle income level; AOR = 2.09; 95% CI = 1.88, 2.33), high income level (vs middle income level; AOR = 1.75; 95% CI = 1.39, 2.12), survey year 2016–2019 (vs 2012–2015; AOR = 1.44; 95% CI = 1.37, 1.52), and youth secondhand smoke exposure (vs no; AOR = 1.74; 95% CI = 1.64, 1.84) were positively associated with youth e-cigarette use. Subgroup analyses by sex and a country's World Bank income level showed similar results (Tables F and G, available as supplements to the online version of this article at http://www.ajph.org).

DISCUSSION

Our study showed that the prevalence of past-30-day e-cigarette use on 1 or more days was 9.2% among youths aged 12 to 16 years from 68 countries surveyed between 2012 and 2019, similar to (somewhat higher than) a recent meta-analysis of data from 69 countries between 2016 and 2020 showing that the pooled prevalence of current e-cigarette use among youths younger than 20 years was 7.8%.[19] However, there are 2 limitations for that meta-analysis. First, not all included countries in that meta-analysis used standard methods for data collection. Second, that meta-analysis did not include low-income countries. We additionally found that the prevalence of e-cigarette use in low-income countries was significantly higher than that in middle-income countries, which might be attributable to insufficient economic power to implement regulations and low awareness of harms of e-cigarettes. Furthermore, to the best of our knowledge, we first found that the prevalence was much higher in male youths and older youths, and that youth cigarette use, low and high levels of country income, youth other tobacco product use, the survey years of 2016 to 2019, parental smoking, and secondhand smoking exposure were positively associated with the use of e-cigarettes among youths.

In this study, the prevalence of past-30-day e-cigarette use on 1 or more days ranged from 1.9% in Kazakhstan to 33.2% in Guam, and nearly half of the included countries (31 of 68) had prevalence greater than 10.0%. Although the prevalence varied largely across countries in our study, previous studies in specific countries also showed a high national prevalence of past-30-day e-cigarette use on 1 or more days among youths (e.g., 19.2% in 2019 among the US middle- and high-school students,[20] 6.2% in 2017 among Serbian youths aged 13–15 years,[21] 32.9% in 2017–2018 among Guam middle- and high-school students[22]). These findings suggest that the high prevalence of e-cigarette use among youths in many countries is worrying, and continuous efforts are needed to prevent and reduce the use of e-cigarettes among youths.

TABLE 3— Prevalence of Past-30-Day E-Cigarette Use Among Youths Aged 12–16 Years by Use Frequency, Sex, World Bank Income Level, Cigarette Smoking, and Other Tobacco Use in 68 Countries and Territories: 2012–2019

Group	No. of Countries or Territories	≥ 1 Day, % (95% CI)			≥ 3 Days, % (95% CI)			≥ 6 Days, % (95% CI)			≥ 10 Days, % (95% CI)		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
World Bank income level													
Low	4	14.3^{b} (11.1, 17.4)	23.6^{b} (17.7, 29.5)	7.1^{a} (5.3, 8.9)	5.3^{b} (3.8, 6.8)	9.1^{b} (6.5, 11.7)	2.0^{a} (1.2, 2.7)	2.6^{b} (1.8, 3.3)	4.3^{b} (2.7, 6.0)	1.1^{a} (0.6, 1.6)	1.4 (1.0, 1.8)	2.2 (1.4, 2.9)	0.7^{a} (0.4, 0.9)
Middle	17	8.1 (6.5, 9.7)	10.3 (8.0, 12.6)	5.4^{a} (4.3, 6.5)	3.0 (2.3, 3.7)	4.0 (3.1, 4.9)	1.7^{a} (1.2, 2.2)	1.6 (1.2, 2.0)	2.3 (1.6, 2.9)	0.8^{a} (0.6, 1.1)	1.1 (0.8, 1.4)	1.5 (1.1, 1.9)	0.5^{a} (0.3, 0.6)
Upper-middle	29	8.1 (6.8, 9.3)	10.3 (8.7, 12.0)	5.6^{a} (4.8, 6.5)	3.1 (2.6, 3.6)	4.1 (3.4, 4.9)	1.9^{a} (1.5, 2.3)	1.7 (1.4, 2.0)	2.4 (2.0, 2.8)	0.9^{a} (0.7, 1.1)	1.0 (0.9, 1.2)	1.6 (1.3, 1.9)	0.7^{a,b} (0.5, 0.8)
High	18	11.0^{b} (8.1, 13.9)	12.9 (9.7, 16.2)	8.9^{a,b} (6.4, 11.4)	5.5^{b} (4.0, 7.1)	6.7^{b} (5.0, 8.5)	4.0^{a,b} (2.9, 5.2)	3.5^{b} (2.6, 4.3)	4.3^{b} (3.2, 5.4)	2.3^{a,b} (1.6, 3.1)	2.4^{b} (1.8, 3.0)	3.2^{b} (2.3, 4.1)	1.5^{a,b} (1.0, 1.9)
Cigarette smoking													
No	68	5.7 (5.0, 6.4)	7.2 (6.3, 8.1)	4.1^{a} (3.6, 4.7)	1.8 (1.6, 2.1)	2.4 (2.1, 2.7)	1.1^{a} (1.0, 1.3)	1.0 (0.9, 1.2)	1.3 (1.1, 1.5)	0.7^{a} (0.5, 0.8)	0.7 (0.5, 0.8)	0.8 (0.7, 1.0)	0.4^{a} (0.3, 0.5)
Yes	68	33.5^{c} (29.2, 37.8)	35.5^{c} (31.2, 39.8)	29.9^{a,c} (25.8, 34.1)	17.5^{c} (14.9, 20.2)	19.2^{c} (16.2, 22.1)	15.1^{a,c} (12.7, 17.5)	10.6^{c} (8.9, 12.2)	12.3^{c} (10.3, 14.2)	7.7^{a,c} (6.3, 9.1)	7.2^{c} (6.0, 8.4)	8.6^{c} (7.1, 10.1)	4.7^{a,c} (3.7, 5.6)
Other tobacco products use													
No	68	7.5 (6.7, 8.2)	8.6 (7.8, 9.5)	5.2^{a} (4.6, 5.8)	2.1 (1.8, 2.4)	2.7 (2.4, 3.0)	1.5^{a} (1.2, 1.9)	1.3 (1.1, 1.5)	1.6 (1.4, 1.8)	1.1^{a} (0.9, 1.3)	0.8 (0.5, 1.0)	0.9 (0.7, 1.1)	0.6^{a} (0.5, 0.7)
Yes	68	23.2^{d} (21.0, 25.3)	26.5^{d} (23.2, 29.7)	20.3^{a,d} (18.7, 21.8)	13.6^{d} (11.5, 15.6)	15.8^{d} (13.6, 17.9)	12.6^{a,d} (11.2, 13.0)	9.8 (9.5, 10.1)	11.3^{d} (10.2, 12.3)	6.8^{a,d} (6.1, 7.5)	6.6^{d} (5.8, 7.4)	7.2^{d} (6.6, 7.8)	4.5^{a,d} (3.4, 5.5)

Note. CI = confidence interval.

[a] There was a statistical significance between sexes.

[b] There was a statistically significant difference compared with middle-income countries.

[c] There was a statistically significant difference between cigarette smoking statuses.

[d] There was a statistically significant difference between other tobacco products use statuses.

TABLE 4— Associated Factors With Past-30-Day E-Cigarette Use (on ≥ 1 Day) Among Youths Aged 12–16 Years in 68 Countries and Territories: 2012–2019

Variable	Prevalence, %	B	AOR (95% CI)[a]
Sex			
Female	6.6		1 (Ref)
Male	11.7	0.546	1.73 (1.65, 1.80)
Age group, y			
12–14	8.0		1 (Ref)
15–16	11.2	0.070	1.07 (1.03, 1.12)
Parental smoking status			
Neither	7.2		1 (Ref)
Father only	10.3	0.122	1.13 (1.07, 1.19)
Mother only	15.7	0.334	1.40 (1.29, 1.52)
Both	20.4	0.567	1.76 (1.66, 1.87)
Cigarette smoking			
No	5.7		1 (Ref)
Yes	33.5	1.971	7.18 (6.84, 7.54)
Other tobacco product use			
No	7.5		1 (Ref)
Yes	23.2	1.355	3.88 (3.62, 4.15)
World Bank income level			
Low	14.3	0.737	2.09 (1.88, 2.33)
Middle	8.1		1 (Ref)
Upper-middle	8.1	−0.088	0.92 (0.78, 1.06)
High	11.0	0.562	1.75 (1.39, 2.12)
Survey year			
2012–2015	6.9		1 (Ref)
2016–2019	10.3	0.365	1.44 (1.37, 1.52)
Secondhand smoke exposure			
No	4.9		1 (Ref)
Yes	11.8	0.551	1.74 (1.64, 1.84)

Note. AOR = adjusted odds ratio; CI = confidence interval. All variables listed in the table were introduced into logistic regression models.

[a] Odds ratios after adjustment for all potential covariates listed in the table.

The prevalence was lower when based on using e-cigarettes on 3 or more days versus 1 or more days (e.g., in Guam: 19.0% vs 33.2%). This is consistent with the finding that the prevalence of regular cigarette smoking in youths decreased by 2 times when based on smoking on 1 or more days versus 3 or more days in the past 30 days.[23] This suggests that the high prevalence of e-cigarette use on 1 or more days might include a substantial proportion of experimenters. Smoking uptake typically transits through 5 stages: preparation, initial trying, experimentation, regular smoking, and nicotine addiction.[24] We also found that nearly one fifth of youths who were past-30-day e-cigarette users (on ≥ 1 day) regularly used e-cigarettes on 21 or more days in their entire life. Our findings suggest that nearly four fifths of youths who were past-30-day e-cigarette users (on ≥ 1 day) might be in preparation for the experimentation stage. We are not aware of studies assessing the proportion of experimenters who transit to regular users, but we can speculate that this proportion would not largely differ from that of combustible cigarettes given the nicotine content in the main types of e-cigarettes. We additionally found that youths with more days of past-30-day e-cigarette use were more likely to be sustained users of e-cigarettes over a longer period (e.g., ≥ 21 or ≥ 51 lifetime days). Therefore, strategies aimed at preventing experimenters from becoming sustained smokers are greatly needed.

We found that the use of e-cigarettes was strongly associated with cigarette use. However, the temporal relation between using e-cigarettes and using combustible cigarettes is controversial, which needs to be investigated in further studies using longitudinal study design with an adequate follow-up. Although previous meta-analyses and reviews based on longitudinal cohort data suggested that e-cigarette use could be a gateway to cigarette use among youths,[11] the aggregate impact might be minimal because of the small increase in smoking initiation among young people.[25] In addition, the information on e-cigarette use was self-reported, and there were several limitations in study designs of previous studies. Although e-cigarettes have been regarded as a smoking cessation aid among adults, they contain pleasurable flavors that may stimulate a vaper's sensory experience.[26] Based on data from the 2016 NYTS in the United States, the common reasons for e-cigarette use among students were the use by family members or friends, pleasurable flavors, and belief of it being less harmful than cigarettes.[27] These findings highlight the need for balancing e-cigarettes' benefits for smoking cessation and their risks to youths, especially to nonsmokers, which may include prohibiting some flavors in e-cigarettes that make them more attractive, limiting added chemicals, ensuring that e-cigarette cartridges and tanks are sealed and disposable, and promoting educational campaigns, such as including messages with specific health effects of e-cigarette use.

Although we did not assess trends in the use of e-cigarettes based on GYTS because of limited available data in the data set, we found prevalence of e-cigarette use increased with survey years. Several previous studies have shown an increasing trend in e-cigarette use among youths.[14,28] These findings highlight that policymakers should also pay close attention to effective control measures of e-cigarette use among youths. Trends in e-cigarette use prevalence in other countries and worldwide among youths should be explored in the future. We found that male youths and older youths were more likely to use e-cigarettes compared with female youths and younger youths, which may be related to sex-specific risk-taking behaviors and peer pressure[29,30] as youths grow older.[31] It has been shown that smoking combustible cigarettes is influenced by family members.[32] We found a similar association of youth e-cigarette use with parental cigarette smoking. In addition, maternal smoking appears to be more influential on e-cigarette use among youths than paternal smoking. This may relate to generally longer time spent at home by youths with their mother versus father and possibly stronger maternal than paternal influence on children's behaviors.[33] Our finding of a relation between e-cigarette use by youths and secondhand cigarette smoking exposure likely partly reflects an effect of parental smoking.[34] In addition, secondhand smoking exposure also reflects habits by peers and by the general public outside of schools.[35] These findings underscore the importance of smoke-free environments in places attended by children and youths, and it might be necessary for policymakers to consider strategies addressing disparities in sex and age.

Strengths and Limitations

A strong point of this study was that data relied on a same standard questionnaire and sampling strategy in all countries, making prevalence estimates directly comparable across countries. In addition, we examined the frequency of e-cigarette use (e.g., ≥ 1 day, ≥ 3 days, ≥ 6 days, or ≥ 10 days during the past 30 days), which may help distinguish experimentation versus regular use.

However, the study also has several limitations. First, data on e-cigarette use were self-reported, which may lead to recall bias with over- or underestimation. Second, data were based on answers to a single question on e-cigarettes in the GYTS surveys, so we are unable to distinguish the use of different systems of e-cigarettes (i.e., ENDS and ENNDS[2]). Third, because data were based on cross-sectional designs, and surveys included in this study were done on only 1 point of time, we cannot infer whether the use of e-cigarettes precedes, follows, or adds to cigarette smoking among youths. Fourth, survey years were different across countries (2012–2019), which may impede the direct comparisons. However, the years when the surveys were conducted were mainly distributed between 2014 and 2018 (91%; 62 of 68 countries). In addition, the pooled prevalence of past-30-day e-cigarette use on 1 or more days based on the 62 countries between 2014 and 2018 was 9.3% (95% CI = 8.2%, 10.4%), which is largely similar to the pooled prevalence based on the 68 countries between 2012 and 2019 (9.2%; 95% CI = 8.2%, 10.2%).

Fifth, many countries outside the included 68 countries were not included in our study because GYTS data did not include data on e-cigarette use in those countries. Sixth, GYTS did not provide information on different types and flavors of e-cigarettes, which should be added in later GYTS questionnaires. Seventh, because the policies across different countries vary, we cannot directly answer whether the policy in the specific country had an effect on e-cigarette use among youths worldwide. To answer this question, it is better to be based on repeated cross-sectional data at least before and after the implementation of policy in the specific country.

Conclusions

In conclusion, we found that e-cigarette use among youths remains a significant public health issue worldwide. Further studies will need to assess to what extent youths use e-cigarettes and combustible cigarettes simultaneously or whether the use of one product leads to the use of the other. Furthermore, our study emphasizes the need for adequate strategies and measures to control tobacco products generally and e-cigarettes more specifically among youths globally. AJPH

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PUBLICATION INFORMATION

Full Citation: Sun J, Xi B, Ma C, Zhao M, Bovet P. Prevalence of e-cigarette use and its associated factors among youths aged 12 to 16 years in 68 countries and territories: Global Youth Tobacco Survey, 2012–2019. *Am J Public Health*. 2022; 112(4):650–661.

Acceptance Date: December 16, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306686

CONTRIBUTORS

B. Xi and P. Bovet designed the study and led the writing of the article. B. Xi was the principal investigator. J. Sun drafted the first version of the article. C. Ma did the data analysis. M. Zhao collated the data. All authors critically revised the article and approved the final version of the article.

ACKNOWLEDGMENTS

This study was supported by the Youth Team of Humanistic and Social Science of Shandong University (20820IFYT1902).

We thank the US Centers for Disease Control and Prevention for sharing the Global Youth Tobacco Survey (GYTS) data.

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

CONFLICTS OF INTEREST

We declare no competing interests.

HUMAN PARTICIPANT PROTECTION

Data from the GYTS and the NYTS are deidentified and do not include any data that allow participant identification. The country data sets are publicly available and have complied with a corresponding national ethical board review.

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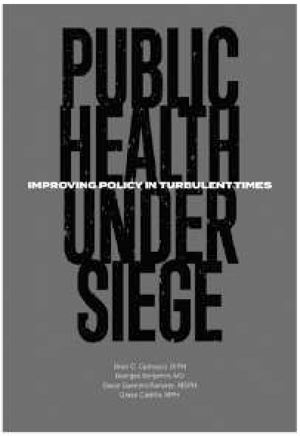

Adverse Childhood Experiences Across Birth Generation and LGBTQ+ Identity, Behavioral Risk Factor Surveillance System, 2019

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Objectives. To identify and describe differences in exposure to adverse childhood events (ACEs) by birth generation and lesbian, gay, bisexual, transgender, and queer plus (LGBTQ+) identity.

Methods. Using data from the 2019 Behavioral Risk Factor Surveillance System, we examined the odds of experiencing 4 or more ACEs for Generation X, millennials, and Generation Z relative to baby boomers (n = 56 262). We also explored differences between generations based on LGBTQ+ identity.

Results. The odds of experiencing 4 or more ACEs were higher for Generation X (odds ratio [OR] = 1.67; 95% confidence interval [CI] = 1.52, 1.83), millennials (OR = 2.12; 95% CI = 1.92, 2.35), and Generation Z (OR = 2.12; 95% CI = 1.79, 2.52) than for baby boomers. This disparity was amplified by LGBTQ+ identity (*P* = .016). The frequency of individual ACEs also varied by generation.

Conclusions. Exposure to 4 or more ACEs has increased for each generation since the baby boomers, and more so for the LGBTQ+ population. The ACEs experienced differ by generation.

Public Health Implications. Increasing ACE scores suggest that younger generations may have an increased risk of ACE-related health problems. Policies are needed to prevent ACE exposure and address the potential fallout from the ACEs that have seen the largest increases. (*Am J Public Health*. 2022;112(4):662–670. https://doi.org/10.2105/AJPH.2021.306642)

AJPH April 2022, Vol 112, No. 4

Adverse childhood experiences (ACEs) refer to distressing, often traumatic, events that happen in a person's life before the age of 18 years, such as physical, sexual, and emotional abuse; neglect; and household dysfunction.[1] ACEs can lead to deleterious effects in adulthood, including worse physical, behavioral, and economic health.[2,3] Parental ACE scores have been linked to the child's ACE score, raising concerns about intergenerational transfer of ACEs.[4,5] A recent systematic review found that national trends for certain ACEs are increasing over time, including incarceration and drug use.[6] However, there is a paucity of evidence comparing the variation in frequency of exposure and type of ACEs experienced between recent birth cohorts (hereafter, generations).

There are several structural and sociological factors that vary across generations with the potential to increase ACE exposure. At the structural level, incarceration rates began climbing in the 1980s, largely from the War on Drugs.[7] Similarly, the crack epidemic of the 1980s and the opioid epidemic of the 1990s and 2000s have contributed to increased drug use and drug-related deaths.[8] Socially, income inequality in the United States has increased sharply since the late 1970s, with top-earning families seeing substantial income gains while the incomes of the bottom 50% of families have stagnated.[9] Children in families with lower incomes experience more ACEs, suggesting that increasing income inequality may contribute to higher ACE exposure in children born after the 1970s.[10] Combined, these changing structural and sociological factors suggest that exposure to ACEs may vary among generations.

Nonmajority groups more heavily impacted by these structural and sociological changes may have experienced different patterns in ACE exposure. One group with potential for change in ACE exposure is the lesbian, gay, bisexual, transgender, and queer plus (LGBTQ+) population. Because of stigma and discrimination, the LBGTQ+ population is at higher risk of substance use and having a lower income than non-LGBTQ+ individuals, making them more likely to be affected by these structural and sociological changes.[11,12] Correspondingly, the LGBTQ+ population may be more affected by changes in exposure to ACEs. In addition, there are more openly LGBTQ+ individuals among millennials and Generation Z (Gen-Z) than in any other generation, at 20% compared with 12% of Generation X (Gen-X) and 7% of baby boomers.[13] Unfortunately, LGBTQ+ status remains strongly linked to ACEs, and this increase in open LGBTQ+ individuals may result in increased exposure to ACEs for younger generations.[14,15]

We explored whether there is a difference in ACE scores among Gen-Z, millennials, Gen-X, and baby boomers, and how that relationship varies for people with LGBTQ+ identities. Given the increases in ACE-associated structural and sociological factors between generations, we hypothesized that exposure to multiple ACEs has increased for each generation cohort. Furthermore, given their sensitivity to these changing factors and underlying elevated risk of ACEs, we anticipated that the relationship between generation and ACE exposure will be greater for LBGTQ+ individuals.

METHODS

This cross-sectional cohort study used data from the 2019 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an annual survey conducted by the Centers for Disease Control and Prevention that collects health risk–related data using a complex sampling strategy designed to generalize to the noninstitutionalized adult US population.[16] The survey is administered via a computer-assisted telephone interview on landlines and cell phones. The BRFSS consists of core modules covering demographics and common health indicators, as well as several optional modules that vary by state. In 2019, 21 states included the ACEs module, and 14 of those included the Sexual Orientation and Gender Identity module (Delaware, Florida, Iowa, Kansas, Mississippi, New York, Ohio, Oklahoma, Rhode Island, South Carolina, Tennessee, Virginia, West Virginia, and Wisconsin).[16] We used data from the 14 states that included both modules.

Measures

Adverse childhood experiences. We calculated participant ACE scores by using the ACE module of the BRFSS.[16] The ACE module contains 11 items: 5 questions indicating household stressors (e.g., "Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?") and 6 questions indicating household violence (e.g., "Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking."). Responses were dichotomized into exposed or unexposed for each question and summed to form a total ACE score as described elsewhere.[17] Responses of "don't know" or "refused" were recoded as missing. Finally, we dichotomized the total ACE score as either "less than four ACEs" or "greater than or equal to four ACEs," as a cut-score of 4 or more ACEs is frequently identified as a point of concern in the ACEs outcome literature.[1,2]

Generation. Generational ranges from the Pew Research Center were used to define birth cohorts based on participant birth year (derived using age at the time of data collection).[18] According to birth year, participants were classified as Gen-Z (1997–2001), millennials (1981–1996), Gen-X (1965–1980), or baby boomers (1946–1964). Individuals from earlier generations, born before 1946, were excluded to reduce survivorship bias relating to the long-term health effects of ACEs.

Sexual orientation and gender identity status. We used the Sexual Orientation and Gender Identity module in the BRFSS to create a binary indicator variable for self-identified LGBTQ+ status. The Sexual Orientation and Gender Identity module contains 1 sexual orientation question and 1 gender identity question.[16] The sexual orientation question asks, "Which of the following best represents how you think of yourself?" with response options including gay, lesbian, bisexual, something else, or "straight, that is, not gay." The gender identity question asks "Do you consider yourself to be transgender?" Participants providing any response other than straight and not transgender were coded as self-identifying as LGBTQ+. Responses of "don't know" or "refused" were recoded as missing.

Statistical Analysis

Of 71 069 people eligible to respond to both the ACE and Sexual Orientation and Gender Identity modules, 20.8% (14 807) were missing data for at least 1 module, and 76.5% (n = 11 326) of those were missing data for both modules. The degree of missingness was not unexpected given the sensitive nature of the measures and aligns with missingness reported in previous studies.[14,15] We included an examination of ACE missingness rates by generation as part of our initial descriptive analysis of the sample. We used a complete-case analysis for the main analyses such that respondents missing information for any variables were excluded from the analyses. For our primary analysis examining differences in ACE score by generation, we evaluated an unadjusted logistic regression model. Next, we evaluated a multiple logistic regression model that included generation, LGBTQ+ status, and the interaction between generation and LGBTQ+ status. Given the use of a logistic model, interactions were interpreted with a focus on the direction and magnitude of the association. For both models, we conducted sensitivity analyses in which the reference generation was changed to Gen-X and then millennials. Finally, we used χ^2 analyses to examine the proportion of respondents exposed to each individual ACE across generation and LGBTQ+ status to explore underlying patterns in exposure that may inform interpretation of the overall ACE scores. To account for the complex sampling strategy of the BRFSS, all analyses included the appropriate design variables provided by the BRFSS (weight, cluster, and strata) and were analyzed using PROC SURVEYLOGISTIC and PROC SURVEYFREQ in SAS version 9.4 (SAS Institute, Cary, NC).

RESULTS

Our total unweighted sample included a total of 56 262 respondents and was predominantly non-Hispanic White (79.98%) and female (54.37%). Four or more ACEs were reported by 19.26% of the sample. The majority of the sample was from the baby boomer generation (52.89%), followed by Gen-X (25.43%), millennials (17.86%), and Gen-Z (3.81%). A total of 5.11% of the respondents self-identified as LGBTQ+. LGBTQ+ identity was most common among Gen-Z (16.2%), followed by millennials (9.7%), Gen-X (4.5%), and baby boomers (3.1%). Millennials had the highest missingness for the ACEs measure at 34.6%, Gen-Z had the lowest at 8.6%, and baby boomers and Gen-X were in the middle with 28.2% and 28.6%, respectively (Appendix A, available as a supplement to the online version of this article at http://www.ajph.org).

Generational Differences

The odds of having 4 or more ACEs varied by generation ($F_{3,55657} = 88.34$; $P < .001$), with younger generations having a higher proportion of individuals reporting a high ACE score (Table 1). Compared with baby boomers, the odds of having 4 or more ACEs were 1.67 times higher for Gen-X (95% confidence interval [CI] = 1.52, 1.83), 2.12 times higher for millennials (95% CI = 1.92, 2.35), and 2.12 times higher for Gen-Z (95% CI = 1.79, 2.52). All comparisons were significant in the sensitivity analyses, with the exception that millennials and Gen-Z were not significantly different.

In examining the frequency of each ACE by generation, we found several significant differences between the generations for all ACEs with the exception of having lived with someone who had alcohol dependency (Table 2). Gen-X, millennials, and Gen-Z all experienced more household depression, drug use, incarceration, parental divorce, and emotional abuse than did baby boomers. Millennials and Gen-Z reported more household depression, incarceration, parental divorce, and emotional abuse than Gen-X. Millennials and Gen-X reported more interparental

TABLE 1— Prevalence of Exposure to 4 or More Adverse Childhood Experiences (ACEs) by Generation: Behavioral Risk Factor Surveillance System, United States, 2019

	Generation, % (95% CI)				
	Baby Boomers	Generation X	Millennials	Generation Z	P
ACEs					< .001
≥ 4	14.69 (13.92, 15.46)	22.31* (21.06, 23.56)	26.77* (25.21, 28.33)	26.78* (23.64, 29.92)	
< 4	85.31 (84.54, 86.08)	77.69* (76.44, 78.94)	73.23* (71.67, 74.79)	73.22* (70.08, 76.36)	

Note. CI = confidence interval. Weighted percentage of people with ≥ 4 ACEs in 2019 for baby boomers (1946–1964), Generation X (1965–1980), millennials (1981–1996), and Generation Z (1997–2001). Percentages are weighted using the design variables for the 2019 Behavioral Risk Factor Surveillance System. The *P* values are for the goodness-of-fit χ^2 test for each ACE.

*Significantly different from baby boomers at $P < .05$.

TABLE 2— Prevalence of Exposure to Each Adverse Childhood Experience (ACE) by Generation: Behavioral Risk Factor Surveillance System, United States, 2019

	Generation, % (95% CI)				
ACEs	**Baby Boomers**	**Generation X**	**Millennials**	**Generation Z**	***P***
Household depression	12.28 (11.52, 13.04)	17.84* (16.69, 18.99)	26.37* (24.85, 27.88)	31.47* (28.01, 34.93)	< .001
Household alcoholism	21.95 (21.06, 22.83)	23.41 (22.19, 24.63)	23.94 (22.52, 25.35)	22.89 (19.84, 25.94)	.17
Household drug use	6.25 (5.73, 6.76)	12.04* (11.05, 13.02)	17.04* (15.80, 18.27)	15.74* (13.39, 18.10)	< .001
Household incarceration	4.18 (3.64, 4.71)	7.85* (7.03, 8.68)	13.86* (12.65, 15.08)	16.43* (13.88, 18.99)	< .001
Parental divorce	19.87 (18.97, 20.76)	35.64* (34.15, 37.12)	42.38* (40.62, 44.14)	40.87* (37.18, 44.55)	< .001
Interparental violence	15.63 (14.82, 16.45)	19.10* (17.91, 20.30)	17.77* (16.48, 19.06)	17.38 (14.70, 20.05)	< .001
Physical abuse	23.74 (22.78, 24.71)	26.74* (25.36, 28.12)	24.67 (23.12, 26.22)	23.45 (20.37, 26.53)	.017
Emotional abuse	29.99 (28.94, 31.03)	35.28* (33.87, 36.70)	41.77* (40.02, 43.53)	44.53* (40.73, 48.33)	< .001
Touched sexually	10.87 (10.16, 11.58)	13.19* (12.17, 14.22)	11.15 (10.00, 12.31)	8.9 (6.94, 10.86)	< .001
Forced to touch sexually	7.40 (6.82, 7.97)	10.41* (9.49, 11.33)	9.04* (7.99, 10.09)	7.41 (5.47, 9.35)	< .001
Rape	4.37 (3.93, 4.82)	6.44* (5.68, 7.20)	5.54 (4.66, 6.42)	4.19 (2.66, 5.72)	< .001

Note. CI = confidence interval; LGBTQ+ = lesbian, gay, bisexual, transgender, and queer plus. Percentages are weighted using the design variables for the 2019 Behavioral Risk Factor Surveillance System. The *P* values are for the goodness-of-fit χ^2 test for each ACE.

*Significantly different from baby boomers at $P < .05$.

violence and sexual abuse than Gen-Z or baby boomers, with both reporting higher proportions of being forced to touch an adult sexually. Gen-X also reported receiving more sexual touching, rape, and physical abuse than any other generation.

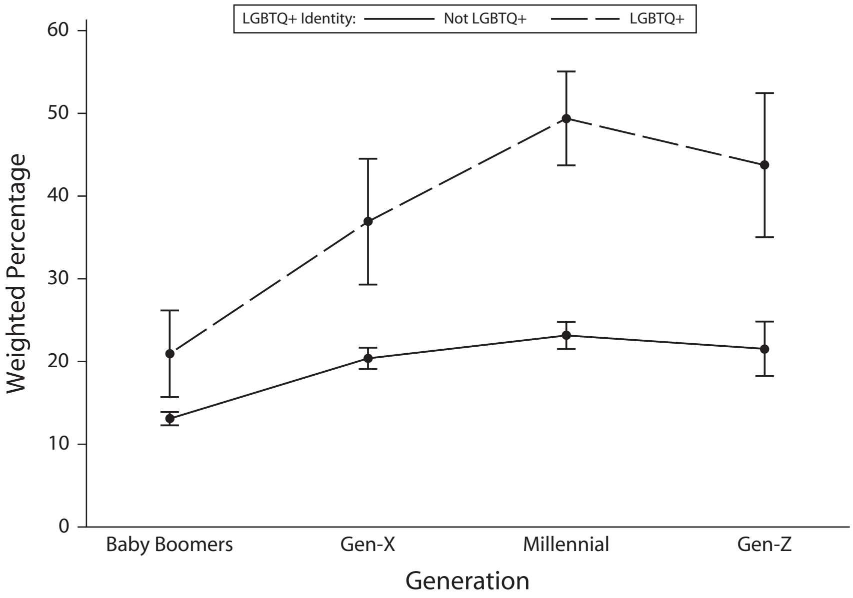
Sexual Orientation and Gender Identity Status

Our analysis examining self-identified LGBTQ+ status and generation yielded significant main effects for both generation ($F_{3,55657} = 32.10$; $P < .001$) and LGBTQ+ status ($F_{1,55659} = 111.71$; $P < .001$). The interaction between LGBTQ+ status and generation was also significant ($F_{3,55657} = 3.46$; $P = .016$; Figure 1). LGBTQ+ respondents from Gen-X were not differently likely to experience 4 or more ACEs than LGBTQ+ baby boomers (odds ratio [OR] = 1.31; 95% CI = 0.84, 2.04). LGBTQ+ millennials were more likely to experience 4 or more ACEs than LGBTQ+ baby boomers (OR = 1.84; 95% CI = 1.26, 2.71). Finally, LGBTQ+ individuals from Gen-Z had higher odds of experiencing ACEs than LGBTQ+ baby boomers, but the difference did not reach statistical significance (OR = 1.61; 95% CI = 0.99, 2.64). In the sensitivity analyses, no LGBTQ+ individuals from any generation significantly differed from LGBTQ+ members of Gen-X, and only LGBTQ+ baby boomers differed from LGBTQ+ millennials.

There were noticeable differences in the individual ACEs reported by generation for LGBTQ+ respondents (Table 3). Gen-X, millennials, and Gen-Z were all more likely to have experienced household depression, incarceration, and divorce than were baby boomers. Gen-X and millennials reported more exposure to interparental violence than baby boomers. Millennials and Gen-Z both had higher rates of emotional abuse than Gen-X and baby boomers. Gen-X more frequently reported rape than other generations. Millennials experienced more household drug use than other generations.

DISCUSSION

We examined ACE exposure through a new lens by exploring generational differences in ACEs in general and by LGBTQ+ status. The proportion of people with 4 or more ACEs, considered to be an indicator of potential toxic stress and trauma, is substantially higher for generations following the baby boomers. Millennials reported the highest proportion of 4 or more ACEs, followed by Gen-Z and Gen-X. Household depression, drug use, incarceration, divorce, and emotional abuse appeared to be universally higher across Gen-X, millennials, and Gen-Z, while several other unique ACEs were elevated for each generation. This finding is consistent with a recent systematic review on trends in individual ACEs that found increases in drug overdoses from 1979 to 2016 and an increase in the divorce rate from 1950 to 2000.[6]



	Baby Boomers		Gen-X		Millennial		Gen-Z	
	Not LGBTQ+	LGBTQ+	Not LGBTQ+	LGBTQ+	Not LGBTQ+	LGBTQ+	Not LGBTQ+	LGBTQ+
Unweighted no.	4 143	241	3 009	240	2 300	481	462	162
Weighted no.	2 200 353	123 941	2 500 999	228 608	2 639 858	608 682	657 548	306 187
Weighted %	14.4	22.0	21.5	37.6	24.2	49.7	22.6	44.2

FIGURE 1— Prevalence of Exposure to 4 or More Adverse Childhood Experiences by Generation and LGBTQ+ Identity: Behavioral Risk Factor Surveillance System, United States, 2019

Note. LGBTQ+ = lesbian, gay, bisexual, transgender, and queer plus. Weighted frequency of people with 4 or more adverse childhood experiences (ACEs) in 2019 by LGBTQ+ identity for baby boomers (1946–1964), Generation X (1965–1980), millennials (1981–1996), and Generation Z (1997–2001). Vertical error bars represent the 95% confidence interval for the estimated percentages. Tests of main effects and interaction for generation ($F_{7,55653} = 32.10$; $P < .001$), LGBTQ+ ($F_{7,55659} = 111.71$; $P < .001$), and generation * LGBTQ+ ($F_{7,55657} = 32.10$; $P = .016$).

LGBTQ+ identity was associated with greater differences between generations when compared with baby boomers, but not Gen-X. Upon examination of individual ACEs experienced by generation and by LGBTQ+ status, ACEs were higher overall for LGBTQ+ individuals, and there were also differences in ACE exposure across generations for LGBTQ+ individuals. These findings suggest that exposure to ACEs has been increasing over time and more so for LGBTQ+ individuals. These findings are relevant as they may have substantial long-term health implications for younger generations, especially LGBTQ+ individuals. In addition, these differences in exposure to individual ACEs across generations may provide guidance toward structural factors that could be addressed to stem the exposure to ACEs. Furthermore, while we described changes in the individual ACEs to which each generation was exposed, we believe these differences may warrant a more thorough analysis than was within the scope of this study. Future studies should apply advanced analytic techniques to better characterize these different profiles of exposure and identify potential health outcomes associated with different ACE exposure profiles.

Limitations

This study had several limitations. First, we conducted this study by using data from a cross-sectional survey. While the BRFSS is designed and weighted to be representative, the self-report nature of this sample does include a risk for bias. In particular, recall bias may be a factor that affects how many ACEs are reported by each generation because of the differences in age at data collection. Thankfully, previous studies have shown that ACE recall is generally stable over time, but caution may still be warranted.[19] Furthermore, the use of these cross-sectional data also confers some additional strengths by facilitating the examination of LGBTQ+ individuals, as longitudinal data of this population is scarce and often limited to more recent years. These data also mitigate some generational differences in responding, as all

TABLE 3— **Prevalence of Exposure to Each Adverse Childhood Experience (ACE) by Generation and LGBTQ+ Identity: Behavioral Risk Factor Surveillance System, United States, 2019**

	Generation, % (95% CI)				
ACEs	**Baby Boomers**	**Generation X**	**Millennials**	**Generation Z**	***P***
LGBTQ+					
Household depression	15.35 (11.23, 19.47)	35.33* (28.02, 42.63)	48.78* (43.27, 54.28)	44.82* (36.52, 53.11)	< .001
Household alcoholism	28.95 (22.38, 35.51)	36.9 (29.46, 44.33)	34.94 (29.97, 39.91)	32.56 (24.85, 40.28)	.47
Household drug use	11.89 (7.71, 16.08)	22.81 (15.71, 29.9)	28.96* (23.97, 33.96)	21.91 (15.67, 28.16)	< .001
Household incarceration	6.08 (2.99, 9.17)	20.32* (13.18, 27.46)	21.11* (17.09, 25.12)	23.18* (16.73, 29.62)	< .001
Parental divorce	25.11 (17.68, 32.55)	40.72* (33.04, 48.40)	47.15* (41.67, 52.64)	47.40* (38.88, 55.92)	< .001
Interparental violence	17.37 (12.97, 21.77)	31.37* (24.02, 38.71)	28.15* (23.52, 32.77)	24.95 (17.81, 32.09)	.021
Physical abuse	30.18 (23.55, 36.81)	38.16 (30.67, 45.65)	39.78 (34.40, 45.16)	33.65 (25.83, 41.47)	.19
Emotional abuse	36.29 (29.90, 42.67)	49.50 (41.85, 57.15)	63.08* (57.68, 68.48)	57.19* (48.44, 65.94)	< .001
Touched sexually	21.98 (15.20, 28.76)	33.21 (25.93, 40.49)	24.63 (19.79, 29.48)	16.63 (10.34, 22.93)	.008
Forced to touch sexually	18.87 (12.21, 25.54)	30.39 (23.12, 37.67)	19.97 (15.75, 24.19)	15.25 (8.99, 21.51)	.011
Rape	10.24 (6.28, 14.19)	22.57* (15.77, 29.36)	14.02 (10.38, 17.66)	10.54 (4.68, 16.39)	.008
Not LGBTQ+					
Household depression	12.16 (11.39, 12.94)	16.93* (15.78, 18.07)	23.85* (22.31, 25.39)	28.29* (24.47, 32.10)	< .001
Household alcoholism	21.69 (20.81, 22.57)	22.70 (21.48, 23.92)	22.70 (21.23, 24.17)	20.59 (17.31, 23.86)	.4
Household drug use	6.04 (5.53, 6.55)	11.47* (10.51, 12.43)	15.70* (14.45, 16.94)	14.27* (11.78, 16.77)	< .001
Household incarceration	4.11 (3.56, 4.65)	7.20* (6.43, 7.97)	13.05* (11.77, 14.33)	14.82* (12.06, 17.59)	< .001
Parental divorce	19.67 (18.79, 20.55)	35.37* (33.86, 36.88)	41.84* (39.98, 43.70)	39.31* (35.23, 43.38)	< .001
Interparental violence	15.57 (14.74, 16.40)	18.46* (17.27, 19.65)	16.61 (15.27, 17.94)	15.57 (12.75, 18.39)	.006
Physical abuse	23.50 (22.54, 24.47)	26.14* (24.75, 27.54)	22.98 (21.37, 24.58)	21.02 (17.72, 24.32)	.003
Emotional abuse	29.75 (28.69, 30.81)	34.54* (33.11, 35.96)	39.38* (37.55, 41.21)	41.51* (37.32, 45.70)	< .001
Touched sexually	10.46 (9.78, 11.14)	12.15* (11.15, 13.14)	9.64 (8.49, 10.79)	7.06* (5.20, 8.92)	< .001
Forced to touch sexually	6.97 (6.44, 7.50)	9.37* (8.49, 10.24)	7.81 (6.75, 8.88)	5.54 (3.70, 7.38)	.001
Rape	4.16 (3.72, 4.59)	5.59* (4.89, 6.30)	4.59 (3.70, 5.48)	2.68 (1.46, 3.90)	.001

Note. CI = confidence interval; LGBTQ+ = lesbian, gay, bisexual, transgender, and queer plus. Weighted frequency of people with each ACE in 2019 by LGBTQ+ identity for baby boomers (1946–1964), Generation X (1965–1980), millennials (1981–1996), and Generation Z (1997–2001). Percentages are weighted using the design variables for the 2019 Behavioral Risk Factor Surveillance System. The *P* values are for the goodness-of-fit χ^2 test for each ACE.

*Significantly different from baby boomers at $P < .05$.

respondents were subject to the same social norms at the time of the survey. Future studies should seek to replicate this study prospectively via longitudinal cohorts or by examining ACEs reported at a fixed time point for each generation (e.g., at age 18 years). In addition, there is a risk of nonresponse bias because of the elevated missingness in the data. In particular, there was some concern that older generations may be less willing to report ACEs because of generational differences in social norms. Upon examination, there was generational variation in nonresponse to the ACE items. However, it was not driven by older generations. Future work is needed to assess the impact of differential missingness in ACE studies.

Second, our assessment of ACEs was limited to the ACEs included in the BRFSS. There remains an ongoing discourse regarding which additional childhood experiences should be added to the ACEs module, such as bullying and economic hardship.[20] Future studies should seek to examine generational differences in exposure to ACEs that are not included in the BRFSS.

Third, Gen-Z only accounted for approximately 4% of our sample, potentially limiting our findings. This limitation is primarily attributable to Gen-Z being the youngest cohort, as most of Gen-Z was aged younger than 18 years and ineligible to be included in the 2019 BRFSS sample. Future studies will need to examine the prevalence of ACEs in Gen-Z further to identify potential differences between older and younger members of Gen-Z.

Health Implications

Our findings have concerning health implications, as ACEs are a well-established and highly documented risk factor for myriad chronic physical and mental health conditions.[2,3] An increase in 4 or more ACEs among younger generations may in part explain observed upward trends in ACE-associated chronic conditions relative to baby boomers. For example, millennials and Gen-Z have been found to have higher incidences of mental health conditions and suicide deaths than previous generations.[21,22] While it is too early to identify any real differences in the long-term health of Gen-Z, there is some early evidence that millennials are experiencing worse chronic health outcomes than Gen-X, and that the health trajectory of Gen-X and millennials is worse than that of baby boomers.[22,23] It will be important for future studies to examine trends in ACE-related outcomes to identify any increases that may be related to the increased prevalence of ACEs. In addition, work is needed to understand the role that increased effort to mitigate the effects of ACEs may have on the relationship between increased generational ACEs and any potential health outcomes. Current and future efforts to address chronic health may need to be updated to account for the shifting ACE landscape.

Our study results showing increased disparity between generations for people who identify as LGBTQ+ is cause for additional concern, as there is already existing literature on the health disparities the LGBTQ+ population faces, and increasing ACEs may serve to exacerbate those disparities.[14,24] Particularly concerning are the findings that 49.7% of LGBTQ+ millennials and 44.2% of LGBTQ+ Gen-Z reported 4 or more ACEs. With previous surveys finding that 20% of millennials and Gen-Z self-identify as LGBTQ+, the potential public health impact of these high ACE scores is immense.[13] There is a documented need for targeted efforts seeking to improve the health of the LGBTQ+ population, and our findings suggest that this effort may be more critical than previously anticipated.[24,25]

Broadly, several intervention strategies have been found to effectively reduce ACE exposure at the family, school, and clinic level, and efforts to implement these strategies should be expanded and targeted toward the ACEs most frequently experienced in the current generation.[26] For example, psychoeducational trainings on family conflict management and integrating social-emotional learning in schools have been successful.[26] Regardless of the specific strategy, 1 of the key components is improving the frequency with which clinicians screen for and discuss ACEs.[26] Previous work on LGBTQ+ health care has suggested the broad adoption of trauma-informed care for this population, a position that is reinforced by our findings.[24] Given the increased prevalence of ACEs in younger generations, however, adopting a trauma-informed approach to care more broadly may be prudent.

Policy Implications

Our results suggest that each generation has faced unique challenges regarding exposure to ACEs. In addition to the universal increases in several ACEs, Gen-X experienced the most sexual abuse and physical abuse, while Gen-Z had the most exposure to household depression, parental incarceration, and emotional abuse. The millennial generation appeared to be a transitional generation, experiencing some of the interparental violence and sexual abuse reported by Gen-X as well as the emotional abuse and household dysfunction experienced by Gen-Z. If the differential exposure to ACEs among generations reflects the influence of structural factors, then our findings may be suggestive of policy areas that should be evaluated for their role in exposure to ACEs.

There is an extensive literature documenting effective strategies for reducing ACE exposure. Universal clinical approaches, such as increasing mental health and intimate partner violence screenings for all parents during perinatal care, as well as targeted interventions, such as nurse–family partnership programs, have achieved success in reducing ACEs.[27,28] In addition, economic and social policies have shown considerable promise regarding ACEs, such as implementing an earned income tax credit, raising the minimum wage, and providing quality early childhood education.[28,29] Increasing financial support for these strategies at the federal, state, and county level has significant potential to reduce future ACE exposure and represents an opportunity for improving the health of future generations.

Gen-X, millennials, and Gen-Z have seen increased exposure to household depression and emotional abuse, both of which may be addressed through increasing access to mental health care. Depression is highly treatable with evidence-based therapies, and mental health care for parents has been identified as a highly effective method for preventing child abuse.[30]

More broadly, improving the use of mental health care among millennials and Gen-Z may aid in reducing the health impacts of ACEs while also reducing the risk of intergenerational transfer of ACEs to the next generation. However, there are currently well-established barriers to mental health care, including workforce shortages and insurance limitations, which will need to be modified at the policy level.[31,32] Gen-X, millennials, and Gen-Z all have experienced increases in household drug use and parental incarceration. Both increasing drug use and increasing incarceration have been at least partially attributed to the War on Drugs and could be addressed through substance use policy reform addressing mandatory minimums for nonviolent drug offenses and improving access to substance use treatment.[33]

As the prevalence of people openly identifying as LGBTQ+ increases, implementing policies that promote LGBTQ+ acceptance and reduce stigma will be vital for reducing ACEs. Policies codifying equal rights protection for LGBTQ+ individuals are essential in addressing discrimination. In addition, policies designed to promote inclusivity in schools, such as the formation of gay–straight alliance student groups and providing funding for Safe-Zone training programs have been shown to reduce stigma.[34] Finally, providers competent and comfortable treating the LGBTQ+ population are in short supply, and health policies that increase access to physical and mental health care for LGBTQ+ individuals will be paramount in efforts to mitigate the deleterious effect of ACEs.[24,25] In particular, improving access to mental health care for the LGBTQ+ population should be addressed, as 63% of LGBTQ+ millennials and 57% of LGBTQ+ people from Gen-Z reported emotional abuse.

Public Health Implications

Our results indicate that exposure to ACEs varies by generation, several ACEs are increasing among younger generations, and LGBTQ+ status is associated with greater ACE exposure and generational differences. These findings suggest that there may be an increase in ACE-related chronic health conditions as Gen-X, millennials, and Gen-Z age, which has implications for health care spending and the available workforce trained in trauma-informed care for these populations as they age. There may be opportunities for policy-level changes to reduce ACEs among future generations, such as improving ACE screening, increasing access to mental health care and substance use treatment, ending the War on Drugs, raising the minimum wage, and increasing access to quality early childhood education. Further effort is needed to identify and implement effective preventive measures.

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PUBLICATION INFORMATION

Full Citation: Hughes PM, Ostrout TL, Pèrez Jolles M, Thomas KC. Adverse childhood experiences across birth generation and LGBTQ+ identity, Behavioral Risk Factor Surveillance System, 2019. *Am J Public Health*. 2022;112(4):662–670.

Acceptance Date: November 22, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306642

CONTRIBUTORS

P. M. Hughes and T. L. Ostrout developed the concept for the study. P. M. Hughes conducted the analysis, interpretation, and writing of the initial draft with guidance from M. Pèrez Jolles and K. C. Thomas. All authors contributed to the editing of the submitted draft and throughout the revision process.

ACKNOWLEDGMENTS

P. M. Hughes is supported by an Eshelman Fellowship from the Eshelman School of Pharmacy, UNC at Chapel Hill.

An earlier version of this work was presented at the 2021 American Public Health Association annual conference.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

This study was deemed exempt by the institutional review board of UNC Chapel Hill.

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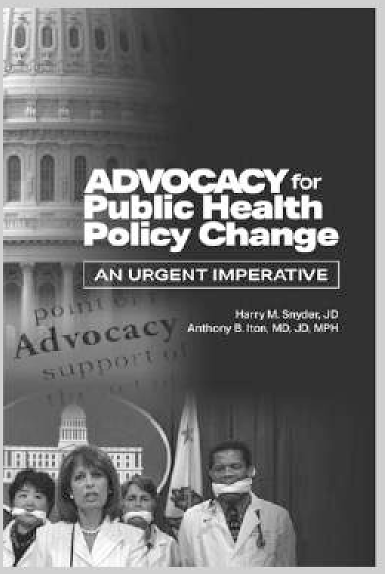

Disparities in Breastfeeding Initiation Among African American and Black Immigrant WIC Recipients in the District of Columbia, 2007–2019

Amira A. Roess, PhD, MPH, Rebecca C. Robert, PhD, MS, Doris Kuehn, MS, RD, Nwanneamaka Ume, MPH, Brianna Ericson, MPH, Emily Woody, MPH, RDN, Swathi Vinjamuri, BE, and Paulette Thompson, MS, RDN

Objectives. To estimate differences in breastfeeding initiation (BFI) rates between African Americans and Black immigrants enrolled in the District of Columbia Special Supplemental Nutrition Program for Women, Infants and Children (WIC) between 2007 and 2019.

Methods. We used data collected as part of routine WIC program activities for first-time mothers (n = 38 142). Using multivariable logistic regression models, we identified determinants of BFI for African Americans, Black immigrants, non-Hispanic Whites, and Hispanics. To assess the trend in BFI over time, we calculated the average of the annual percentage changes.

Results. Compared with African Americans, Black immigrants had a 2.7-fold higher prevalence and Hispanics had a 5.8-fold higher prevalence of BFI. The average of the annual percentage changes was 0.85 for Hispanics, 3.44 for Black immigrants, 4.40 for Non-Hispanic Whites, and 4.40 for African Americans. African Americans had the only statistically significant change ($P < .05$). Disparities in BFI persisted over the study period, with African Americans demonstrating the lowest rates each year.

Conclusions. Significant differences exist in BFI between Black immigrants and African Americans. Combining African Americans and Black immigrants masks important differences, overestimates rates among African Americans, and may lead to missed opportunities for targeting interventions and policies to improve breastfeeding. (*Am J Public Health*. 2022;112(4):671–674. https://doi.org/10.2105/AJPH.2021.306652)

AJPH April 2022, Vol 112, No. 4

Breastfeeding reduces the risk for sudden infant death syndrome, infectious diseases, asthma, obesity, and type 2 diabetes in infants and children, and for breast and ovarian cancer in women who breastfed, all of which disproportionately affect African American populations.[1] Healthy People 2020's target for breastfeeding initiation (BFI; 81.9%) was met nationally by the year 2014, but not by all racial/ethnic groups.[2] Persistent disparities by race/ethnicity remain; the Centers for Disease Control and Prevention's most recently reported data show that BFI is lowest among non-Hispanic Blacks, which, at 73.7%, falls short of the Healthy People 2020 target.[3]

However, current federal race/ethnicity classifications are problematic because they may mask potentially important differences in health behaviors and outcomes among the Black American population.[4] For example, a recent systematic review of breastfeeding practices of Black immigrants residing in high-income countries provides evidence of high BFI (90%).[5] Others report statistically greater odds of BFI among Black immigrants than among nonimmigrant Blacks in the United States.[6–8] Without detailed data by race/ethnicity, the potential for poorly targeted interventions and policies exists, and opportunities to improve breastfeeding may be missed. We did not find any literature estimating BFI differences between Black American subgroups of women in the

Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Our objective was to estimate BFI rate differences between African Americans and Black immigrants enrolled in the District of Columbia WIC program over time.

METHODS

We conducted a secondary analysis of de-identified data collected as part of routine WIC program activities in the District of Columbia WIC program. We extracted data for all mothers who gave birth to a first child, singleton infant between January 1, 2007 and December 31, 2019 (n = 38 142). The final models consisted of all women with breastfeeding behavior data specified and no missing responses for the independent variables included (n = 35 108).

Outcome

We determined the outcome, BFI (yes or no), using WIC food package issuance data, a valid indicator for breastfeeding behavior.[9] At the first WIC site visit following the infant's birth, WIC staff collect breastfeeding behavioral data to determine eligibility for WIC benefit issuance (i.e., receipt of food package for the mother, formula, or both).

Determinants

We based selected sociodemographic and other potential determinants on a literature review, which included maternal age (aged ≤ 20, 21–30, 31–45, or ≥ 46 years), education (< high school, high school graduate or equivalent, and > high school education), maternal marital status (married or unmarried), household size (1–2, 3–4, 5–6, or ≥ 7), low birth weight status (yes or no), year of participation (continuous variable), and race/ethnicity (non-Hispanic White, Hispanic, and Black, which included 2 subgroups: African American and Black immigrants). We defined African Americans as those self-reporting as African American, not Hispanic, and speaking English only. We defined Black immigrants as those self-reporting as African American, not Hispanic, and speaking a language other than English.[10]

Statistical Analysis

We conducted bivariate analyses between the outcome (BFI) and each of the potential determinants, and between pairs of sociodemographic variables to assess their relation and multicollinearity. We included variables associated with BFI in the bivariate analysis ($P < .05$) or that we found important from the literature in the final models. Using a multivariable logistic regression model, we estimated adjusted odds ratios (AORs) and 95% confidence intervals (CIs) between BFI and potential determinants. To assess the trend over time in BFI, we calculated the average of the annual percentage changes (AAPC). We tested the hypothesis of whether the true average was greater than zero based on a 2-sided *t* test. We conducted all analyses with Stata version 16 (StataCorp, LP, College Station, TX).

RESULTS

Almost half of the sample was aged 21 to 30 years (50.4%), possessed a high school degree or equivalent (45.0%), and lived in a household of 3 to 4 people (46.7%). Most were unmarried (89.2%) and 10.0% gave birth to a low birth weight baby. The number of women enrolled in WIC each year decreased over time, from 2426 in 2007 to 2210 in 2019. The largest racial/ethnic group was the Black subgroup of African American (74.8%), followed by Hispanic (16.9%), the Black subgroup of Black immigrant (6.0%), and non-Hispanic White (2.0%).

The average BFI rate was 48.6%. It was highest among Hispanics (77.7%), followed by Black immigrants (69.6%), non-Hispanic Whites (60.9%), and finally African Americans (39.9%). In the multivariable analysis, married compared with unmarried recipients and recipients with more than a high school education compared with those with less education had a significantly higher prevalence of BFI (Table A, available as a supplement to the online version of this article at http://www.ajph.org). Recipients in the youngest and oldest age groups had a significantly lower prevalence of BFI than did those aged 21 to 45 years. Those who gave birth to a low birth weight baby and recipients who lived in households with 7 or more people compared with smaller households had a significantly lower prevalence of BFI.

A significant increase in BFI occurred over the 13-year study period (AOR = 1.06; 95% CI = 1.05, 1.06). Race/ethnicity demonstrated the strongest association with the outcome. Compared with African Americans, Hispanics had a 5.8-fold higher prevalence of BFI and Black immigrants had a 2.7-fold higher prevalence. The AAPC was 0.85 for Hispanics, 3.44 for Black immigrants, 4.40 for non-Hispanic Whites, and 4.40 for African Americans; the last group was the only one with a statistically significant change ($P < .05$; Figure 1). Disparities in BFI persisted over the study period, with African Americans demonstrating the lowest rates each year (Figure 1).

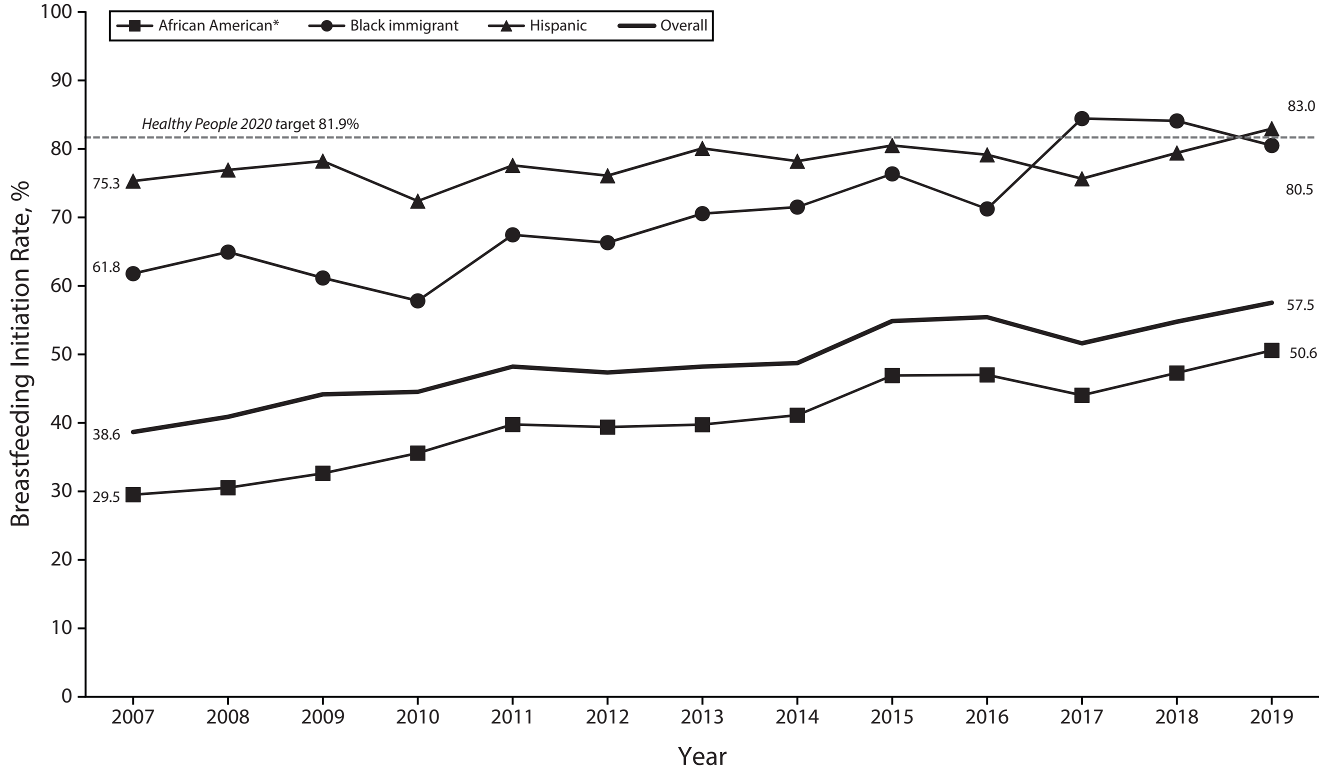

FIGURE 1— **Breastfeeding Initiation Rate (%) by Race/Ethnicity With Black Subgroups in the District of Columbia Special Supplemental Nutrition Program for Women, Infants and Children (WIC) population: 2007–2019**

Note. AAPC = average annual percentage change. The sample size was n = 36 015. AAPC in rate, 2007–2019: Hispanic = 0.92; Black immigrant = 2.78; and African American = 4.51 ($P < .05$). Non-Hispanic Whites not shown because of low numbers.

DISCUSSION

We uncovered significant differences in BFI between Black immigrants and African Americans enrolled in the District of Columbia WIC program. These results align with the literature, with findings of higher BFI for Black immigrants than for African Americans.[6–8] Overall, BFI increased significantly over time in the study population, mirroring the national temporal trend,[2] but at lower prevalence rates. This is similar to national data on WIC recipients compared with the general US population.[3] Differentiating between African Americans and Black immigrants showed a significant annual increase in BFI among African Americans but a modest, statistically nonsignificant increase in all other groups.

As with most program data, inherent limitations exist. WIC data are collected to evaluate program impact on breastfeeding and other health and nutrition outcomes and to adjust the issuance of WIC benefits recipients receive (i.e., not for research purposes). Potential self-report bias may include underreporting breastfeeding behavior to obtain formula vouchers or overreporting to receive additional maternal food package issuance. Using primary language spoken at home to identify Black immigrants may underestimate this population, particularly in the District of Columbia, where some Black immigrants may come from English-language countries.[10]

Differentiating Black American WIC recipients by primary language spoken at home allowed us to conduct this study of WIC recipients. Our findings add to the literature on the importance of differentiating between racial/ethnic subgroups when evaluating behaviors, health, and development outcomes.[4,7,11,12] This is the first study, to our knowledge, to examine Black American subgroups enrolled in WIC. WIC and other federal programs can employ similar methods to evaluate the reach and impact of their programs using readily available data that may include language spoken at home or place of birth.

PUBLIC HEALTH IMPLICATIONS

In our analysis of a diverse, low-income population enrolled in the District of Columbia WIC program over a 13-year period, African Americans experienced the lowest BFI rates, whereas Black immigrants demonstrated significantly higher rates. Combining African American and Black immigrant subgroups masks important differences and overestimates rates among African Americans. This in turn overestimates the impact of interventions, particularly among African Americans, and may lead to missed opportunities for targeting interventions and policies to improve breastfeeding. AJPH

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PUBLICATION INFORMATION

Full Citation: Roess AA, Robert RC, Kuehn D, et al. Disparities in breastfeeding initiation among African Americans and Black immigrant WIC recipients in the District of Columbia, 2007–2019. *Am J Public Health.* 2022;112(4):671–674.

Acceptance Date: December 4, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306652

CONTRIBUTORS

A. A. Roess led the data analysis. A. A. Roess and R. C. Robert conceptualized the study and wrote the brief. D. Kuehn, E. Woody, S. Vinjamuri, and P. Thompson assisted with results interpretation and writing the brief. N. Ume and B. Ericson assisted with data analysis.

ACKNOWLEDGMENTS

N. Ume was supported by a fellowship from the Clara Schiffer Project on Women's Health.

The authors wish to thank the staff at the District of Columbia (DC) Department of Health, DC Women Infant Child State Agency, Washington, DC, for their assistance and support throughout the analysis.

Note. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the District of Columbia Department of Health.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

HUMAN PARTICIPANT PROTECTION

We conducted a secondary analysis of de-identified data collected as part of routine Special Supplemental Nutrition Program for Women, Infants and Children (WIC) program activities in the District of Columbia WIC program; thus the District of Columbia WIC institutional review board did not consider this study human participant research.

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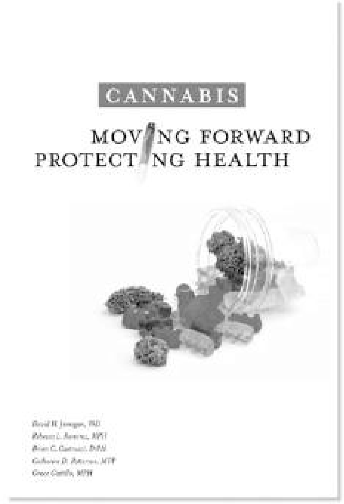

Menstrual Product Insecurity Resulting From COVID-19–Related Income Loss, United States, 2020

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Objectives. To identify key effects of the pandemic and its economic consequences on menstrual product insecurity with implications for public health practice and policy.

Methods. Study participants (n = 1496) were a subset of individuals enrolled in a national (US) prospective cohort study. Three survey waves were included (March–October 2020). Menstrual product insecurity outcomes were explored with bivariate associations and logistic regression models to examine the associations between outcomes and income loss.

Results. Income loss was associated with most aspects of menstrual product insecurity (adjusted odds ratios from 1.34 to 3.64). The odds of not being able to afford products for those who experienced income loss was 3.64 times (95% confidence interval [CI] = 2.14, 6.19) that of those who had no income loss and 3.95 times (95% CI = 1.78, 8.79) the odds for lower-income participants compared with higher-income participants.

Conclusions. Pandemic-related income loss was a strong predictor of menstrual product insecurity, particularly for populations with lower income and educational attainment.

Public Health Implications. Provision of free or subsidized menstrual products is needed by vulnerable populations and those most impacted by pandemic-related income loss. (*Am J Public Health*. 2022;112(4):675–684. https://doi.org/10.2105/AJPH.2021.306674)

By March 23, 2021, the United States had experienced approximately 29.9 million COVID-19 cases and 544 131 deaths.[1] The negative impacts of COVID-19 across the United States range from illness to significant economic impact. Unemployment has grown substantially; millions lack access to basic goods and services, such as health care, food, and housing.[2,3] The pandemic has had gendered implications, including women's increased vulnerability to the social and economic repercussions of lockdowns and expanded caretaking roles.[4] A key aspect of the gendered experience of COVID-19 has remained inadequately explored—that of how the pandemic affected the experience of managing menstruation, including access to menstrual products.

Recently, there has been growing attention globally to "period poverty" or the inability to afford menstrual products as needed.[5,6] Although minimal evidence exists across the United States, it is likely that more people struggle to afford menstrual products than is documented.[6–8] During the pandemic, US women's economic security has significantly decreased, with women more likely to have become unemployed than men.[9] Food bank dependence increased significantly, with some organizations reporting a 60% increase in users,[10,11] and there has been an increased reliance on support services for other essential necessities.[12] Menstrual products are not included within most US public assistance programs and cannot be purchased under the Supplemental Nutrition Assistance Program or the Special Supplemental Nutrition Program for Women, Infants, and Children.

However, in March 2020, with the passage of the Coronavirus Aid, Relief, and Economic Security Act, the US government classified menstrual products as medical expenses, enabling the use of flexible spending accounts or health savings accounts and health reimbursement arrangements to purchase products.[13] While this indicates progress, only certain segments of the population will benefit, as it still requires knowing that funds can be used for menstrual products and having the funds to purchase them.

Those who menstruate may have faced noneconomic COVID-19–related barriers to accessing menstrual products, including being unable to leave home because of underlying health conditions, transportation challenges, or an inability to purchase online because of lack of Internet access or credit. An added barrier was the depleted stocks because of shortages.[14] Menstruation also continues to be perceived as something to be kept hidden, and a matter of personal, not societal, responsibility.[15] People may thus feel embarrassed or ashamed seeking products from free sources, like foodbanks,[6,16] or may be suffering from menstrual leaks because of inadequate access to products. Challenges may be greater for those newly menstruating who may lack access to peer groups as sources of menstrual products given the shift to virtual learning.[17] Understanding if the pandemic has contributed negative experiences in managing menstruation is essential to devise appropriate policy and social support solutions.[18]

We identified key effects of the pandemic and its economic consequences on the ability to manage menstruation and explored what characteristics increase risk of menstrual product insecurity, both having implications for public health practice and policy.

METHODS

Study participants were a subset of individuals enrolled in the Communities, Households, and SARS-CoV-2 Epidemiology (CHASING COVID) Cohort Study. CHASING COVID is a national prospective cohort study of 6753 adults launched on March 28, 2020, to understand the spread and impact of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, detailed in a previous publication.[19] Study visits (completion of online questionnaires) occur every 1 to 3 months and will continue through December 2021. Eligibility was determined during cohort screening enrollment. To be eligible for inclusion in the cohort, individuals had to (1) reside in the United States or a US territory, (2) be aged 18 years or older, (3) provide a valid e-mail address, and (4) demonstrate early engagement in longitudinal study activities. Study participants were recruited via advertisements in both English and Spanish on social media platforms (e.g., Facebook, Instagram, and Scruff), Qualtrics Panel, or via referral to the study (anyone with knowledge of the study was allowed to invite others). Study staff systematically monitored cohort demographics and proactively adjusted advertisement strategies to balance geographic and sociodemographic characteristics of respondents. Data were collected by using Qualtrics (Qualtrics, Provo, UT).

For inclusion in this analysis, participants (1) could not be currently pregnant and (2) answered “yes” to the question “Since March 2020, have you menstruated?”

Variable Definitions

Menstrual product insecurity outcomes. All menstruation-related variables were from the third wave of surveys (completed by 75% of the CHASING COVID cohort participants), executed between October 15 and November 19, 2020. The questions were asked of all female, nonbinary, or transgender male participants who were not currently pregnant and had menstruated since March 2020 (a total of 1496 participants). Six outcome variables were designed to understand the impact of the COVID-19 pandemic on challenges around managing menstruation and specific causes of difficulties related to acquiring menstrual products, including affordability and accessibility. Additional variables sought to capture coping mechanisms if participants were unable to afford or access products. Lastly, we sought to explore the emotional impact of not being able to access or afford products by exploring levels of stress around managing menstruation.

We assessed “change in menstrual management” with “Since March 2020, you have not experienced change related to your sanitary product.” In models, coding was reversed so that “yes” indicated that there were changes (i.e., the participant’s menstrual management was affected), and “no” indicated that there were no changes. This variable is designed to capture overall impact. We assessed “not affordable” with “Since March 2020, I have not been able to buy the sanitary product I normally use because I could not afford it.” We assessed “not available” with “Since March 2020, I have not been able to buy the sanitary product I normally use because it was not available in the store.” We assessed “change products less often" with "Since March 2020, I have to change my used sanitary product less often to make each one last longer." We assessed "use makeshift materials" with "Since March 2020, I have had to use makeshift materials because I ran out of my sanitary product." We assessed "increased stress" with "Compared to before the pandemic, getting my sanitary product is more stressful."

Exposure variable. The exposure variable of interest captures personal loss of income during the COVID-19 pandemic. This was collected at waves 1, 2, and 3. If the participant answered "yes" at any wave, "loss of income" was coded as "yes" (i.e., any reported loss of income during the pandemic). The "loss of income" question was "Have you experienced a personal loss of income in the past month as a result of the new coronavirus?"

Individual-level factors. The following basic demographics were collected: age, gender, race/ethnicity, educational attainment, employment, and annual income at baseline. We assessed "food insecurity" with "In the past month, the food that we bought just didn't last, and we didn't have money to get more." Participants chose 1 of 3 responses (1 = never true; 2 = sometimes true; 3 = always true). The highest value reported at any wave was retained. We assessed "housing insecurity" with the question "In the past month, how often would you say you were worried or stressed about having enough money to pay your rent/mortgage?" Participants chose 1 of 5 possible responses (from 1 = never to 5 = always). The highest-value response at any wave was retained.

Contextual factors. We assigned Zip Code Tabulation Area–level "locale" (city, suburb or town, or rural) based on the participant's home zip code, which was obtained from the Education Demographic and Geographic Estimates Program.[20] To assess (1) COVID-19 death rate and (2) SARS-CoV-2 case rate, we used county- or county-equivalent–level cumulative COVID-19 death and SARS-CoV-2 case rates per 100 000 residents on the day the participant began the survey to quantify COVID-19 burden in each participant's county. We obtained case and death data from *New York Times* data repository.[21] We used American Community Survey 2018 5-year estimates via the National Historic Geographic Information System as the denominators.[22]

Statistical Analysis

We calculated descriptive statistics to assess the prevalence of menstrual product insecurity outcomes, income loss, and distribution of characteristics in our study sample. We compared demographic, economic, and contextual characteristics by the exposure and outcome variables of interest in bivariate analyses to screen for potential explanatory variables for subsequent multivariate analyses. We calculated crude odds ratios (ORs) and adjusted ORs (AORs) with 95% confidence intervals (95% CIs) in logistic models. We examined the associations between income loss and menstrual product insecurity outcomes, accounting for selected demographic, economic, and contextual factors, in adjusted logistic regression models. We selected control variables based on the findings from bivariate analyses as well as existing evidence of the impact of race/ethnicity, education, income, and geography on period poverty.[6–8] Gender identity was not included because of the relatively small number of transgender or nonbinary participants who menstruated during the study period (n = 47; 3.1%) as compared with female participants (n = 1449; 96.9%). We determined statistical significance at the *P* less than .05 level. We conducted all analyses by using R version 3.6.1.[23]

RESULTS

Inclusion restrictions resulted in a study population of 1496 participants whose characteristics are shown in Table 1. All age groups were represented, with the plurality falling between 25 and 34 years (36%). There was variation in locale, with 42% living in cities, 26% in suburbs or towns, and 32% in rural areas. The majority of participants were employed at baseline (62%), had a college degree (58%), and were non-Hispanic White (55%). Vulnerable or marginalized groups were also well represented with nearly one third (31%) having a baseline income below $35 000, 15% having a high-school education or less, and 20% identifying as Hispanic/Latinx. Nearly half the participants (49%) reported income loss at least once. Housing and food insecurity were also highly prevalent, with 33% reporting housing insecurity "usually" or "often" and 35% reporting food insecurity "sometimes" or "often" at least once.

Income Loss

Participants' characteristics stratified by income loss can be seen in Table 2. Income loss was associated with those who were younger (aged 18–24 years; *P* = .033), those who were out of work at baseline, those who earned less than $35 000 per year, those who had lower educational attainment, those who were non-Hispanic Black or Hispanic/Latinx, and those with either food or housing insecurity (all $P < .001$). Locale (city, suburb or town, or rural) and cumulative death and case rates were not associated with income loss.

TABLE 1— **Study Sample Characteristics: CHASING COVID Cohort Study, United States, March–October 2020 (n = 1496)**

Characteristic	No. (%) or Mean ±SD	Missing
Age group, y		1
18–24	315 (21.1)	
25–34	540 (36.1)	
35–44	438 (29.3)	
≥ 45	202 (13.5)	
Employment		0
Employed	922 (61.6)	
Homemaker	162 (10.8)	
Out of work	178 (11.9)	
Student	234 (15.6)	
Income, $		66
< 35 000	445 (31.1)	
35 000–49 999	163 (11.4)	
50 000–99 999	446 (31.2)	
≥ 100 000	376 (26.3)	
Education		0
High school or less	219 (14.6)	
Some college	410 (27.4)	
College	867 (58.0)	
Race/ethnicity		5
Non-Hispanic White	814 (54.6)	
Asian/Pacific Islander	174 (11.7)	
Non-Hispanic Black	147 (9.9)	
Hispanic	300 (20.1)	
Other	56 (3.8)	
Income loss		17
No	762 (51.5)	
Yes	717 (48.5)	
COVID-19–related housing anxiety		0
Never	313 (20.9)	
Rarely	295 (19.7)	
Sometimes	401 (26.8)	
Usually	201 (13.4)	
Always	286 (19.1)	
COVID-19–related food anxiety		0
Never	980 (65.5)	
Sometimes	313 (20.9)	
Often	203 (13.6)	
Locale		11
Rural	471 (31.7)	
Suburb or town	385 (25.9)	
City	629 (42.4)	
Cumulative case rate per 100 000 residents	2532 ±1047	11
Cumulative death rate per 100 000 residents	86.20 ±81.11	11

Menstrual Product Insecurity Outcomes

When we compared the 6 outcome variables with the other factors, certain trends could be identified (Tables A–F, available as supplements to the online version of this article at http://www.ajph.org). Income loss, the exposure of interest, was associated with all of the menstrual product insecurity outcomes other than "not available." Similarly, lower income and educational attainment at baseline were both consistently associated with all of the outcomes other than "not available." All outcomes were associated with housing and food insecurity—those who had more menstrual product insecurity also suffered from higher insecurities around other basic needs.

Other factors were not as consistently associated with menstrual product insecurity outcomes as those listed previously. Employment was only correlated with "not affordable," "change products less often," and "use makeshift materials," where the participants who were out of work tended to have the most challenges. Identifying as Hispanic/Latinx was associated with "change in menstrual management," "not affordable," and "change products less often," whereas those who identified as non-Hispanic Black were associated with "not affordable," and participants who did not fall in predefined racial/ethnic category were associated with both "not affordable" and "change products less often."

Living in rural zip codes was associated with both "changes in menstrual management" and "not affordable," and SARS-CoV-2 case rates were not associated with any outcomes. Counterintuitively, COVID-19 death rates were inversely associated with 3 of the outcomes ("not affordable," "not available," and "use makeshift materials").

Models

Unadjusted logistic regression models show the crude associations between the menstrual product insecurity outcome variables and income loss (Table 3). All outcome variables, other than "not available," were significantly associated with the exposure. Participants who suffered economic loss had more than 5 times the odds of not being able to afford menstrual products (OR = 5.26; 95% CI = 3.20, 8.64) compared with those who did not experience income loss. They had 3.5 times the odds of using makeshift materials to manage menstruation (OR = 3.51; 95% CI = 2.07, 5.94), more than 3 times the odds of changing menstrual products less often (OR = 3.43; 95% CI = 2.00, 5.91), and more than 2 times the odds of experiencing increased stress when acquiring products (OR = 2.45; 95% CI = 1.83, 3.28) and to have experienced a general change in menstrual management (OR = 2.44; 95% CI = 1.93, 3.09) when compared with those who did not experience income loss. Participants who experienced income loss had increased odds of experiencing a lack of availability of menstrual products, but this was not statistically significant (OR = 1.38; 95% CI = 0.97, 1.96).

Based on the findings from bivariate analyses, adjusted models did not

TABLE 2— Distribution of Selected Participant Characteristics by Income Loss: CHASING COVID Cohort Study, United States, March–October 2020

Characteristic	Had Income Loss (n = 717), No. (%) or Mean ±SD	No Income Loss (n = 762), No. (%) or Mean ±SD	P
Age group, y			.033
18–24	167 (23.3)	139 (18.3)	
25–34	249 (34.7)	289 (38.0)	
35–44	216 (30.1)	218 (28.6)	
≥ 45	85 (11.9)	115 (15.1)	
Missing	0	1	
Employment status			< .001
Employed	405 (56.5)	515 (67.6)	
Homemaker	68 (9.5)	92 (12.1)	
Out of work	129 (18.0)	44 (5.8)	
Student	115 (16.0)	111 (14.6)	
Missing	0	0	
Income, $			< .001
< 35 000	286 (41.8)	149 (20.4)	
35 000–49 999	86 (12.6)	76 (10.4)	
50 000–99 999	189 (27.6)	256 (35.0)	
≥ 100 000	123 (18.0)	250 (34.2)	
Missing	33	31	
Education			< .001
High school or less	142 (19.8)	72 (9.4)	
Some college	223 (31.1)	180 (23.6)	
College	352 (49.1)	510 (66.9)	
Missing	0	0	
Race/ethnicity			< .001
Non-Hispanic White	366 (51.3)	442 (58.2)	
Asian/Pacific Islander	70 (9.8)	100 (13.2)	
Non-Hispanic Black	76 (10.6)	70 (9.2)	
Hispanic	167 (23.4)	127 (16.7)	
Other	35 (4.9)	21 (2.8)	
Missing	3	2	
COVID-19–related housing anxiety			< .001
Never	58 (8.1)	252 (33.1)	
Rarely	90 (12.6)	201 (26.4)	
Sometimes	195 (27.2)	201 (26.4)	
Usually	134 (18.7)	64 (8.4)	
Always	240 (33.5)	44 (5.8)	
Missing	0	0	
COVID-19–related food anxiety			< .001
Never	359 (50.1)	609 (79.9)	
Sometimes	193 (26.9)	116 (15.2)	
Often	165 (23.0)	37 (4.9)	
Missing	0	0	

Continued

TABLE 2— Continued

Characteristic	Had Income Loss (n = 717), No. (%) or Mean ±SD	No Income Loss (n = 762), No. (%) or Mean ±SD	*P*
Locale			.62
Rural	223 (31.3)	242 (32.0)	
Suburb or town	193 (27.1)	188 (24.9)	
City	296 (41.6)	326 (43.1)	
Missing	5	6	
Cumulative case rate per 100 000 residents	2570 ±1041	2510 ±1046	.27
Missing	5	6	
Cumulative death rate per 100 000 residents	86.62 ±81.16	86.61 ±81.26	.99
Missing	5	6	

include type of employment or SARS-CoV-2 case rate variables because of lack of association or duplication of included variables. Housing and food insecurity were also not included as they were viewed as "outcomes" of financial loss or hardship, similar to menstrual product insecurity. When models were adjusted for individual (i.e., age, race/ethnicity, education, income at baseline) and contextual-level factors (i.e., locale, cumulative COVID-19 death rate), the associations between income loss and menstrual product security outcomes were attenuated but remained significant for all models other than product availability (AOR = 1.34; 95% CI = 0.92, 1.96; Table 3; Figure 1). Generalized variance inflation factors, a collinearity diagnostic designed to accommodate categorical variables, were less than 2.0 in all models, suggesting that there was not excessive collinearity among the independent variables.

Participants who experienced income loss, compared with those without income loss, had more than 3.5 times the odds of being unable to afford menstrual products (AOR = 3.64; 95% CI = 2.14, 6.19), nearly 3 times the odds of changing products less often or using makeshift materials to manage menstruation (AOR = 2.88; 95% CI = 1.61, 5.15 and AOR = 2.58; 95% CI = 1.47, 4.53, respectively), and more than 2 times the odds of experiencing more stress when acquiring products and experiencing overall changes in menstrual management (AOR = 2.2; 95% CI = 1.66, 2.77 and AOR = 2.14; 95% CI = 1.61, 3.02, respectively). Having lower income at baseline (e.g., < $35 000) compared with those who made more than $100 000 also showed significant associations in all of the adjusted models other than changing products less often and increased stress when acquiring products. The strength of association was greatest with participants' inability to afford products (AOR = 3.95; 95% CI = 1.78, 8.79).

Lower educational attainment (e.g., high school or less) also showed significant associations in adjusted models when compared with those with college degrees for all outcomes other than product availability, and again the strongest association was with product affordability (AOR = 2.72; 95% CI = 1.48, 5.00). The only racial/ethnic characteristics that maintained significance in adjusted models were participants who identified as Hispanic/Latinx, who had more than 2 times the odds of changing products less often (AOR = 2.01; 95% CI = 1.09, 3.69) when compared with non-Hispanic White participants. The only locale category that showed significance in the models was those living in rural areas, who had higher odds of not being able to afford products (AOR = 1.79; 95% CI = 1.05, 3.03) when compared with those living in cities, and those living in areas with higher COVID-19 cumulative death rates having fewer issues with product availability (AOR = 1.00; 95% CI = 0.99, 1.00).

DISCUSSION

This study's key finding was that income loss was a strong predictor of menstrual product insecurity. Half of the study population reported economic loss during the pandemic, most of whom also reported having lower income and educational attainment at baseline. Among the outcomes reported, the odds of not being able to afford products were higher among participants with pandemic-related income loss and for lower-income participants. We use "menstrual products" in reference to the questionnaire items regarding "sanitary products" given the evolving terminology.

Some of the reported menstrual product insecurity outcomes measured individual mitigation strategies, such as changing menstrual products less often or using makeshift materials. Both approaches have important health and social implications. An inability to change as needed or to use products that are sufficiently absorbent may lead to vaginal irritation or anxiety and stress around

TABLE 3— Associations Between Income Loss and Menstrual Product Security Outcomes: CHASING COVID Cohort Study, United States, March–October 2020

	Change in Menstrual Management	Not Affordable	Not Available	Change Products Less Often	Use Makeshift Materials	Increased Stress
Crude OR (95% CI)						
(Intercept)	0.23 (0.19, 0.28)	0.03 (0.02, 0.04)	0.09 (0.07, 0.11)	0.02 (0.02, 0.04)	0.03 (0.02, 0.04)	0.12 (0.09, 0.15)
Income loss ever						
No (Ref)	1	1	1	1	1	1
Yes	2.44 (1.93, 3.09)	5.26 (3.20, 8.64)	1.38 (0.97, 1.96)	3.43 (2.00, 5.91)	3.51 (2.07, 5.94)	2.45 (1.83, 3.28)
AOR (95% CI)						
(Intercept)	0.17 (0.09, 0.32)	0.01 (0.00, 0.02)	0.1 (0.04, 0.25)	0.04 (0.01, 0.15)	0.02 (0.01, 0.09)	0.16 (0.08, 0.35)
Income loss ever						
No (Ref)	1	1	1	1	1	1
Yes	2.14 (1.66, 2.77)	3.64 (2.14, 6.19)	1.34 (0.92, 1.96)	2.88 (1.61, 5.15)	2.58 (1.47, 4.53)	2.20 (1.61, 3.02)
Income, $						
< 35 000	1.87 (1.30, 2.71)	3.95 (1.78, 8.79)	1.94 (1.09, 3.47)	0.60 (0.28, 1.28)	2.57 (1.11, 5.93)	0.95 (0.62, 1.44)
35 000–49 999	1.46 (0.93, 2.29)	1.44 (0.51, 4.04)	2.33 (1.21, 4.49)	0.90 (0.37, 2.18)	1.42 (0.49, 4.12)	1.10 (0.66, 1.82)
50 000–99 999	1.09 (0.76, 1.55)	1.32 (0.55, 3.18)	1.51 (0.87, 2.62)	0.79 (0.38, 1.65)	1.43 (0.60, 3.41)	0.50 (0.33, 0.77)
≥ 100 000 (Ref)	1	1	1	1	1	1
Age	1.00 (0.99, 1.02)	1.01 (0.98, 1.03)	1.00 (0.97, 1.02)	0.98 (0.95, 1.01)	0.99 (0.97, 1.02)	0.99 (0.98, 1.01)
Education						
High school or less	1.52 (1.05, 2.22)	2.72 (1.48, 5.00)	0.86 (0.49, 1.51)	2.54 (1.18, 5.48)	1.97 (1.00, 3.88)	1.74 (1.12, 2.71)
Some college	1.13 (0.83, 1.54)	2.41 (1.38, 4.19)	0.74 (0.47, 1.18)	2.85 (1.52, 5.35)	1.60 (0.87, 2.94)	1.28 (0.88, 1.85)
College (Ref)	1	1	1	1	1	1
Race/ethnicity						
Non-Hispanic White (Ref)	1	1	1	1	1	1
Asian/Pacific Islander	0.74 (0.47, 1.16)	0.56 (0.21, 1.51)	0.45 (0.20, 1.01)	1.18 (0.46, 3.01)	0.42 (0.12, 1.40)	1.22 (0.76, 1.96)
Non-Hispanic Black	0.76 (0.49, 1.19)	0.97 (0.49, 1.91)	0.64 (0.32, 1.31)	0.78 (0.29, 2.15)	0.58 (0.23, 1.46)	0.57 (0.32, 1.02)
Hispanic	1.26 (0.92, 1.73)	0.94 (0.54, 1.64)	1.05 (0.66, 1.67)	2.01 (1.09, 3.69)	1.16 (0.64, 2.09)	0.93 (0.63, 1.38)
Other	1.35 (0.74, 2.48)	1.59 (0.69, 3.69)	1.40 (0.62, 3.15)	2.11 (0.74, 5.99)	0.94 (0.31, 2.83)	0.98 (0.46, 2.06)
Locale						
City (Ref)	1	1	1	1	1	1
Suburb or town	0.88 (0.63, 1.21)	1.20 (0.65, 2.19)	0.99 (0.61, 1.59)	0.91 (0.47, 1.77)	0.80 (0.41, 1.59)	1.02 (0.70, 1.48)
Rural	1.13 (0.83, 1.55)	1.79 (1.05, 3.03)	1.07 (0.68, 1.68)	1.09 (0.58, 2.04)	1.12 (0.63, 2.00)	0.95 (0.65, 1.39)
Cumulative death rate	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (0.99, 1.00)	1.00 (0.99, 1.00)	1.00 (0.99, 1.00)	1.00 (1.00, 1.00)

Note. AOR = adjusted odds ratio; CI = confidence interval; OR = odds ratio. Crude models: n = 1479; adjusted models: n = 1402. Additional descriptive statistics provided in tables available as supplements to the online version of this article at http://www.ajph.org.

potential odors or menstrual leaks onto clothing.[24–29] This in turn may impact the ability to go about activities of daily living, ranging from household chores to employment or caregiving.[26] There may also be social implications, including a loss of dignity or confidence.[8] Study findings suggested that the need for individual mitigation strategies was not only associated with COVID-19–related income loss but changing products less often was also associated with lower educational attainment and being Hispanic, while resorting to makeshift materials was associated with lower income and educational attainment.

The availability of menstrual products was not found to be associated with income loss, but may be linked to broader structural issues rather than

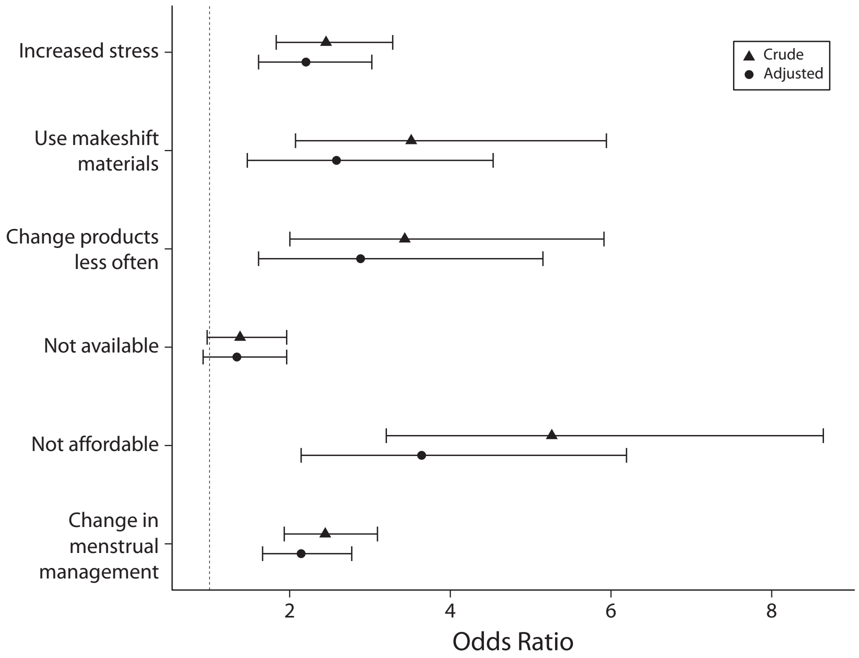

FIGURE 1— Associations Between Income Loss and Menstrual Product Security Outcomes: CHASING COVID Cohort Study, United States, March–October 2020

Note. Whiskers indicate 95% confidence intervals. Values are provided in Table 3.

associated with COVID-19 (e.g., lower-income participants tended to live in areas with less product availability). However, to fully study this relationship, a different project design may be in order; this may similarly explain the significant negative association with higher COVID-19 death rates. There did not appear to be any age-specific effect in relation to menstrual product insecurity during the pandemic, with age-related associations disappearing when we controlled for other characteristics.

The outcomes identified in relation to menstrual product insecurity during the pandemic were closely associated with housing and food insecurity. Although limited evidence on period poverty exists in the United States, a prepandemic survey conducted in 2019 of 183 low-income women in St Louis, Missouri, found that nearly 64% were unable to afford needed menstrual products in the previous year.[8] More recently, a survey conducted with 58 female students in St Louis found that nearly half were unable to afford needed menstrual products at least once in the last school year.[7] Similar challenges have been found among those experiencing homelessness in New York City and Seattle, Washington, who reported resorting to theft or going without food to obtain menstrual products.[26,28] Although some food banks and other social service organizations do provide menstrual products, stockouts and intermittent availability often hinder access.[8,29]

Around the world, there are numerous reports of period poverty, exacerbated by the impacts of the COVID-19 pandemic.[30,31] However, there have been few quantitative studies designed to understand the effect and determine who is at greatest risk. Reports of the negative impact of period poverty spurred the government of Scotland to announce new legislation mandating period products be made available to all in need.[32] However, insufficient data on the extent of US period poverty, and the ways in which COVID-19 has served to compound menstrual management challenges, have limited the development of appropriate legislation. This study's findings help inform this evidence gap.

The study findings also raise issues about the impact of menstrual product insecurity on people's physical and mental health and underscore the reality of gendered (and sex-based) burdens resulting from the COVID-19 pandemic. While such challenges may have an impact on everyone, those who experienced financial loss or had lower income tended to be the most affected. This suggests that health and social policy strategies are warranted, such as free or heavily subsidized menstrual products, along with more general economic interventions for those struggling with income loss. Of equal importance is raising awareness of the need for menstrual equity, ensuring that those who menstruate are able to manage their menstrual blood flow with dignity, ease, and comfort. This includes removing the remaining taxes on menstrual products in states across the United States[33] and ensuring that menstrual products are considered an essential item to be made available through social providers in times of emergency, both in the United States and globally.

Limitations

There are a number of limitations. First, the study used a panel with a pre-existing sampling frame and broad-based sociodemographic and economic questions not specifically designed to examine issues associated with menstruation or menstrual product insecurity. However, the range of variables collected were sufficient to support this study. Second, only a limited number of menstruation questions were permitted, restricting our exploration to key themes. Third, there was a limited overall sample size constraining the depth of some of the analyses (e.g., few responses per cell). This also reflects our inability to report on menstrual product insecurity for transgender or nonbinary participants. Fourth, menstrual product insecurity questions were only asked at 1 wave of the larger cohort study, and, as such, lacked longitudinal information. Fifth, the use of self-reported responses, and potential cultural differences within the responses, may under- or overrepresent experiences. Lastly, our study recruited participants primarily online, thereby limiting the potential participation of and generalizability to those without Internet access via a smartphone or desktop computer. While our study is national in scope and sociodemographically diverse, it was not designed to provide representative estimates of seroprevalence and cumulative incidence in the US population.[34]

There are multiple avenues to be explored in future research, including qualitative studies examining the context and if menstrual product availability can be better modeled and understood within the structural realities of peoples' lives, understanding the impact of menstrual product insecurity with and without housing and food anxiety on mental health, and, finally, examining the impact of mitigation strategies and policies, such as providing menstrual products at food banks or making them freely available.

Conclusions

Our study demonstrates that income loss was a strong predictor of menstrual product insecurity during the pandemic across the United States thus far. Populations with lower incomes at baseline and with the lowest educational attainment were most vulnerable. Provision of free or subsidized menstrual products, which is not included in the US emergency response, is needed for such populations.

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PUBLICATION INFORMATION

Full Citation: Sommer M, Phillips-Howard PA, Gruer C, et al. Menstrual product insecurity resulting from COVID-19–related income loss, United States, 2020. *Am J Public Health*. 2022; 112(4):675–684.

Acceptance Date: December 10, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306674

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M. Sommer, P. A. Phillips-Howard, and A. R. Maroko conceptualized the study and led on the development of the questions and the writing. C. Gruer and M. L. Schmitt contributed to the conceptualization and drafting of content. A. Berry, S. Kochhar, S. G. Kulkarni, and D. Nash contributed to the design and analysis of the data and supported the writing of the article. A.-M. Nguyen and A. R. Maroko led the formal analysis of the menstrual-specific data and supported the writing and reviewing of the article draft.

ACKNOWLEDGMENTS

Funding to support this project was provided by the Sid and Helaine Lerner Faculty Support Fund (M. Sommer, M. L. Schmitt, C. Gruer) and by the National Institute for Allergies and Infectious Diseases, award 3UH3AI133675-04S1 (MPI: D. Nash), the CUNY Institute for Implementation Science in Population Health, the CUNY Graduate School of Public Health and Health Policy (COVID-19 Grant Program; D. Nash, A. Berry, S. Kochhar, S. G. Kulkarni, A. R. Maroko).

The authors wish to thank all of the participants who shared their personal insights and recommendations about how menstrual insecurity affected their lives during and because of the pandemic, and how it could be better addressed within society going forward.

CONFLICTS OF INTEREST

The authors report no conflicts of interest.

HUMAN PARTICIPANT PROTECTION

The study protocol was approved by the institutional review board at the CUNY Graduate School of Public Health and Policy.

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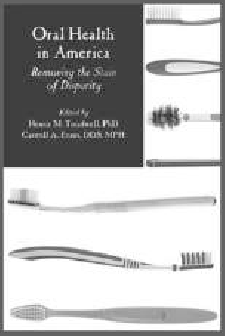

Polysubstance Use in Motor Vehicle Crash Fatalities

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I read with great interest the article by Lira et al.[1] assessing the involvement of cannabis and alcohol in motor vehicle crash (MVC) fatalities in the United States. The authors used data from the National Highway Traffic Safety Administration Fatality Analysis Reporting System (FARS) to examine trends in cannabis- and alcohol-involved MVC deaths from 2000 to 2018. The authors should be commended for their efforts in producing a significant step in our understanding of cannabis involvement in relation to alcohol involvement in MVC fatalities in the United States. However, I do have some comments regarding the analysis.

The authors note that FARS reports a maximum of three drugs involved in MVCs based on hierarchy of importance (narcotics, depressants, stimulants, hallucinogens, and then cannabinoids).[2] Based on the availability of three involved drugs, it is not justified why the authors chose not to include analyses on the presence (or absence) of a third drug reported in cases in which cannabinoids and alcohol were already present. It was previously observed in a 2014 study by Wilson et al. on fatal MVCs using FARS data that three or more drugs were detected in a significant number of individuals.[3] While the authors mention controlling for the presence of a third drug as a confounder as part of an adjusted model, it was not selected as a predictor, which prevents the identification of significant associations that may have explained the observed trends.

When one is assessing the implications of cannabis prevalence in MVC fatalities, the drug testing procedures and classification also warrant consideration. The authors describe the impairing effects of Δ9-tetrahydrocannabinol (THC) in cannabis on driving ability as important support for cannabis being a risk factor for MVCs; however, FARS only reports collapsed data on cannabinoids, with individual cannabinoids not being analyzed. In addition, FARS currently has no standardized drug testing protocol across states.[4] This may limit the generalizability of these findings, as it cannot be determined whether THC was involved.

Polysubstance use is highly prevalent in the United States,[5–7] yet the effects of driving under the influence of multiple substances are not fully understood. It is critical to consider the extent of the decedents' polysubstance use when one is assessing cannabis and alcohol involvement trends. By not considering the full extent of decedents' polysubstance use, Lira et al. may have missed significant associations that would help further solidify the study as an important step toward our understanding of cannabis- and alcohol-involved MVC fatalities. AJPH

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PUBLICATION INFORMATION

Full Citation: McCabe AJ. Polysubstance use in motor vehicle crash fatalities. *Am J Public Health*. 2022;112(4):e1–e2.

Acceptance Date: December 23, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306706

ACKNOWLEDGMENTS

A. McCabe was supported by the University of Florida Substance Abuse Training Center in Public Health from the National Institute of Drug Abuse of the National Institutes of Health under award T32DA035167 (PI: Cottler).

Note. The content is solely the responsibility of the author and does not necessarily represent the official views of the National Institutes of Health.

CONFLICTS OF INTEREST

The author reports no conflicts of interest.

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Lira and Naimi Respond

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AJPH April 2022, Vol 112, No. 4

We appreciate McCabe's insightful comments regarding our recent article on alcohol and cannabis involvement in motor vehicle crash fatalities.[1] He notes that, given the presence of up to three substances in the Fatality Analysis Reporting System (FARS), it would have been preferable to assess the presence of additional substances. The decision to focus on alcohol and cannabis was based on (1) alcohol and cannabis being the most prevalent substances involved in impaired driving and (2) the changing landscape of cannabis policy and increasing cannabis use in the United States.[2,3] However, we agree that assessing coinvolvement of other substances is merited, and we included opioid involvement and other, nonopioid substance involvement in our main, fully adjusted model presented with our original article in supplemental Table A, an excerpt of which is provided here in Table 1.

While McCabe is correct that these were not identified a priori as primary exposures, their relationship with alcohol coinvolvement can nevertheless be at least preliminarily ascertained through our models given that many of the same confounders would be applicable. Involvement of opioids was not associated with alcohol involvement at blood alcohol concentrations (BACs) lower than 0.05%, and was associated with decreased odds of alcohol involvement at BACs of at least 0.05%. We speculate this may be attributable to combined depressive effects of simultaneous opioid and alcohol use so that driving may be precluded in the first place.[4] However, presence of a substance other than opioids and cannabis (e.g., stimulants, depressants, hallucinogens) was associated with increased odds of alcohol coinvolvement, especially at low BACs. Future research is needed to disentangle multiple substance–impaired driving.

In addition, McCabe points out that there are several flaws with the cannabis testing data in FARS. We agree that cannabis testing can and should be improved in the future. From 2018 onward, FARS includes all involved substances, and the 2021 Infrastructure and Jobs Act includes funding for

TABLE 1— Mixed Effects Multinomial Logistic Regression Models of the Odds of Alcohol Involvement by Blood Alcohol Concentration (BAC) Level, Fatality Analysis Reporting System: United States, 2000–2018

	Outcome, OR (95% CI)[a]		
Crash-Level Substance Involvement	**BAC 0.01%–0.049%**	**BAC 0.05%–0.079%**	**BAC ≥ 0.08%**
Cannabis involvement (vs no)	1.56 (1.48, 1.65)	1.62 (1.52, 1.72)	1.46 (1.42, 1.50)
Opioid involvement (vs no)	1.02 (0.95, 1.09)	0.82 (0.76, 0.90)	0.61 (0.59, 0.63)
Other substance involvement (vs no)	1.42 (1.36, 1.48)	1.42 (1.34, 1.50)	1.02 (1.00, 1.04)

Note. CI = confidence interval; OR = odds ratio.

[a] Ref = 0.00%.

multiple substance–impaired driving research and prevention, both of which should support future research on multiple substance–impaired driving.[5,6]

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PUBLICATION INFORMATION

Full Citation: Lira MC, Naimi TS. Lira and Naimi respond. *Am J Public Health*. 2022;112(4):e2–e3.

Acceptance Date: December 23, 2021.

DOI: https://doi.org/10.2105/AJPH.2021.306707

CONTRIBUTORS

M. C. Lira and T. S. Naimi worked together to draft and revise this letter.

ACKNOWLEDGMENTS

This study was supported by award R01AA026268 from the National Institute on Alcohol Abuse and Alcoholism (NIAAA).

Note. The content is solely the responsibility of the authors and does not necessarily represent the official views of NIAAA or National Institutes of Health. NIAAA had no role in the study design; collection, analysis, and interpretation of data; writing the report; and the decision to submit the report for publication.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

HUMAN PARTICIPANT PROTECTION

This study was determined to be not human participant research by the institutional review board at Boston University Medical Campus (protocol H-37378).

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Children With Uncontrolled Asthma

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The July 2021 issue of *AJPH* contained an editorial discussing the importance of community-based asthma self-management interventions for children. In “Mind the Gap: Yet More Evidence for the Importance of Education for Children With Uncontrolled Asthma,” Homaira and Jaffe evaluated the methods and results of the Asthma Action at Erie Trial.[1] The results of this trial were published in the same issue.[2]

One important discrepancy in this evaluation must be pointed out. Because Martin et al.[2] did not fully describe the details of the community health worker (CHW) intervention, Homaira and Jaffe incorrectly interpreted that the Asthma Action at Erie Trial did not provide assessment and remediation of home environmental triggers. In actuality, the CHWs were trained in environmental remediation and integrated pest management to reduce home trigger exposures. Most of the CHW visits (95.2%) were conducted in the homes where trigger identification and reduction was one of the core topics and was addressed in 45.2% of the 722 visits.[3] Tobacco exposure reduction was coded separately and was addressed in 15.5% of visits.[3]

What separates this trial from others is that the CHWs did not provide the actual remediation equipment such as vacuums and allergy covers. As an example, when a child had a dust mite allergy, the CHW would help the family understand the role of allergy mattress covers, figure out where the family could buy them, and strategize ways to pay for them. Our goal was to help families establish sustainable routes to obtain the equipment they needed. The fact that the trial’s asthma control results were similar to those of studies that provided this equipment (through research subsidies) is meaningful, as it shows that supporting families to obtain remediation equipment on their own works as well as providing the actual equipment, which is not covered by insurance.

CORRESPONDENCE

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PUBLICATION INFORMATION

Full Citation: Martin MA. Children with uncontrolled asthma. *Am J Public Health*. 2022;112(4):e4.

Acceptance Date: December 30, 2021.

DOI: https://doi.org/10.2105/AJPH.2022.306715

CONFLICTS OF INTEREST

The author has no conflicts to disclose.

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Erratum In: “Placing Racial Equity at the Center of Substance Use Research: Lessons From the HEALing Communities Study”

In: Chatterjee A, Glasgow L, Bullard M, et al. Placing racial equity at the center of substance use research: lessons from the HEALing Communities Study. *Am J Public Health*. 2022;112(2):204–208. https://doi.org/10.2105/AJPH.2021.306572

An acknowledgment was omitted. On page 207, the Acknowledgements section should read: AJPH

ACKNOWLEDGMENTS

The authors would like to acknowledge Maya Randolph for their foundational work on incorporating racial equity principles into the HEALing Communities Study.

This research was supported by the National Institutes of Health (NIH) through the NIH Helping End Addiction Long-Term (HEAL) Initiative under award numbers UM1DA049406, UM1DA049412, UM1DA049415, UM1DA049417, and UM1DA049394.

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

This addition does not affect the paper’s conclusions.

https://doi.org/10.2105/AJPH.2021.306572e

Erratum In: “Balancing Consideration of the Risks and Benefits of E-Cigarettes”

In: Balfour DJK, Benowitz NL, Colby SM, et al. Balancing consideration of the risks and benefits of e-cigarettes. *Am J Public Health*. 2021;111(9):1661–1672. https://doi.org/10.2105/AJPH.2021.306416

A conflict of interest was not properly disclosed. On page 1668, the Conflicts of Interest section should read:

CONFLICTS OF INTEREST

N. L. Benowitz is a consultant to Pfizer and Achieve Life Sciences, companies that market or are developing smoking cessation medications, and has been an expert witness in litigation against tobacco companies. S. J. Leischow is conducting a clinical trial supported by Achieve Life Sciences, which is developing a nonnicotine medication for smoking cessation, and has consulted with them. He also consulted more than 1 year ago for GSK, which is working to bring a new nicotine-replacement product to market, and he receives medication for a National Institutes of Health–funded smoking-cessation study from Pfizer. N. A. Rigotti receives royalties from UpToDate Inc for writing about smoking cessation and e-cigarettes and is a consultant for Achieve Life Sciences for an investigational smoking-cessation medication. R. West has undertaken research and consultancy for Pfizer and GSK, companies that manufacture smoking-cessation medications. R. Niaura reviewed grant proposals from 2018-2019 for the Foundation for a Smokefree World, which was created by and remains fully funded by Philip Morris. R. Niaura did not receive any compensation for this activity, monetary or otherwise.

This addition does not affect the paper’s conclusions.

https://doi.org/10.2105/AJPH.2021.306416e