

# Kesmas

Jurnal Kesehatan Masyarakat Nasional  
(National Public Health Journal)

Quarterly Journal

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**The Indonesian Strategy to Achieve Universal Health Cover Through National Health Insurance System: Challenges in Human Resources**  
(pp. 221-227)

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**Mental Fatigue and Its Associated Factors among Coal Mining Workers after One Year of COVID-19 Pandemic in Indonesia** (pp. 228-235)

**Integrated Model of a Family Approach and Local Support in Tuberculosis Case Finding Efforts in People with HIV/AIDS** (pp. 250-256)

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# Kesmas

Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)

Volume 16, Issue 4, November 2021

p-ISSN 1907-7505

e-ISSN 2460-0601

**Kesmas:** Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal) is a journal that contains both research articles and invited review articles in the field of public health and published quarterly

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G301 Building G 3<sup>rd</sup> Floor  
Kampus Baru UI, Depok 16424  
Mobile Phone: +62815-1141-6600  
E-mail: [jurnalkesmas.ui@gmail.com](mailto:jurnalkesmas.ui@gmail.com) or [jurnalkm@ui.ac.id](mailto:jurnalkm@ui.ac.id)  
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  - Book :  
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# The Indonesian Strategy to Achieve Universal Health Coverage through National Health Insurance System: Challenges in Human Resources

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## Abstract

Many countries are currently trying to achieve universal health insurance coverage in order to provide health protection for their population. Indonesia has received a strong political commitment to implement national health insurance including government support to finance the poor. The implementation of comprehensive national health insurance requires human resources, each of which has a role in fighting for noble goals for the welfare of all people. This paper is taken from the experience of Indonesia and several other countries as well as guidelines that can be used in exploring the role of human resources for the success of the implementation of national health insurance.

**Keywords:** human resources, national health insurance, universal health coverage

Indonesia's national health insurance (NHI) system called *Jaminan Kesehatan Nasional* (JKN) was declared in January 2014 by the elected President, Joko Widodo. The NHI is a form of government commitment to achieving universal health coverage (UHC). This policy is a result of Indonesia's struggle since the issuance of the National Social Security System Law No. 40 of 2004.<sup>1,2</sup> Since 2011, Indonesia has continued to develop NHI and shared experiences with other countries to move towards universal health coverage.<sup>3,4</sup> The current NHI implementation is being considered quite successful in achieving UHC.<sup>5,6</sup> According to the World Health Organization (WHO), "Universal health coverage is a system in which everyone in a society can get the healthcare services they need without incurring financial hardship." WHO's Director-General, Margaret Chan, asserts that "Universal health coverage is the single most powerful concept that public health has to offer."<sup>7</sup> The President of the UN General Assembly, María Fernanda Espinosa Garcés, states that "If we look at the full impact—and cost—of poor health services, the case for prioritizing universal health coverage is clear."<sup>8</sup>

Five years of running the NHI have shown Indonesia quite significant results. Comparing the statistical data provided by the National Social Security Council/*Dewan*

*Jaminan Sosial Nasional* (DJSN) in 2014 and 2019 on JKN coverage shows an increase from 133 million to 224 million.<sup>9</sup> The increasing number of coverage is listed as follows 156,790,287 (2015), 171,939,254 (2016), 187,982,949 (2017), 208,054,199 (2018), and 224,149,019 (2019). The increasing number of the NHI coverages reflects the public's expanded access to health services in Indonesia in all forms of service levels, both primary and referral services.<sup>10,11</sup> It is also specifically highlighted that the NHI has prioritized and contributed to reducing maternal mortality by increasing access to services for pregnant women and childbirth.<sup>12</sup> However, to achieve UHC, qualified human resources (HR) are essential for providing adequate and equitable health services in the various regions.<sup>13-15</sup> It should be noted that the main requirement for the NHI is to be able to fulfill the right to health services for the participants by making the facilities available. The variation in the number of accesses between provinces and regions indicates the need for additional health facilities and HR.<sup>16,17</sup>

Limited HR serving the NHI participants in dominant government health facilities suggests opportunities to invite the private sector to play a role in the NHI.<sup>18,19</sup> In addition, due to the relatively large number of participants, Social Security Administrator for Health/*Badan*

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Received : October 22, 2021  
Accepted : October 30, 2021  
Published : November 29, 2021

*Penyelenggara Jaminan Sosial (BPJS) Kesehatan* is required to carry out reliable health-insurance business functions with HR who know health insurance both at the central level and at the regional branch level.<sup>19,20</sup> Likewise, the ability to develop, regulate, and supervise the relatively complex NHI integrates health services with financing requires HR with knowledge of health insurance.<sup>21</sup> The term “human resources” implies that people (along with other resources such as money, materials, and information) in an organization have capabilities to drive the organizational performance. Other terms such as “human capital” and “intellectual assets” have in common the idea that people make the difference in how an organization performs.<sup>22</sup> This paper will discuss the three crucial HR, as actors in the NHI, who work as health service providers, NHI organizers, and regulators.

### **The Health Service Providers: Service Quality and Cost Containment**

The main challenge of providing health insurance coverage in low-middle-income countries such as Ghana, Myanmar, and Indonesia is the unequal presence of health service providers, especially in the poor and remote areas.<sup>23-25</sup> Special attention should be given to directing enough workforce to eastern Indonesia, considering that the number of workers and facilities is still insufficient. Another challenge for the NHI in urban areas is the high number of non-communicable diseases (NCDs) cases such as diabetes mellitus, hypertension, heart disease, and cancer that cost relatively large amounts of money. Neighboring Australia is still looking for a pattern to handle NCDs to achieve UHC by improving Primary Health Care (PHC) services.<sup>26</sup> Although, on the one hand, Indonesia has implemented a chronic disease management program/*Program Penatalaksanaan Penyakit Kronis* (PROLANIS) at the PHC services, which is related to the capitation for all the NHI participants,<sup>27</sup> this capitation payment system, unfortunately, has more time for PHC workers to serve the NHI patients. On the other hand, the public health program that must be strengthened with sufficient HR and quality services is neglected.<sup>28</sup> Indonesia is still experiencing the problem of the high number of cases of infectious diseases such as tuberculosis and malaria.

There is a criticism of UHC efforts which have caused a decrease in the achievement of public health programs.<sup>29,30</sup> The efficiency of public health programs, which are the responsibility of regional financing, tends to decline, resulting in poor quality of public health programs. Even a big country like the United State of America is currently debating developing UHC because low-income people cannot access quality services and chronic NCDs in the current health insurance system.<sup>31</sup>

The existence of a significant relationship between the global health security index (GHSI) and the universal health coverage index (UHCI) indicates that there must be a synergy between UHC and the public health program.<sup>32</sup> Therefore, it is necessary to balance the use of HR to achieve UHC that is also responsible for the NHI.

The NHI must implement a service quality assurance program because participants expect satisfactory service in return.<sup>33,34</sup> The NHI that pays for primary health facilities with the capitation method provides an opportunity to improve the quality of services, including increasing HR capacity. According to the regulation, the amount of capitation should be reviewed every two years. But it has not yet been improved, which results in low service quality. Low-middle-income countries that procure substandard essential medicines show a negative relationship indicator between service coverage and government effectiveness. While in drug services, the friendly attitude of officers, completeness of prescriptions, and drug safety information have a significant positive effect on hospital pharmacy use,<sup>35,36</sup> factors of doctors, pharmacists, and patients have a joint impact on the availability of drugs in the NHI.<sup>37</sup>

Service quality assurance and cost control cannot stand alone. The provision of health services should think about quality by using sophisticated services and not controlling costs. The provision of health services should pay attention to the importance of health technology assessment.<sup>38</sup> The HR of health services must consider whether a treatment intervention uses medical devices that are not burdensome cost the money incurred but follow the therapy protocol.

### **The National Health Insurance Organizer: Professional Work Appearance**

The systematic reviews of the NHI in several countries have found only one paper regarding health management and administration in social protection schemes, even though the implementation of the NHI requires professional HR. The NHI organizer should implement health management and administration in social protection schemes that include some key competencies: a good knowledge about the insured population, responsiveness to health needs and preferences, administration of the insured (registration, collecting contributions, information, advice, and directing patients, control of fraud, and abuse), a good understanding of health technology assessment, assessment of provider competencies (service quality and accreditation, claims management), and negotiation with providers (on volume, quality, and cost of services), and then subsequently contracting, monitoring, and controlling results,<sup>39</sup> WHO has outlined a global HR strategy for health workforce 2030 to accelerate progress toward UHC and Sustainable Development Goals

(SDGs). The availability of health workers is said to be adequate if they are evenly distributed, accessible, and supported by the health system and have the required competencies to provide quality services that are acceptable to the population.<sup>40</sup>

Implementing the NHI using social insurance mechanisms and the principle of prepaid care financing requires HR who understand the basics of health insurance and managed care. Selecting and collaborating with health facilities involves negotiation skills, especially while dealing with private health facilities that are expected to support government policies voluntarily. HR of the NHI organizer reviews health services to ensure that the quality of services is cost controlled. In Indonesia, the laws related to health insurance require an NHI organizer to be called BPJS Kesehatan to carry out its functions professionally and understand health insurance for all populations. The regulations require that the implementation of health insurance should be managed by HR, who have expertise in health insurance.<sup>41,42</sup> It needs the NHI organizer to do marketing so that the public knows the benefits of the NHI to maintain those who have become participants and achieve the target of 98% of the population coverage. Although the coverage has reached around 83% of the population, many registered participants still do not know how to use the health facilities according to the standard procedures. Provision of information regarding the importance of following referral procedures must continue to be carried out to prevent public complaints,<sup>11</sup> NHI organizers need to provide counseling that preventing illness through first-level services is more efficient than referral services.

In terms of funding, the NHI has the most significant source of financing from the subsidy for the poor for carrying out social duties. Besides that, the local governments in several provinces and districts are still developing regional health insurance programs that need to accommodate the potential resources of this area so that they can be integrated with the central budget.<sup>43</sup> The NHI HR requires considering the need for health costs that integrate regional budget and central to maximize the NHI financing. The NHI funding must be managed with financial management that can be accounted for transparently free from corruption, so it requires HR with good mental and moral behavior. The implementation of the NHI function requires supervision to prevent violations and misuse of intentions, which in terms of fraud insurance.<sup>44,45</sup> However, the human resources responsible for overseeing NHI's business operations are primarily low in knowing that NHI is integrating financing with health services.<sup>46</sup>

Indonesia is not alone. Most countries that are developing UHC face human resource challenges. For instance, Bangladesh, which is experiencing a shortage of

HR.<sup>47</sup> Japan, which has achieved UHC since 1961, is still improving its quality human resource system.<sup>48</sup> To achieve UHC, Iran uses the Global Health Workforce Alliance (GHWA) framework and has identified that every country should engage critical stakeholders, including government, professional bodies, and academics, to formulate appropriate strategies to overcome human resources for health (HRH) challenges. Iran developed eleven strategies related to education and training for new disciplines, balancing universities based on manpower needs, and enrolling local students from disadvantaged areas.<sup>49</sup>

All possible efforts should be made to improve HR and enable them to perform their work professionally, even though these resources are limited. Especially in this era of digitalization, the NHI requires the ability of HR who are technology literate to accelerate services not only at the center but also to the nearest community service level. Some professional organizations participate in supporting the implementation of the NHI.<sup>50</sup> It is necessary to conduct a series of training and certification competency tests. But only a few universities incorporate health financing and insurance into the education curriculum.<sup>51</sup>

### **The Regulators: National Health Insurance Arrangements**

Regulators are responsible for NHI arrangements. Many countries fail in the inclusiveness of coverage due to a lack of a legal framework to support informal sector funding and a lack of political will to address these failures.<sup>52,53</sup> Regulations in health financing determine the sustainability of the NHI. The Philippine NHI has successfully obtained major achievements by expanding population coverage by using an earmarked revenue source (Sin Tax).<sup>54</sup> Ghana is considering adopting a broad tax-based approach to cover all citizens and persons with legal residence.<sup>55</sup> Thailand started its efforts to achieve UHC in 2002. Policies that prioritize the tax financing system face challenges because there are still many poor people. Developing the existing primary care system in Thailand has the most significant potential for UHC sustainability by shifting from the traditional role of PHC in providing primary disease-based care to being the first contact in an integrated care system prioritized by the national health budget.<sup>56</sup> Indonesia NHI receives subsidy allocation funds for the poor from the Ministry of Health budget based on data released by the Ministry of Social Affairs. The Ministry of Finance determines the number of funds allocated for subsidies and contributions, determined through a presidential decree. However, HR upgrading the unified database/*Basis Data Terpadu* (BDT) from the village to district level still encounter obstacles in terms of invalid targeting, which will have an impact on the amount of the NHI budget.<sup>57</sup>

**Table 1. Three Categories of Human Resources in National Health Insurance (Role and Function)**

| Role and Function                     | Three Categories of Human Resources in NHI                      |  |  |
|---------------------------------------|---|--|--|
|                                       | Health Service Provider   | Organizer  | Regulator                                |
| Responsibility                        | Service quality and cost containment                            | Professional work appearance                         | NHI arrangements                         |
| Duty                                  | Carry out NHI cooperation                                       | Health management and administration                 | Political and policy support             |
| Role                                  | Balance of individual health services and public health program | Achieving targeted coverage                          | Harmonizing and synchronizing regulation |
| Relation in HR                        | Adhere to protocol therapy                                      | Competent in health insurance concept and management | Explore the potential of private HR      |
| Relation in local/regional government | Equal distribution and incentive                                | Availability of health facilities and infrastructure | Lobbying central and regional funding    |

**Notes:** NGI = National Health Insurance, HR = Human Resource

As with the nonprofit nature of social insurance, implementing the NHI to achieve UHC requires government policy support. As a human right, UHC requires consistency and authoritative and practical guidance.<sup>58</sup> The UHC can be accomplished only through the law. Advancing the right to health through UHC requires that health services adhere to five fundamental values of being (1) universally accessible, (2) equitable, (3) affordable, (4) high quality, and (5) cost-effective. A comprehensive national health law should ensure that everyone in the country is eligible for the whole package of health services, medicines, and vaccines.<sup>59</sup> Four principles—the legal right to health, government financing, efficient spending, and financial protection of vulnerable populations—are significantly more vital in national medicines policies.<sup>60</sup> The UHC is a human right that requires a national program-oriented human rights-based approach as a consistent, authoritative, and practical guide to support countries on the path to achieving UHC.

As a regulator and the legislature, the government is the main legitimate duty bearer under international human rights law is working together with civil society towards UHC.<sup>61</sup> A study in Rwanda found that the commitment to expanding health insurance coverage was made possible by a dominant political settlement.<sup>62</sup> Human resource gaps are a major concern for successful UHC. A study in South Africa recommends that the NHI demonstrate a multistakeholder structure with an integrated plan that considers the health system as a whole.<sup>63</sup> Bilateral cooperation in medical education, such as that carried out by the South African government, shows that doctors have adequate skills to meet the challenges of UHC.<sup>64</sup> China has taken a long-term task toward UHC that started in 2010. Continued political support is the most important and enabling factor, and clear political will can make UHC achievement a more country-led process. These two critical factors are increasing health financing and the investment from both government and private sector.<sup>65</sup> The idea of UHC is very much in a po-

litical fashion. HR needs skills to carry out political lobbying both at the central and regional levels.<sup>50,66</sup> The NHI requires that HR who sit in the bureaucracy should understand the importance of policies for the continuity of the NHI for social welfare (Table 1).

### Conclusion

The National Health Insurance (NHI) towards universal health coverage (UHC) needs to be qualified and motivated human resources (HR) at the central level and the regional level. Three key actors reflect the needs of human resource specifications: health service providers, organizers, and regulators. The health service provider works to ensure service quality and that costs are controlled. The organizer functions to perform a task professionally. The first two actors can work well in a clear and coordinated setting where the regulator makes consistent policy and regulatory arrangements. The need for human resources globally is expected to grow significantly in the coming decades due to population growth, changing epidemiology, and new technologies. The human resource must constantly update their knowledge, skills, and attitude. Designing strategies for specific training and education are important to reflect the broader nature of the NHI toward UHC.

### Abbreviations

NHI: National Health Insurance; JKN: *Jaminan Kesehatan Nasional*; UHC: Universal Health Coverage; WHO: World Health Organization; UN: United Nation; DJSN: *Dewan Jaminan Sosial Nasional*; HR: Human Resources; BPJS: *Badan Penyelenggara Jaminan Sosial*; NCD: Non-communicable Diseases; PROLANIS: *Program Penatalaksanaan Penyakit Kronis*; PHC: Primary Health Care; GHSI: Global Health Security Index; UHCI: Universal Health Coverage Index; SDGs: Sustainability Development Goals; GHWA: Global Health Workforce Alliance; HRH: Human Resources for Health; PAMJAKI: *Perkumpulan Ahli Manajemen Jaminan dan Asuransi Kesehatan Indonesia*; BDT: *Basis Data Terpadu*.

### Ethics Approval and Consent to Participate

Not Applicable

### Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

The data that support the findings of this study were available from NHI. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors upon reasonable request and with the permission of NHI.

### Authors' Contribution

AA carried out the literature survey, analyzed the data, and wrote the manuscript. Conveniently, by having only one author, there were no decisions to make regarding author order or corresponding authorship.

### Acknowledgment

Not Applicable

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# Mental Fatigue and Its Associated Factors among Coal Mining Workers after One Year of the COVID-19 Pandemic in Indonesia

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## Abstract

Mental fatigue among coal mining operators was related to driving activities that require high concentration. This study aimed to determine factors that contributed to mental fatigue among coal mine operators in Indonesia, specifically in Kalimantan and Sumatra, after a one-year COVID-19 pandemic. This cross-sectional study was conducted among 480 operators from two companies and seven sites. A self-administrated questionnaire in the Google Form was used to measure mental fatigue, the non-work-related factors (age, education, marital status, residence, and stress level), and work-related factors (working periods, shift pattern, type of shift, and work area in mining). The data analyzed using Chi-square and binomial logistic regression showed that the prevalence of mental fatigue was 32.3%. Operators with moderate stress and working in the pit area demonstrated a significant association with mental fatigue ( $p$ -value < 0.001). Multivariable analysis showed that medium stress (AOR = 2.11; 95% CI = 1.41-3.15) and working in the pit (AOR = 2.27; 95% CI: 1.45-3.57) had a positive association with mental fatigue. Thus, the pit condition and stress levels were the dominant factors influencing mental fatigue and became points to manage mental fatigue in coal mining operators in Kalimantan and Sumatra.

**Keywords:** coal mining operator, COVID-19 pandemic, mental fatigue, stress

## Introduction

Work-related fatigue is a common problem that has raised complaints from the working population. More than 20% of workers in the United States (US) experience fatigue every day,<sup>1</sup> several surveys about fatigue among workers have obtained prevalence rates ranging from 7% to 45%, depending on the method, instrument, and cutoff points used.<sup>2</sup> Work fatigue for coal mining workers, especially operators, is an essential issue in occupational health and safety that needs to be managed. Operator or driver is a worker who has the main task to operate mining equipment and mining vehicles and generally works under a shift work system. Generally, operator fatigue is related to the driving activity that is more mentally than physically because it requires the coordination of sustained vigilance, selective attention, complex decision-making, and the occasional use of automatic perceptual-motor control skills.<sup>3</sup>

The characteristics of driving activities and several factors of the mining environment provide a high cognitive load to cause mental fatigue to the operator. High-level theories related to fatigue in mining workers include

situational awareness, decreased mental resources, worker stress, and other health factors.<sup>4</sup> In other words, the characteristics of fatigue experienced by operators are more mental fatigue. It is known that operator fatigue can cause work accidents in mining activities. Drive fatigue is one of the critical features that cause traffic accidents in mining operations.<sup>5</sup> In open-pit mines, fatigue-related accidents account for up to 65% of truck driving accidents alone.<sup>6</sup> Driver fatigue causes more than 15% of fatal accidents, and nearly 20% of serious accidents are caused by driving fatigue.<sup>7,8</sup> Meanwhile, according to European Road Safety Observatory (ERSO), in 2018, 10%-25% of road accidents were caused by driver fatigue.<sup>9</sup>

Fatigue among operators is caused by both multi factors included work-related and non-work-related.<sup>10-12</sup> Some experts stated that the main causes of operator fatigue are sleep-related issues, such as lack of sleep, poor sleep quality, and demands for sleep caused by circadian rhythms.<sup>4,9</sup> Some causes of fatigue can be purely due to continuous high mental or cognitive activity, known as mental fatigue. Mental fatigue is related to a decrease in

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Received : July 2, 2021  
Accepted : July 30, 2021  
Published : November 29, 2021

motivation; the ability to process and respond to information. Mainly is the decline of incompetence, productivity, and ability to avoid mistakes or errors.<sup>1</sup> Furthermore, working under a shift system also increases the potential to cause a decrease in a person's mental condition. Continuous mining activities that last 24 hours per day and seven days per week can cause circadian rhythm disturbances, resulting in worker fatigue, especially mental conditions.<sup>6</sup> The high mental demand of tasks in coal mining can increase the stress level among operators. Stress also plays a vital role in the fatigue experienced and is associated with sleep problems, with higher levels of stress positively associated with fatigue.<sup>13,14</sup>

During the coronavirus disease 2019 (COVID-19) pandemic in Indonesia, which was started when the first case was discovered in March 2020 and is still ongoing, many sectors have been affected. The COVID-19 pandemic affects the health aspect and affects the business world, including coal mining. Several coal mining companies have implemented the COVID-19 prevention policies in line with local and national government policies. This condition is suspected to increase pressure on mining workers, especially operators, the largest group of workers in coal mining. This study aimed to determine non-work-related factors and work-related factors that were contribute to mental fatigue among coal mine operators in Kalimantan and Sumatra after one year of the COVID-19 pandemic in Indonesia.

## Method

This cross-sectional study was conducted one year after the COVID-19 pandemic in Indonesia, where data collection started from mid-March to mid-April 2021. The study involved two coal mining companies, seven mining sites, and 480 operators. The sample was calculated using simple random sampling formula (CI: 95%,  $d = 5\%$ ,  $p\text{-value} = 0.57$ ), and a minimum sample of 379 was determined based on a previous study.<sup>15</sup> The sampling technique used was simple random sampling. Participants were recruited based on a list of employees who were on shift during the data collection period. Data was collected using a self-administered questionnaire based on a Google Form and filled out online regarding government and company's pandemic policies.

The participants received a link address to answer the questionnaire on their smartphones. All participants gave written informed consent by selecting the (yes) button in the online questionnaire for the question: "Are you willing to be a respondent for this research?" The participants were instructed to fill out the questionnaire at the off time, shift change break, or at the end of the daily shift while resting in the company mess or at home after a minimum of four days of work. The questionnaire in-

cluded questions about mental fatigue, non-work-related factors (age, education, marital status, residence, and stress level), and work-related factors (working periods, shift pattern, type of shift, and work area in mining).

Mental fatigue was measured using the selected items from three standard questionnaires. The first questionnaire is the Checklist of Individual Strength-20 (CIS-20), which measures mental fatigue on items 3, 8, 11, 13, and 19.<sup>16</sup> The second questionnaire is the Multidimensional Fatigue Inventory-20 (MFI) that measures mental fatigue on items 7, 11, 13, and 19.<sup>17</sup> The third questionnaire is Swedish Occupational Fatigue Inventory (SOFI) and measures mental fatigue on items 5, 9, 14, and 16.<sup>18</sup> All three questionnaires used a Likert scale. The CIS-20 has a score from 1 to 7, MFI has a score from 1 to 5, and SOFI has a score from 0 to 6. The participants were categorized into experiencing mental fatigue on each questionnaire if they had a total score exceeding the median value. The three instruments used to measure mental fatigue must indicate mental fatigue, and then a participant would be categorized as experienced mental fatigue.

The questions about non-work-related factors, including age (30-44 years/<30 years and  $\geq 45$  years), education (junior high school or less/senior high school or more), marital status (single or divorced/married), and stress level that measured using 10 items of Perceived Stress Scale by Cohen.<sup>19-21</sup> The questions about work-related factors, including working periods (<10 years or  $\geq 10$  years), shift pattern (8-hours shift/12-hours shift), type of shift (day shift/night shift), and location of work in mining (hauling area/pit area). Association between non-work-related factors and work-related factors with mental fatigue was analyzed by Chi-square test or Fisher exact test as per applicability,  $p\text{-value} < 0.05$  was considered as significant at a 95% confidence interval (CI). Variables that had a  $p\text{-value} < 0.25$  were considered for multivariate binomial logistic regression.

## Results

The total of operators who completed the online self-administered questionnaire was 480. The prevalence of mental fatigue was 32.3% based on the criteria in the total sample. Operators were determined to experience mental fatigue when all the questionnaires had the same result as mental fatigue. This study only measured the prevalence of mental fatigue on operators without differentiating its level.

This study measured five variables related to non-work factors: age, education, marital status, place of residence, and stress level. The average age was 32 ( $\pm 6$ ) years, with a range of 21–58 years old. Table 1 shows the non-work-related factors of the study participants or operators. Most coal mining operators were married (85%) and living at home (63.5%). They have a relatively good

level of education, which most of them (97.9%) graduated from senior high school or college/university. The highest stress level among operators was moderate, with a percentage almost similar to operators with low stress (49.4% compared to 50.6%). The Chi-square test showed only stress levels in the non-work-related factors that indicated a significant association with mental fatigue (p-value<0.001).

The work-related factors in this study are shown in Table 2. Most of the operators (60.2%) had ≥10 years of working periods as an operator. The majority (65.8%) of operators worked in the pit area. The pit area is the central location of the coal mining activities requiring various tasks and equipment involved during the mining process. The number of operators according to day shift and night shift was approximately equal, so there was no significant difference in the percentage of mental fatigue between day and night shifts.

The work-related factor that demonstrated a significant association with mental fatigue was work location in mining. Operators who worked in the pit area (38.6%)

experienced more mental fatigue than those in the hauling area (20.1%). Mental fatigue more occurrence among operators with ≥10 years of working periods (34.9%) compared to operators with <10 years of working periods (28.3%), as same as working with 8-hours shift pattern (34.2%) compared to 12-hours shift pattern (30.4%).

Multivariate analysis with a binomial logistic regression test was used to determine contributing factors of mental fatigue among coal mining operators. Table 3 shows the results of the multivariable analysis. Four variables have met the criteria as candidates of multivariate analysis (p-value<0.25). The four variables include age, years of service, stress level, and working location in mining from Table 1 and 2. The results of the analysis showed that age and working period were excluded from the multivariable model.

The result of the multivariable analysis shows that the work area in mining had more contributed to mental fatigue than the stress level. Working in the pit area was more likely to experience mental fatigue (AOR = 2.27;

**Table 1. Non-work-related Factors and Their Association with Mental Fatigue (n = 480)**

| Variable           | Category                                | Mental Fatigue |            |            | p-value |
|--------------------|---|----------------|------------|------------|---------|
|                    |   | Total          | Yes        | No         |         |
|                    |   | n (%)          | n (%)      | n (%)      |         |
| Age (year)         | 30–44 <sup>a</sup>                      | 267 (55.6)     | 96 (36.0)  | 171 (64.0) | 0.07    |
|                    | <30 and ≥45                             | 213 (44.4)     | 59 (27.7)  | 154 (72.3) |         |
| Education          | Senior high school or more <sup>a</sup> | 470 (97.9)     | 152 (32.2) | 318 (67.7) | 1.00    |
|                    | Junior high school or less              | 10 (2.1)       | 3 (30.0)   | 7 (70.0)   |         |
| Marital status     | Single or divorced <sup>a</sup>         | 72 (15.0)      | 24 (33.3)  | 48 (66.7)  | 0.95    |
|                    | Married                                 | 408 (85.0)     | 131 (32.1) | 277 (67.9) |         |
| Place of residence | Company mess <sup>a</sup>               | 175 (36.5)     | 54 (30.9)  | 12 (69.1)  | 0.68    |
|                    | Home                                    | 305 (63.5)     | 101 (33.1) | 204 (66.9) |         |
| Stress level       | Low <sup>a</sup>                        | 243 (50.6)     | 57 (23.5)  | 186 (76.5) | <0.001* |
|                    | Moderate                                | 237 (49.4)     | 98 (41.4)  | 139 (58.6) |         |

Notes: \*Indicates significance at p-value<0.05, <sup>a</sup>Reference category

**Table 2. Work-related Variables and Their Association with Mental Fatigue (n = 480)**

| Variable               | Category                  | Mental Fatigue |            |            | p-value |
|------------------------|---------------------------|----------------|------------|------------|---------|
|                        |                           | Total          | Yes        | No         |         |
|                        |                           | n (%)          | n (%)      | n (%)      |         |
| Working periods (year) | <10 <sup>a</sup>          | 191 (39.8)     | 54 (28.3)  | 137 (71.7) | 0.15    |
|                        | ≥10                       | 289 (60.2)     | 101 (34.9) | 188 (65.1) |         |
| Shift pattern          | 3 (8 hours) <sup>a</sup>  | 240 (50.0)     | 82 (34.2)  | 158 (65.8) | 0.44    |
|                        | 2 (12 hours)              | 240 (50.0)     | 73 (30.4)  | 167 (69.6) |         |
| Shift type             | Day shift <sup>a</sup>    | 240 (50.0)     | 77 (32.1)  | 163 (67.9) | 1.00    |
|                        | Night shift               | 240 (50.0)     | 78 (32.5)  | 162 (67.5) |         |
| Work area in mining    | Hauling area <sup>a</sup> | 164 (34.2)     | 33 (20.1)  | 131 (79.9) | <0.001* |
|                        | Pit area                  | 316 (65.8)     | 122 (38.6) | 194 (61.4) |         |

Notes: \*Indicates significance at p-value<0.05, <sup>a</sup>Reference category

**Table 3. Multivariable Analysis Factors Contributed to Mental Fatigue**

| Variable            | $\beta$ | Sig. | Exp (B) | 95% CI for Exp (B) |       |
|---------------------|---------|------|---------|--------------------|-------|
|                     |         |      |         | Lower              | Upper |
| Work area in mining | 0.821   | .000 | 2.272   | 1.447              | 3.567 |
| Stress level        | 0.746   | .000 | 2.108   | 1.412              | 3.146 |
| Constant            | -1.709  | .000 | 0.181   |                    |       |

Note: CI: Confidence Interval

95% CI = 1.45-3.57) in operators than in the hauling area. At the same time, operators with moderate stress levels were more likely to experience mental fatigue than operators with a low level of stress (AOR = 2.11; 95% CI = 1.41-3.15). The multivariable analysis was conducted by controlling by working period and age as covariates.

## Discussion

Mental fatigue in coal mining operators is closely related to the characteristics of driving work. Operators whose main job is to operate mining equipment or vehicles are particularly vulnerable to mental fatigue. This study found that the prevalence of operators who experienced mental fatigue was 32.3%. This percentage is still in the range of the fatigue prevalence among workers, which is 7%-45%.<sup>2</sup> This study result indicated that the percentage of operator experienced mental fatigue was lower than the study on drivers in Spain found 38.5% of drivers experienced mental fatigue. That study found a high proportion of drivers frequently drove under the condition that causes cognitive, emotional, and motor deterioration, thus affecting driving.<sup>22</sup> Another study of fatigue and its associated risk factors among electronics manufacturing shift workers in Malaysia also found that 30.2% of the workers have experienced mental fatigue.<sup>23</sup> The high percentage of mental fatigue among coal mining operators indicated that mental fatigue was a critical issue in coal mining companies and needed control measures. The mental fatigue among the operator was related to various factors such as characteristics of the driving task. Operators must be stay alert during the working time because they are usually driving alone on a lonely road or driving in a crowded area in the pit.

This study examined the contributing factors of mental fatigue from non-work-related and work-related factors. Based on the literature, respondents categorized in the risk group (exposed) are aged <30 years and  $\geq$ 45 years, have low education, are married, live at home, and have high stress.<sup>13,19,20,23,24</sup> The analysis showed that only stress levels as non-work-related factors that are significantly associated with mental fatigue. The results showed that 41.4% of operators who experience moder-

ate stress levels experienced mental fatigue. Fatigue was also positively associated with higher levels of stress.<sup>16</sup> Uncontrolled and chronic stress is one of the main factors causing fatigue,<sup>26</sup> or fatigue is one of the implications of chronic stress from continuous physical and cognitive work.<sup>27</sup>

Driving a mining vehicle is one task that requires high cognitive effort and must maintain concentration for a long time.<sup>3</sup> Study on 213 male workers in the manufacturing industry in Japan found that psychological stress correlates with fatigue,<sup>28</sup> and decreased performance.<sup>3</sup> Operators with a high-stress level are more likely to experience mental fatigue than those with lower stress levels (OR = 2.11). Higher stress level is significantly associated with mental fatigue. Driver stress contributes not only to fatigue but also to decrement in driver performance.

Stress among coal mining operators can increase due to conditions such as time pressure to complete a job, long work hours, monotonous driving, personal situations, communication in the mining area, unpredictable and hazardous road conditions, and other truck traffic.<sup>3</sup> Stress and mental fatigue can be two things that affect each other. Operators who experience stress due to work demands and other factors will be more prone to experiencing mental fatigue. On the other hand, operators who experienced mental fatigue due to work pressure and personal characteristics are more likely to get stress acutely and long. Therefore, stress management programs are most important in reducing the occurrence of mental fatigue.

Another determinant factor of mental fatigue among coal mining operators in Kalimantan and Sumatra is working in the pit area. This study divided the working area into the pit area and hauling area. The work environment or work area is one of the main causes of fatigue in mining workers.<sup>25</sup> The results showed that operator who work in the pit area has the possibility of experiencing mental fatigue 2.3 times higher than operators who worked in the hauling area. A study in China on the effect of fatigue on driving performance found that the effects of fatigued driving were higher on curved, downhill, and changing directions than straight roads.<sup>9</sup> The result of this study indicated that the pit area of mining which has many curves and intersections, road geometry conditions, and traffic lanes that often change, caused more fatigue than straight lines like in the hauling area. The pit area is the central area of coal mining activities. The situation in the pit area can create a stressful work environment. In surface mining, the condition of the pit area is very dynamic and usually changes according to the progress of the mining work. Changing the mine road and intersections, traffic, mine design, and layout, and also changes the pit topography caused by climate conditions are some

examples in the pit area that contributed to mental fatigue.<sup>3,11</sup>

The mining design is an essential first step of the coal mining process. The implementation of excellence and proper mining design that complies with mining safety standards and at the same time also fulfills the occupational health and safety standards are essential approaches to develop control measures to reduce mental fatigue. A holistic approach to managing the mental fatigue among coal mining operators should consider various aspects, such as work-time arrangements, work design, environmental factors, and personal factors.<sup>11</sup>

This study has several limitations. The first is using online self-administered questionnaires. Regarding the pandemic policy, visiting the study sites were not allowed. Coordination with safety personnel and management personnel was conducted to distribute the link address of the questionnaire and explain the study objective to the respondents. Another limitation in this study is using a cross-sectional design that will not allow the authors to conclude causality for the established associations. In addition, future researchers may benefit from this research by investigating other factors that contribute to mental fatigue, such as the social life of coal mining operators, management programs related to fatigue management, and so forth. The future study design should be quantitative and qualitative. This study will help to understand mental fatigue from both non-work-related and work-related perspectives, and determine factors that become entry points for intervention programs.

## Conclusion

Working in the coal pit area and the stress level on the operator are two factors that significantly contribute to the mental fatigue experienced by coal mining operators in Kalimantan and Sumatra, especially concerning after one year of the COVID-19 pandemic in Indonesia. The non-work-related factor that had a significant relationship with mental fatigue was moderate stress levels. While on work-related factors, working in the pit area is a factor that has a significant association with mental fatigue. The two factors have almost the same odds ratio to caused mental fatigue. The coal mining company can develop programs to deal with mental fatigue by creating programs to minimize worker stress and design the mining area that complies with related standards and regulations.

## Abbreviations

US: United States; ERSO: European Road Safety Observatory; COVID-19: coronavirus disease 2019; CIS-20: Checklist of Individual Strength-20; MFI: Multidimensional Fatigue Inventory-20; SOFI: Swedish Occupational Fatigue Inventory; CI: Confidence Interval; AOR: Adjusted Odd Ratio.

## Ethics Approval and Consent to Participate

This study was approved by the Ethical Committee of the Faculty of Public Health, Universitas Indonesia, under the ethical clearance number: Ket-28/UN2.F10.D11/PPM.00.02/2021. Informed consent was obtained from all participants before filling the questionnaires.

## Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

## Availability of Data and Materials

Data and information used as study materials were original study conducted by the corresponding author.

## Authors' Contribution

HD conceptualized, designed, and prepared the manuscript. BU, IMD, and SMN, as the counsel in conducted study, developed the analytical framework of data.

## Acknowledgment

This study was supported by HSE personnel in the mining sites located in Kalimantan and Sumatra and the management personnel of both companies. The authors thank both companies for the permission in conducting the study, Abdul Kadir, S.KM, M.Sc., for proofreading the draft of manuscript, and Indri Hapsari Susilowati, S.KM, M.KKK, Ph.D., for helping in the process of submitting the manuscript.

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# The COVID-19 Pandemic: Role of Coping Humor and Internal Health Locus of Control on Social Dysfunction and Anxiety & Depression

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## Abstract

The concerns about the impact of social distancing on mental health have been widely discussed. This study aimed to know the predictive effect of coping humor and Internal Health Locus of Control (Internal HLoC) on social dysfunction and anxiety & depression during the implementation of the COVID-19 social distancing agenda. This study was also intended to assess the effect of humor content on coping humor. A quantitative approach was used as the method of the study with 243 online-recruited participants, and a PLS-SEM analysis was applied to find out the predictive effect in this study. The results and conclusions showed that anxiety & depression predict social dysfunction ( $\beta = 0.584$ ,  $t$ -value = 11.93,  $f^2 = 0.563$ ). It was found that coping humor was able to directly increase the Internal HLoC ( $\beta = 0.187$ ,  $t$ -value = 2.60,  $f^2 = 0.036$ ) and indirectly decrease social dysfunction ( $\beta = -0.144$ ,  $t$ -value = 2.85) and anxiety & depression ( $\beta = -0.070$ ,  $t$ -value = 2.42). Humor content unrelated to the issue of COVID-19 directly increase the coping-humor level ( $\beta = 0.266$ ,  $t$ -value = 4.13,  $f^2 = 0.076$ ), and indirectly increase Internal HLoC ( $\beta = 0.050$ ,  $t$ -value = 2.07), and decrease anxiety & depression level ( $\beta = -0.046$ ,  $t$ -value = 2.20). On the other hand, Internal HLoC directly decrease levels of social dysfunction ( $\beta = -0.233$ ,  $t$ -value = 4.126,  $f^2 = 0.089$ ) and anxiety & depression ( $\beta = -0.373$ ,  $t$ -value = 7.84,  $f^2 = 0.161$ ).

**Keywords:** coping humor, depression, locus of control, social distancing, social dysfunction

## Introduction

The President's speech on Sunday, March 15, 2020, at Bogor Palace,<sup>1</sup> has become a signal for the implementation of social distancing agenda in Indonesia to prevent the spreading of the coronavirus disease 2019 (COVID-19). Social distancing has been widely applied not only in Indonesia but also in many other countries. Even the use of the term "social distancing" was responded to by the World Health Organization (WHO), where WHO suggested using the term "physical distancing" because it refers explicitly to the restrictions of physical contact, not social contact.<sup>1</sup> However, regardless of the term used, the advantages and effectiveness are believed to exist in the practice of social distancing. Also, worries about its impact on mental health have surfaced. Social distancing is strongly suspected to be the potential cause of stress, panic, anxiety, and depression, especially in individuals with history of anxiety disorder, compulsive disorder, or paranoia.<sup>2</sup>

The study from Sibley, *et al.*,<sup>3</sup> in New Zealand

revealed that the participants in lockdown (surveyed during pandemics) had higher mental stress levels than participants in pre-lockdown (surveyed before the pandemic status was established). People have shown more stressful experiences concerning health problems and job insecurities, work-family conflicts, and even discrimination during the pandemic.<sup>4-6</sup> Furthermore, Zacher & Rudolph,<sup>7</sup> in Germany, conducted a study at the early stage of pandemic (December 2019-May 2020) and showed that the COVID-19 pandemic has not only an impact on medical and economic crises but also psychological dimensions; the main aspects of society on subjective well-being have been decreased. This matter needs further scientific research to provide additional literature about physical/social distancing when applied to pandemic situations.

Anxiety and depression are highlighted by a series of remembered and believed negativity, affecting someone's social function. Social factors, social disorder, and impaired social function are often associated with depression.<sup>8</sup> Social disorders have also been proved to

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Received : February 8, 2021  
Accepted : July 5, 2021  
Published : November 29, 2021

be positively correlated with anxiety symptoms.<sup>9</sup> Close relationships (with spouses, families, or colleagues) and superficial interactions as the elements that support social function are also associated with humor.<sup>10-12</sup> In cross-cultural studies, it has been proved that subjects with a high level of humor show a higher level of well-being and lower level of anxiety, depression, or negative emotions.<sup>13-15</sup> Many studies also underlined that humor has a positive effect on social, emotional, and physical well-being.<sup>16</sup> In particular, laughter is believed to reduce the impact of stress on daily life,<sup>16</sup> and give a positive energy when individuals try to cope with traumatic events.<sup>17</sup> A study of humor from Martin & Lefcourt,<sup>18</sup> featured an interesting term known as coping humor. Coping humor is different from situational humor response and sense of humor that do not focus on stressful experiences. Coping humor acts as a cognitive appraisal strategy,<sup>19</sup> it sees the extent to which individuals use humor (present situation) in stressful situations or events (stressful experiences). By looking at the context of this study, the coping humor variable can show the level (quality) of individuals' use of humor during the implementation of the COVID-19 social distancing agenda.

Besides coping humor, the authors included Internal Health Locus of Control (Internal HLoC) which aimed to see how individuals engage themselves (believing that they have control) to establish healthy behavior. The implications of locus of control in health are certainly not new. Previous studies stated in Jacobs-Lawson, Weddell, and Webb's study have found many correlations between locus of control with health outcomes, demographic variables, and many other psychological variables.<sup>20</sup> Individuals with an internal locus of control tend to be more resistant to psychological pressure and depression.<sup>21</sup> It is interesting to know the dynamics of Internal HLoC effectiveness amid a pandemic situation, especially for authors. In this study, the authors also examined the effect of humor content: Humor Non-COVID Effect/HNCE (level of entertainment from humor contents on social media unrelated to COVID-19 problems) and Humor COVID Effect/HCE (level of entertainment from humor contents on social media related to COVID-19 issues). During this pandemic, memes and jokes about the coronavirus have spread massively on the internet. Emphasizing the social distancing context, the purpose of this study was to answer the question, "Do coping humor and Internal HLoC can predict social dysfunction and anxiety & depression due to the implementation of social distancing?". Therefore, the study objective was to find out the predictive effect of coping humor and Internal HLoC on social dysfunction and anxiety & depression in the implementation of social distancing, as well as the

effect of humor content on coping humor.

## Method

The data collection in this study was carried out through a Google Form (study questionnaire link) spread on social media, starting from April 8 to April 15, 2020. The sample size estimation was based on the inverse square root method, which suggested using a minimum of 160 participants when using a Partial Least Square-Structural Equation Modeling (PLS-SEM).<sup>22</sup> The total sample in this study was 243 social media users like Instagram, Facebook, Twitter, TikTok, WhatsApp, and YouTube (age 16-64 years,  $M_{age} = 27.9$   $SD_{age} = 8.477$ ; Male = 70, Female = 173), meaning that the minimum sampling has been fulfilled. All of the scales used were translated into Bahasa Indonesia and then translated back into English to harmonize. Some items have been adjusted so that participants could understand better without reducing the true meaning of the scale (concept and semantic equivalent).

The authors modified the SFQ scale,<sup>23</sup> to describe a person's social functions (good or bad) over the past two weeks by randomizing the item number and applying a reflective format to measure seven areas; work and homework, finances, social contacts, relationships with family, sexual activity, isolation, and me time. The SFQ is a powerful short instrument and serves to assess social functions in various situations. Then, the authors adapted the Patient Health Questionnaire (PHQ)-4 scale,<sup>24</sup> a combination of the PHQ-2 and Generalized Anxiety Disorder (GAD)-2 scales. PHQ-4 scale was used to measure the anxiety & depression levels in the last two weeks. Coping Humor scale,<sup>18</sup> was also distributed to see how often individuals use humor to cope with stressful experiences during social distancing.

On the other hand, the HLoC scale,<sup>21</sup> was applied to calculate participants' internal locus of control. Last but not least, HNCE and HCE were constructed by authors to specify the effect of humor content on participants. The HNCE and HCE were composed of one item; as for HNCE, "How much are you entertained by funny contents that are not related to the COVID-19 issues on social media?". For HCE, "How much are you entertained by funny contents that are related to the COVID-19 issues on social media?". Both of which have a response ranging of five choices (1 = never feel entertained; 5 = very often feel entertained).

The demographic categorization in this study was sex which consisted of female and male, education which consisted of Diploma III and Bachelor Degree up to Doctoral Degree, and marital status, which consisted of single, married, and widow/widower. As for the anxiety & depression variable, the categorization was based on related journals,<sup>24</sup> ranging from minimal, mild,

moderate, and severe. As for the variables of social dysfunction, coping humor, Internal HLoC, humor content (HNCE and HCE), the authors determined three categories (low, moderate, and high). The variable categorization follows the calculations and guidelines that have been applied.<sup>25</sup>

The authors used a Partial Least Square-Structural Equation Modeling (PLS-SEM) approach through SmartPLS software (v.3.2.8 Single-User Licenses) to analyze the relationship between variables.<sup>26</sup> In addition to the data categorization values obtained through Microsoft Excel, all variables in this study were also analyzed using SmartPLS software. As for the descriptive analysis in the worksheet, the Validity and Reliability Tests were conducted through PLS algorithm calculation by eliminating several items (coping humor (CH)1, CH4, CH5, locus of control (LOC)5, LOC6, LOC7) based on the outer loading values before direct and indirect testing (presented in Figure 1 and Table 1). The direct and indirect effects (mediation) were obtained through bootstrapping analysis (presented by Figure 2, Table 2, and Table 3). Besides simultaneously analyzing constructs formed with reflective and formative indicators, PLS can estimate large/complex models with various construct latent variables and indicators.<sup>27</sup>

**Results**

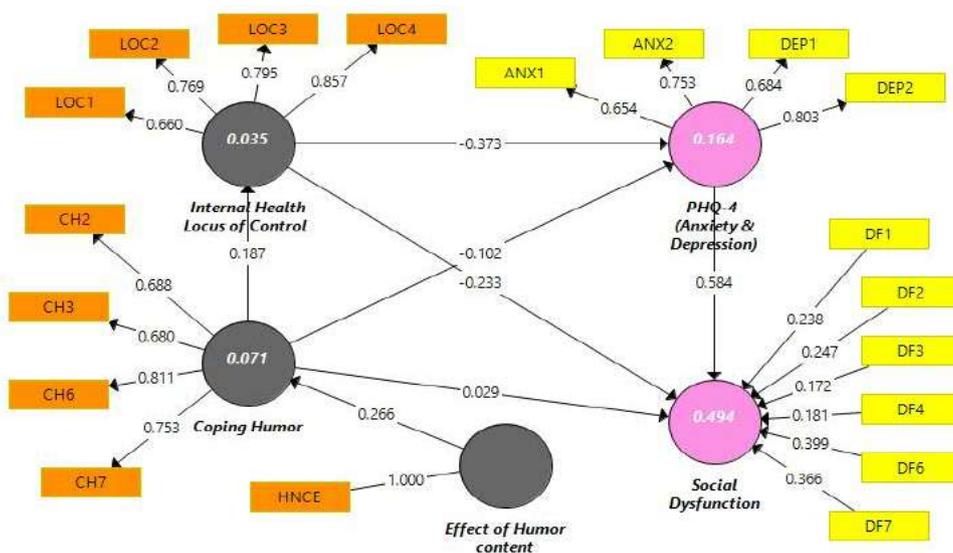
A descriptive analysis and data categorization were performed (Table 1) before the PLS algorithm was conducted to overview of participants' characteristics and the tendency of subject scores in general. Table 1 points out that the majority of the participants were females (71.2%), have Diploma IV/Bachelor Degree

(64.2%), and single/not married (69.1%). It is shown that 17.7% of them have a high level of social dysfunction while the other 67.9% have a moderate level. The participants have a mild (44.9%), moderate (7.4%), and severe (2.1%) level of anxiety & depression. It is also

**Table 1. Descriptive Analysis and Data Categorization (n = 243)**

| Variable   | Category               | n   | %    |
|--|------------------------|-----|------|
| Gender   | Female                 | 173 | 71.2 |
|  | Male                   | 70  | 28.8 |
| Education  | High school/vocational |     |      |
|  | high school            | 19  | 7.8  |
|  | D3/associate degree    | 21  | 8.6  |
|  | D4/bachelor            | 156 | 64.2 |
|  | Master                 | 44  | 18.1 |
| Marriage status  | Doctoral               | 3   | 1.2  |
|  | Single/not married     | 168 | 69.1 |
|  | Have marriage          | 70  | 28.8 |
| Anxiety & depression<br>(Mean = 3.02; SD = 2.047)  | Widow/widower          | 5   | 2.1  |
|  | None-minimal           | 111 | 45.7 |
|  | Mild                   | 109 | 44.9 |
| Social dysfunction<br>(Mean = 6.08; SD = 3.498)  | Moderate               | 18  | 7.4  |
|  | Severe                 | 5   | 2.1  |
|  | High                   | 43  | 17.7 |
| Coping humor<br>(Mean = 24.17; SD = 4.521)   | Moderate               | 165 | 67.9 |
|  | Low                    | 35  | 14.4 |
|  | High                   | 42  | 17.3 |
| Internal health locus of control<br>(Mean = 33.73; SD = 6.777)                                   | Moderate               | 160 | 65.8 |
|  | Low                    | 41  | 16.9 |
|  | High                   | 42  | 17.3 |
| Feel amused about humor content that related to the COVID-19 issues<br>(Mean = 2.82; SD = 1.091) | Moderate               | 163 | 67.1 |
|  | Low                    | 38  | 15.6 |
|  | High                   | 69  | 28.4 |
| Feel amused about humor content not related to the COVID-19 issues<br>(Mean = 4.02; SD = 0.741)  | Moderate               | 137 | 56.4 |
|  | Low                    | 37  | 15.2 |
|  | High                   | 63  | 25.9 |
|  | Moderate               | 127 | 52.3 |
|  | Low                    | 53  | 21.8 |

Note: SD: Standard Deviation



**Figure 1. Structural Model (Inner and Outer Model, Path Coefficients)**

Table 2. Validity and Reliability Test (Inner and Outer Model)

| Construct                        | Items | Scale      | Loadings/t-value | Weights | Cronbach's alpha | CR/VIF | AVE |
|----------------------------------|-------|------------|------------------|---------|------------------|--------|-----|
| Social dysfunction               | DF1   | Formative  | 3.320            | -       | -                | 1.149  | -   |
|                                  | DF2   |            | 2.959            | 1.147   |                  |        |     |
|                                  | DF3   |            | 2.176            | 1.364   |                  |        |     |
|                                  | DF4   |            | 2.635            | 1.112   |                  |        |     |
|                                  | DF6   |            | 5.223            | 1.249   |                  |        |     |
|                                  | DF7   |            | 4.349            | 1.377   |                  |        |     |
|                                  | DF5   |            | 2.635            | 1.112   |                  |        |     |
| Anxiety & depression             | ANX1  | Reflective | 0.654            | 0.702   | 0.816            | 0.527  |     |
|                                  | ANX2  |            | 0.753            |         |                  |        |     |
|                                  | DEP1  |            | 0.684            |         |                  |        |     |
|                                  | DEP2  |            | 0.803            |         |                  |        |     |
|                                  | DEP3  |            | 0.803            |         |                  |        |     |
| Coping humor                     | CH2   | Reflective | 0.688            | 0.725   | 0.824            | 0.541  |     |
|                                  | CH3   |            | 0.680            |         |                  |        |     |
|                                  | CH6   |            | 0.811            |         |                  |        |     |
|                                  | CH7   |            | 0.753            |         |                  |        |     |
|                                  | CH4   |            | 0.680            |         |                  |        |     |
|                                  | CH5   |            | 0.680            |         |                  |        |     |
|                                  | CH1   |            | 0.688            |         |                  |        |     |
| Internal health locus of control | LOC1  | Reflective | 0.660            | 0.785   | 0.855            | 0.598  |     |
|                                  | LOC2  |            | 0.769            |         |                  |        |     |
|                                  | LOC3  |            | 0.795            |         |                  |        |     |
|                                  | LOC4  |            | 0.857            |         |                  |        |     |
|                                  | LOC5  |            | 0.660            |         |                  |        |     |
| Effect of humor content          | HNCE  | Formative  | 1.000            | -       | 1.000            | -      |     |

Notes: CR: Composite Reliability; VIF: Collinearity Statistics; AVE: Average Variance Extracted; t-value>1.96; DF1, DF2, DF3, DF4, DF6, DF7: Items of Social Dysfunction; ANX1, ANX2, DEP1, DEP2; Items of Anxiety & Depression; CH2, CH3, CH6, CH7; Items of Coping Humor; LOC1, LOC2, LOC3, LOC4; Items of Internal HLoC; HNCE; Humor Content Contents that are not related to COVID-19 issues

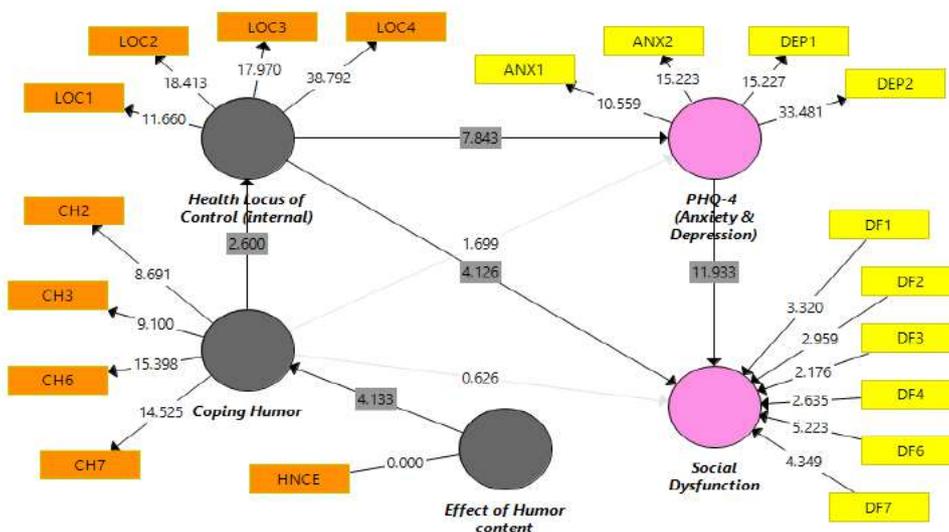


Figure 2. Structural Model (Inner and Outer Model, t-values)

revealed that 17.3% of them have high coping humor and Internal HLoC. In terms of humor content, 28.4% of the participants were highly entertained with funny content related to the COVID-19 issues. In comparison, the other 25.9% were entertained with funny content unrelated to the COVID-19 issues. Figure 1 and Table 2 below show a series of variables involved in this study and have been tested internally and externally.

The reflective scale was evaluated based on the value of AVE (>0.5), outer loadings (>0.6), Cronbach's alpha (>0.6), and composite reliability (>0.7). The item with

an outer loading value of < 0.6 (CH1, CH4, CH5, LOC5, LOC6, LOC7) must be eliminated by the model before direct and indirect tests. Table 1 illustrates that the overall reflective scale has met the convergent validity requirements. The discriminant validity conditions, which were set based on Fornell-Larcker criteria and cross-loading values, also have been fulfilled. On the one hand, the formative scale 28 was assessed based on outer weight bootstrap value (p-value<0.05), where the calculation results made item DF5, DF8, and HCE (p-value>0.05) eliminated from the model. Figure 2 shows

**Table 3. Direct Effect**

| Variable Relationship                      | Std. Beta | Std. Error | t-value | p-value | f <sup>2</sup> |
|--|-----------|------------|---------|---------|----------------|
| Anxiety & depression -> Social dysfunction | 0.584     | 0.049      | 11.933  | 0.000** | 0.563          |
| Internal HLoC -> Social dysfunction        | -0.233    | 0.056      | 4.126   | 0.000** | 0.089          |
| Internal HLoC -> Anxiety & depression      | -0.373    | 0.048      | 7.843   | 0.000** | 0.161          |
| Coping humor -> Anxiety & depression       | -0.102    | 0.060      | 1.699   | 0.089   | 0.012          |
| Coping humor -> Social dysfunction         | 0.029     | 0.047      | 0.626   | 0.531   | 0.002          |
| Coping humor -> Internal HLoC              | 0.187     | 0.072      | 2.600   | 0.009** | 0.036          |
| Humor content -> Coping humor              | 0.266     | 0.064      | 4.133   | 0.000** | 0.076          |

Notes: \*\*p-value<0.01, \*p-value<0.05; f<sup>2</sup>: Effect Size; HLoC: Health Locus of Control

**Table 4. Indirect Effect (Mediation)**

| Variable Relationship                                       | Std. Beta | Std. Error | t-value | p-value |
|---|-----------|------------|---------|---------|
| Coping humor -> Internal HLoC -> Social dysfunction         | -0.144    | 0.050      | 2.859   | 0.004** |
| Coping humor -> Internal HLoC -> Anxiety & depression       | -0.070    | 0.029      | 2.424   | 0.015*  |
| Humor content -> Coping humor -> Internal HLoC              | 0.050     | 0.024      | 2.076   | 0.038*  |
| Humor content -> Coping humor -> Anxiety & depression       | -0.046    | 0.021      | 2.208   | 0.027*  |
| Internal HLoC -> Anxiety & depression -> Social dysfunction | -0.218    | 0.035      | 6.225   | 0.000** |

Notes: \*\*p-value<0.01, \*p-value<0.05; HLoC: Health Locus of Control

an image of the final bootstrap result (5,000 subsamples, CI Method: Bias-Corrected and Accelerated Bootstrap), and blindfold calculations.

Table 3 and Figure 2 indicates anxiety & depression ( $\beta = 0.584$ ,  $M = 0.591$ , 95% CI BCa = 0.473; 0.666, t-value = 11.93, p-value<0.01,  $f^2 = 0.563$ ) and Internal HLoC ( $\beta = -0.233$ ,  $M = -0.233$ , 95% CI BCa = -0.336; -0.113, t-value = 4.126, p-value<0.01,  $f^2 = 0.089$ ) predicts social dysfunction ( $R^2 = 0.494$ ). Internal HLoC predicts anxiety & depression ( $\beta = -0.373$ ,  $M = -0.379$ , 95% CI BCa = -0.457; -0.267, t-value = 7.84, p-value<0.01,  $R^2 = 0.164$ ,  $f^2 = 0.161$ ). Coping humor predicts Internal HLoC ( $\beta = 0.187$ ,  $M = 0.198$ , 95% CI BCa = 0.025; 0.313, t-value = 2.60, p-value<0.01,  $R^2 = 0.035$ ,  $f^2 = 0.036$ ). Humor content predicts coping humor ( $\beta = 0.266$ ,  $M = 0.271$ , 95% CI BCa = 0.124; 0.380, t-value = 4.13, p-value<0.01,  $R^2 = 0.071$ ,  $f^2 = 0.076$ ).

Table 4 and Figure 2 indicate that coping humor predicts social dysfunction ( $\beta = -0.144$ ,  $M = -0.153$ , 95% CI BCa = -0.231; -0.031, t-value = 2.85, p-value<0.01) and anxiety & depression ( $\beta = -0.070$ ,  $M = -0.075$ , 95% CI BCa = -0.123; -0.012, t-value = 2.42, p-value<0.05) through Internal HLoC (mediator variable). Humor content predicts Internal HLoC ( $\beta = 0.050$ ,  $M = 0.054$ , 95% CI BCa = 0.009; 0.100, t-value = 2.07, p-value<0.05) and anxiety & depression ( $\beta = -0.046$ ,  $M = -0.048$ , 95% CI BCa = -0.089; -0.009, t-value = 2.20, p-value<0.05) through coping humor. Internal HLoC predicts social dysfunction ( $\beta = -0.218$ ,  $M = -0.224$ , 95% CI BCa = -0.283; -0.148, t-value = 6.22, p-value<0.01).

## Discussion

Based on Table 1, it is known that many participants of this study have experienced social function problems, anxiety, or depression. Previous studies showed that anxiety and depression have a negative impact on social function.<sup>8,9</sup> Likewise, the analysis results (see Table 3) strengthen the assumption that anxiety and depression can reduce people’s social function (work and homework, finances, social contacts, sexual activity, sense of belonging) during the implementation of social/physical distancing program. In this section, it is necessary to review that anxiety and depression can grow sequentially and even simultaneously on a subject. The symptoms can also be said to overlap like two sides of a coin. However, the difference in question can be seen from the measurement items. Anxiety accentuates the feeling of “nervous, anxious, or on edge,” while depression features the feeling of “sad, depressed, or hopeless.” The most striking differences are described by Glasofer,<sup>29</sup> based on a mental marker (symptoms or expressions of the conditions). It is explained that suicidal tendency in anxiety is still limited to the fear of death, whereas, in mild to severe depression, suicidal thoughts will appear to be more specific. From there, it can be said that the impact of depression will be much riskier on social function compared to anxiety.

Concerning humor, the results of this study (see Table 3 and Table 4) support all arguments from every person who suggests having some humor during the implementation of social distancing.<sup>30,31</sup> This finding is also in line with results from other studies in different situations and conditions.<sup>32-35</sup> Based on the results of the analysis in this study, coping humor is known to have a direct posi-

tive effect on the Internal HLoC variable and an indirect negative effect on social dysfunction and anxiety & depression. This condition indicates that collaborating those two variables can positively impact people's health during difficult situations (e.g., the COVID-19 pandemic). However, it should be emphasized that the effect size found in this study is relatively small. Referring to Fessell,<sup>15</sup> 70% of humor occurs spontaneously in everyday life. This result is in line with the unique concept of coping humor that happens in the current situation. It is suitable for people to focus on building positive emotions in the current situation rather than feeling sad to think about what happened in the past or being excessively worried about something that has not happened in the future. Some simple things can be done to improve the quality of humor, such as listening to favorite songs, calling friends who are good at making jokes, especially when difficult situations happen, or just enjoying comedy television shows like standup comedy. Some studies have proved that the strategies above are effective in reducing anxiety and increasing positive emotions.<sup>13,36</sup>

Humor content (HNCE only) is validated (see Table 3 and Table 4) to predict coping humor and Internal HLoC as well as anxiety & depression (indirect effect). It signifies that humor content on social media (unrelated to the COVID-19) can positively impact coping humor; the more entertained the individual, the higher the coping humor is. This condition eventually will help to decrease social dysfunction and anxiety & depression. On the other hand, humor content can also predict the positive impact of Internal HLoC on someone's well-being. Previous studies stated in Nick's study have linked laughter to the production of endorphins that can improve mood and reduce stress, increasing disease resistance.<sup>37</sup> Whereas, please understand and note that even though many studies have proved the positive effect of humor in various contexts, it is still suggested to pay attention to the sensitivity when using humor. Speaking of the concept of humor style, not all types of humor can function well in a pandemic situation. As revealed by Peter McGraw from Humor Research Lab,<sup>37</sup> the authors also advise enjoying and using friendly humor.

Internal HLoC is directly and persistently capable (see Table 3) to predict social dysfunction and anxiety & depression. The effectiveness of Internal HLoC in the pandemic situation has been demonstrated in this study. Other variables have been tested in other conditions, such as social loafing,<sup>38</sup> and collective action.<sup>39</sup> In the field of health, previous studies stated in Kesavayuth, Poyago-Theotoky, and Zikos showed that men and women with Internal HLoC tend to have better self-assessed physical and mental health. They rely less on preventive and curative medical care.<sup>21</sup> In addition, those with Internal HLoC tend to be less prone to psychological

distress and depression.<sup>21</sup> Jacobs-Lawson, *et al.*,<sup>20</sup> said that education level as well as self-assessed and self-efficacy health could predict the Internal HLoC. Locus of control is the core dimension of self-evaluation along with neuroticism, self-efficacy, and self-esteem.<sup>40</sup> In the context of social distancing, individuals with high Internal HLoC will depend more on their inner spirit. They believe that what happens to themselves is a consequence of their actions and efforts.

On the contrary, individuals with high External HLoC will depend more on external factors (e.g., fate, luck, or intervention from others). This result does not mean that External HLoC should be ruled out. A combination of Internal HLoC and External HLoC is possible. This is expected to give more effective and efficient results precisely. The study conducted by April, Dharani, and Peters,<sup>41</sup> showed that an individual's maximum level of happiness could be achieved with a balanced locus of control that is the combination of two controls (internal and external) known as the "Bi-Locals" type. Rotter mentioned that internality and externality are a continuum, not a typology.<sup>42</sup> Therefore, the authors of this study argue that conditions and situations should be considered in every locus of control study.

This study is expected to contribute to literature studies related to social dysfunction, anxiety, depression, coping humor, Internal HLoC, and humor contents on social media, particularly regarding implementing a social distancing agenda during the COVID-19 pandemic. In addition to the scientific contribution, this study can be used as a reference for the preparation of social distancing programs such as the socialization to use appropriate humor as a coping strategy in difficult situations or to conduct training to strengthen Internal HLoC in the health sector. Further researches must pay attention to the limitations of the study. For example, this study was conducted only at the beginning of social distancing implementation.

The data collected did not cover until the end of the period and only measured what participants felt in the last two weeks. The effect size also needs to be considered because the effect of coping humor and humor content is relatively small. This study showed that only anxiety & depression have a significant impact on social dysfunction. Internal HLoC has a relatively small effect on social dysfunction but is moderate on anxiety & depression. This indicates that other causative variables need to be involved. It also may be caused by the variability of data. Besides that, the social dysfunction scale in this study only measured five areas. Two items that measure "relationships with family" and "me time" were eliminated by the PLS model. Overall, the authors encourage further researchers to pay more attention to the procedures used, such as the measuring instruments, de-

mographic variables, statistical power, and other locations/regions.

### Conclusion

From the results, it can be concluded that anxiety & depression directly predict social dysfunction. Coping humor directly predicts Internal HLoC and indirectly predicts social dysfunction and anxiety & depression. Humor content (only humor content on social media unrelated to the COVID-19 issues) directly predicts coping humor and indirectly predicts Internal HLoC and anxiety & depression. Moreover, this study reveals that Internal HLoC directly predicts social dysfunction and anxiety & depression. It means that the higher the anxiety & depression, the higher the social dysfunction would be. Increasing the Internal HLoC and higher coping humor can also decrease social dysfunction and anxiety & depression. Humor content unrelated to the COVID-19 issues can increase the level of coping humor and thus lower the level of anxiety & depression. To sum up, this study proves that Internal HLoC can decrease social dysfunction and anxiety & depression levels.

### Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; HNCE: Humor Non-Covid Effect; HCE: Humor Covid Effect; SFQ: Social Function Questionnaire; PHQ: Patient Health Questionnaire; GAD: Generalized Anxiety Disorders; CH: Coping Humor; SD: Standard Deviation; M: Mean; PLS-SEM: Partial Least Square-Structural Equation Modeling; CI Bca: Confidence Interval Bias Corrected and Accelerated; VIF: Collinearity Statistics; AVE: Average Variance Extracted; CR: Composite Reliability; HLoC: Health Locus of Control.

### Ethics Approval and Consent to Participate

Ethical approval was obtained from the local hospital (No. 239/Kom-Etik/Int/VI/2019).

### Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that were likely to have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

Data and all related materials are available to all authors. Please get in touch with the correspondence if data is required.

### Authors' Contribution

MAS proposed research topic. Overall, all of the authors (MAS, Z, HRA, AZF) are involved and contribute to every step of the process of drafting the manuscript.

### Acknowledgment

The authors would like to thank all participants who helped to spread

the research questionnaire, especially the colleagues from Intellectual Freedom (Ruang Ide) and Halo Jiwa Indonesia.

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# Breastfeeding Knowledge and Behavior in Lactational Amenorrhea Method (LAM) as a Natural Contraceptive

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## Abstract

The lactational amenorrhea method (LAM) is a natural contraceptive that is highly effective after the three essential criteria are fulfilled. However, there is a significantly low adoption resulting from poor knowledge and correct practices. This study aimed to determine the correlation between knowledge and behavior of breastfeeding mothers on breastfeeding as a natural contraceptive. This was an analytic observational study with a cross-sectional design involving 89 breastfeeding mothers and was performed from January to March 2018. Furthermore, data were collected using a questionnaire, and the results showed knowledge of breastfeeding mothers to be good (59.6%) and not good (40.4%). However, the individual's behavior towards the implementation of LAM was not good (48.3%) and good (51.7%). Based on the statistical test, there was a correlation between knowledge and behavior of breastfeeding mothers, with a p-value of 0.006 (OR = 3.463; 95% CI = 1.411 – 8.498). In brief, knowledge of LAM amongst the participants is good, despite the poor application in terms of behavior. Also, a relationship was also established between the knowledge and behavior of breastfeeding mothers as a natural contraceptive.

**Keywords:** behavior, breastfeeding, knowledge, lactational amenorrhea

## Introduction

A healthy, happy, and prosperous family is the dream of every family to produce quality families through family planning programs. The form of family planning program is the use of contraceptives. Contraception involves methods which potentially used to prevent pregnancy.<sup>1</sup> Making the right choice will help improving the health and well-being of individuals, families, and communities.<sup>2</sup> This selected method is carried out immediately after childbirth because most women aspire to limit their pregnancy.<sup>3</sup> The contraceptives commonly used include pills, injectables, implants, intrauterine devices, condoms, vaginal rings, patches, male and female sterilization, spermicides and diaphragms, cervical caps, lactational amenorrhea methods, withdrawal, and fertility awareness-based methods.<sup>1</sup> Moreover, contraception has some advantages; preventing unwanted pregnancies, avoiding pregnancy, and reducing morbidity and maternal mortality.<sup>2</sup> These are also used as a driving factor to maintain women's health and socioeconomic well-being.<sup>4</sup>

Mothers must prepare early in making decisions about their pregnancy to avoid the risk of unwanted preg-

nancy due to contraceptive failure. Moreover, statistics have shown the existence of over 74 million unwanted pregnancies every year in developing countries, and 30% were attributed to contraceptive failure.<sup>5</sup> These malfunctions are mainly due to the user's young age and low economic status,<sup>6</sup> as well as the adoption of incorrect and inconsistent methods. In addition, age, education, family income, marital status, and contraceptive method type have also been identified.<sup>7</sup> These failures are significantly common amongst quitting acceptors, as recorded by Surayya, *et al.*<sup>8</sup> This dropout attitude is caused by some factors, including age, family planning history, and side effects.<sup>9</sup> Moreover, natural family planning methods are also considered an option by mothers and couples intending to avoid or minimize the side effects of contraceptives.<sup>10</sup>

Natural family planning is an option for couples who committed not to use hormonal contraceptives or devices. Commitment and motivation with the partner are very important for the successful use of natural family planning. The three natural family planning methods including fertility awareness-based, lactational amenorrhea

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Received : January 19, 2021  
Accepted : July 13, 2021  
Published : November 29, 2021

method (LAM), which is discussed in this study, and withdrawal methods.<sup>11</sup> Particularly, the LAM is a contraceptive technique involving exclusive breastfeeding. This technique is characterized by the advantages of being safe, helping delay menstruation, supporting exclusive breastfeeding, and preventing pregnancy.<sup>12</sup> Furthermore, other benefits include improving the mothers' ability to provide exclusive breastfeeding, pregnancy prevention, cost-effectiveness, ease of performing, and natural. Also, LAM does not require drugs or devices, and interferes with body hormones and sexual intercourse. This provides protection and serves as an alternative method for women searching for ways where barriers, including diaphragms, cervical cap, male condom, spermicide foam, and sponge, are not used.<sup>13</sup>

Moreover, an understanding of breastfeeding as a contraceptive method has been established at the Bellagio consensus, Italy, since 1988. This consensus brought together an international interdisciplinary study group in lactation infertility to discuss LAM as an effective and safe contraception method. The consensus results showed a 98% chance of protection against pregnancy and amenorrhea in the first six months after childbirth, under the circumstances where the mother practices direct breastfeeding.<sup>14</sup> The study by Tiwari, *et al.*,<sup>15</sup> highlighted the absence of any conception amongst breastfeeding mothers within the first six months postpartum. This indicates the propensity to adopt LAM as a natural contraceptive method, which is very effective for mothers engaged in exclusive breastfeeding for the first six months postpartum.<sup>15</sup> In addition, this approach is considered appropriate if the three LAM criteria are fulfilled.<sup>16</sup>

Breastfeeding mothers must understand the three LAM criteria so that this contraceptive method can be successful, not just breastfeeding. Three LAM criteria are including being a breastfeeding mother for up to six months after childbirth, amenorrhea, and having babies less than six months old.<sup>17</sup> The LAM is a non-hormonal contraceptive method that is good for breastfeeding mothers,<sup>18</sup> and knowledge of LAM and correct behavior in the application of LAM can help reduce the incidence of pregnancy among LAM users.<sup>19</sup> Based on a study conducted in Turkey, 17% of mothers receive information about breastfeeding as a contraceptive method, 41.3% acknowledge the tendency to use breast milk as a contraceptive method, 68.9% receive information about LAM from a nurse, and 38.9% receive knowledge related to the potential side effects.<sup>20</sup> In addition to the individual understanding, it is also important to consider the mothers' behavior towards the application because incorrect execution has played a significant role in failures, and an increased possibility of pregnancy, resulting from the return of fertility.

Study conducted in Nigeria showed the use of LAM in 52% of the study participants, while 21% have substantial knowledge regarding the proper application.<sup>16</sup> In addition, a study in rural Turkey showed high breastfeeding rates, despite the low adoption of LAM as a contraception method. This population characteristic is attributed to the non-fulfillment of one of the intrinsic criteria.<sup>21</sup> The effectiveness of LAM is known to decrease with the return of menstruation. Hence, mothers are expected to immediately use another contraceptive approach when a postponement of pregnancy is needed.<sup>22</sup>

Pregnancy can occur when the mother's fertility returns. A study by Van der Wijden and Manion stated that the pregnancy rate amongst LAM users is between 0% and 7.5%, while fully breastfeeding and amenorrheic women reported not using any contraceptive methods was 0.88%.<sup>12</sup> Based on preliminary studies, Indonesia is one of the largest archipelagic countries globally, with a population of 131,879,182 people. This consists of 131,879,182 and 133,136,131 females and males, respectively. In addition, most of the women are of reproductive age, comprising 70,715,592 people, and efforts are currently being made to control this population size by implementing a sustainable family planning program.<sup>23</sup> The estimates of contraception methods used amongst women of the reproductive age worldwide in 2019 include female sterilization was 24%, the male condom was 21%, intrauterine device (IUD) was 17%, the pill was 16%, injectable was 8%, withdrawal was 5%, the rhythm was 3%, the implant was 2%, and others were 2%.<sup>24</sup> Proportionally, the most popularly adopted technique was the three-month injections (42.4%), pills (8.5%), IUD (6.6%), one-month injections (6.1%), implants (4.7%), women's operating methods (3.1%), male condoms (1.1%), and the male operation method (0.2%).<sup>25</sup> However, the correct use of the LAM has not been well documented.

Therefore, providing substantial information is necessary to increase maternal knowledge about LAM and distinguish the correct application technique. Moreover, health workers are encouraged to record the success of mothers adopting LAM and support the realization of exclusive breastfeeding. In addition, field experience shows the poor knowledge of this method amongst a majority of the mothers. Hence, there is a need to disseminate related information from the inception of pregnancy to the postpartum period. The previous study by Mulyani, *et al.*,<sup>26</sup> highlighted the higher tendency for mothers receiving postpartum counseling about LAM from applying the contraception method because this category of women received information and support from health workers. The education provided plays an important role in influencing a mother to decide the appropriate contraception method.<sup>27</sup> These educational efforts require ini-

tial information on the individuals’ understanding of the knowledge shared. However, few studies have been conducted to determine the correlation between the knowledge and behavior of breastfeeding mothers towards the application of LAM.

This contraceptive method is recommended due to the high cost-effectiveness, absence of any side effects, and the potential application by couples in need of natural techniques without any drugs or devices. Therefore, correct understanding and application are expected from postpartum mothers. Moreover, receiving support in the form of knowledge, information, and education regarding the use of natural contraceptives is essential to regulate pregnancy and respect human rights regarding the individual’s choices. Therefore, this study aimed to determine the correlation between knowledge and behavior of breastfeeding mothers on breastfeeding as a natural contraceptive.

### Method

This was a cross-sectional design study conducted from January to March 2018 in ‘Aisyiyah Moyudan Primary Clinic, Moyudan Sub-district, Sleman District, Yogyakarta Province, Indonesia. Sleman District is known to have the highest success rates in terms of exclusive breastfeeding (81.7%), compared to Bantul (77.7%), Kulon Progo (76.3%), Gunung Kidul (68.8%), and Yogyakarta City (67.4%).<sup>28</sup> In addition, this observation is the basis of this study because LAM involves providing exclusive breastfeeding. This study involved 89 individuals from a total population of 810 breastfeeding mothers. The samples were collected through purposive sampling, based on the inclusion criteria, the participants’ abilities or knowledge, and the study needs.<sup>29</sup>

The inclusion criteria include mothers aged above 25 years, married women, individuals with a history of normal delivery, babies weighing over 2,500 grams at birth, babies with no abnormalities or congenital disabilities, and mothers with no breast abnormalities. However, the exclusion criteria include women with mental health disorders, a history of depression, and sufferers of severe infectious diseases. The data required were collected using the knowledge and behavior questionnaire. The knowledge questionnaire consists of 18 statements, including five statements on breastfeeding, four on breastfeeding as a contraceptive method, three on the advantage of using LAM, four on the limitations, and two focused on those eligible to use LAM. In addition, the respondent was expected to choose one of two answers for each, where “Yes” indicates a mothers’ knowledge about LAM, and “No” means the absence of awareness.

The behavior questionnaire consisted of 10 statements regarding an individuals’ attitude towards the application of LAM. This assessment required the respondent to

choose one of two answers for each statement, where “Yes” indicates the mother applies LAM, while “No” means otherwise. The data collected were then analyzed to determine the frequency distribution of breastfeeding mothers’ knowledge. Furthermore, bivariate and multivariate analyzes were conducted to determine the statements with the most significant influence on maternal knowledge about LAM. The variables used include breastfeeding, breastfeeding as a method of contraception, the advantage of using LAM, limitations of using LAM, and an individuals’ eligibility to use LAM. Therefore, knowledge and behavior were measured using the  $X > \text{mean}$  value, which indicates ‘good,’ while  $X < \text{mean}$  denotes ‘not good.’ The mean value is obtained by adding all the sampled data values and dividing by the number of samples.

### Results

A total of 89 breastfeeding mothers were involved in this study. Table 1 shows the demographic data collected, which identified all as Muslim, with most having a last education of Senior High School (46.1%). Furthermore, the husband’s most common job was an employee (45%), while the major occupation of most mothers was a housewife (61.8%). The family income per month was <2 million IDR (24.7%) and  $\geq 2$  million IDR (75.3%). All participants were determined to know about exclusive breastfeeding based on the data collected regarding the mother’s knowledge about LAM. This practice characterized by providing of breast milk to babies from birth to the age of six months without any additional food or drinks, except drugs.

Table 2 also highlights the mothers’ knowledge about breastfeeding as a technique to prevent breast cancer.

Table 1. Characteristic of Breastfeeding Mothers (n = 89)

| Characteristic                    | Category             | n  | %    |
|-----------------------------------|----------------------|----|------|
| Religion                          | Muslim               | 89 | 100  |
|                                   | Non-Muslim           | 0  | 0    |
| Education                         | Elementary school    | 1  | 1.1  |
|                                   | Junior high school   | 11 | 12.4 |
|                                   | Senior high school   | 41 | 46.1 |
|                                   | Diploma              | 5  | 5.6  |
|                                   | Bachelor             | 31 | 34.8 |
| Husband’s occupation              | Entrepreneur         | 35 | 39.3 |
|                                   | Civil servants       | 4  | 4.5  |
|                                   | Employee             | 40 | 45   |
|                                   | Farmer               | 5  | 5.6  |
|                                   | Teacher              | 5  | 5.6  |
| Breastfeeding mother’s occupation | Housewife            | 55 | 61.8 |
|                                   | Civil servants       | 2  | 2.2  |
|                                   | Entrepreneur         | 16 | 18.0 |
|                                   | Teacher              | 4  | 4.5  |
|                                   | Employee             | 12 | 13.5 |
| Family income (per month)         | <2 million IDR       | 22 | 24.7 |
|                                   | $\geq 2$ million IDR | 67 | 75.3 |

Table 2. Frequency Distribution of Mother's Knowledge About Lactation Amenorrhea Method

| Variable                                | Category   | Yes (%) | No (%) |
|---|--|---------|--------|
| Breastfeeding                           | Exclusive breastfeeding is breast milk given from the baby born until six months without additional food or drinks other than drugs  | 100     | 0      |
|   | Breast milk is the best food for babies and cheap  | 93      | 7      |
|   | Breastfeeding can prevent breast cancer  | 100     | 0      |
|   | Breast milk protects babies from various diseases  | 53      | 47     |
|   | A sick baby should not be breastfed  | 49      | 51     |
| Breastfeeding as a contraceptive method | Family planning is used to avoid pregnancy   | 92      | 8      |
|   | The lactation amenorrhea method (LAM) is one of the natural contraceptive methods  | 74      | 26     |
|   | Breastfeeding is a contraceptive method  | 76      | 24     |
| The advantage of using LAM              | You can get pregnant if you have not used contraception  | 96      | 4      |
|   | The LAM does not require drugs or tools  | 78      | 22     |
|   | The LAM method has high effectiveness, meaning that pregnancy rarely occurs  | 66      | 34     |
|   | The LAM method is safe to use and does not interfere with intercourse  | 47      | 53     |
| Limitations of using LAM                | The LAM is long-term contraception   | 66      | 34     |
|   | Pumping or milking can affect the performance of the LAM   | 35      | 65     |
|   | The LAM method is difficult to implement due to environmental, social, and support factors   | 47      | 53     |
| Someone who can use LAM                 | The LAM method protects mothers from sexually transmitted diseases (STIs) and HIV/AIDS   | 33      | 67     |
|   | The LAM can still be used even if the mother has menstruated   | 38      | 62     |
|   | Exclusive breastfeeding mothers and mothers using additional contraception such as injections, pills, implants, intrauterine devices (IUDs), condoms for fear of pregnancy | 33      | 67     |

The results showed a sufficient understanding of breast milk as the best and cheapest food for babies (93%). Also, the mothers acknowledge breastfeeding to protect babies against various diseases (53%). In addition, some participants continue this practice despite any infant illness (49%), and some tend to stop due to the fear of the baby becoming sicker (51%).

Regarding the statement about family planning as a technique used to avoid pregnancy, 92% of mothers answered "Yes," while 74% acknowledged LAM as a natural contraceptive. Moreover, 76% answered "Yes," and 24% picked "No" to the statement of identifying breastfeeding as a contraceptive method. Almost all participants agreed with the statement, "If you don't use contraception, you can get pregnant" (96%). Based on the statement that the practice of LAM contraception does not require any drugs or tools, 78% of mothers answered "Yes," indicating knowledge on how to use this method, while 22% do not know. Therefore, some participants continued to adopt other contraceptive methods, where 66% acknowledged LAM as highly effective after correct application. However, most mothers had no idea about the inability to interfere with sexual relations (53%) (Table 2).

In addition, 66% of the respondents said LAM is a long-term contraceptive. The mothers answered "Yes" to the statement of "milking or pumping breast milk can affect LAM performance" (35%), while 65% stipulated "No." Moreover, 47% answered "Yes" to knowing LAM as a difficult process resulting from environmental, soci-

al, and support factors, while 53% answered "No." To the statement about this technique not having the capacity to protect mothers from sexually transmitted diseases and HIV/AIDS, 33% answered "Yes," while 67% ticked "No."

Approximately 38% of mothers answered "Yes" to the statement of "LAM can still be used although the mother has menstruated," while 62% stated "No." This answers indicated that most participants have perceptions towards the possibility of using LAM after the onset of menstruation. In addition, 33% choose to use additional contraception because of the fear of pregnancy resulting from potential LAM failure. In the statement about the potentially reduced effectiveness of LAM after the additional use of contraception, 33% and 67% of mothers answered "Yes" and "No," respectively. In conclusion, most mothers were assumed to have sufficient knowledge on good and proper breastfeeding, alongside the potential application as a safe, inexpensive, and efficient natural contraception. Moreover, there is a need to improve the knowledge about LAM to prevent the wrong implementation.

Table 3 shows that all mothers provided exclusive breastfeeding, although 65% used other contraception in addition to LAM for the first six months after childbirth, while 35% did not. Moreover, some respondents tended to use contraception immediately after delivery, including the IUD (49%), while 15% used additional contraception for the first six months. The results showed that 31% of mothers provided breast milk using a

**Table 3. Frequency Distribution of Mother’s Behavior in Applying the Lactation Amenorrhea Method as a Natural Contraceptive**

| Statement   | Yes (%) | No (%) |
|---|---------|--------|
| Exclusive breastfeeding                                   | 100     | 0      |
| Contraception less than first six months after childbirth | 65      | 35     |
| Contraception after post placenta                         | 49      | 51     |
| Contraception first six months after childbirth           | 15      | 85     |
| Provide breast milk using a milk bottle                   | 31      | 79     |
| Breastfeeding more than eight times/day                   | 98      | 2      |
| Menstruation after the baby is six months old             | 52      | 48     |
| Husband and family support                                | 96      | 4      |
| Work outside the home more than six hours                 | 25      | 75     |
| Pumping or expressing breast milk                         | 27      | 73     |

**Table 4. The Correlation between Knowledge and Behavior Breastfeeding Mothers in Lactational Amenorrhea Method as a Natural Contraceptive**

| Variable  | Category |      |          |      | OR    | 95% CI      | p-value |
|-----------|----------|------|----------|------|-------|-------------|---------|
|           | Good     |      | Not Good |      |       |             |         |
|           | n        | %    | n        | %    |       |             |         |
| Knowledge | 53       | 59.6 | 43       | 51.7 | 3.463 | 1.411-8.498 | 0.006   |
| Behavior  | 36       | 40.4 | 46       | 48.3 |       |             |         |

Notes: OR = Odds Ratio; CI = Confidence Interval; p-value<0.05

milk bottle, and 98% breastfeed more than eight times/day. In addition, 52% reportedly have their menstruation again at six months postpartum, and 96% received support from husbands and family during this phase and while applying LAM. Meanwhile, 25% of the respondents work outside for more than six hours daily, which indicated the mothers were not with the babies for that period.

The behavior of mothers pumping or expressing breast milk to be later fed to babies through a pacifier or milk bottle was 27% (Table 3). This behavior means that the respondents did not directly breastfeed, which affects the use of LAM. Besides, there is no stimulation of the baby’s mouth suction over the mother’s nipple, which is expected to stimulate hormone performance. However, this maternal behavior is not appropriate to the success and effectiveness of using LAM as a contraceptive. This behavior indicated poor knowledge or uncertainty, as the respondents chose to use additional contraceptives.

Table 4 shows mothers with good knowledge (59.6%) about breastfeeding as a natural contraceptive method known as LAM. However, despite the incorrect application, the respondent’s behavior towards the application was not good (48.3%), indicating substantial knowledge about this technique as a natural contraceptive method. This attitude is associated with the mothers feeling of uncertainty about using breastfeeding only for contraception. Based on the results of the statistical tests,

the p-value obtained was 0.006 (OR = 3.463; 95% CI = 1.411-8.498), indicating the existence of a relationship between breastfeeding knowledge and the adoption as behavior aimed at natural contraception.

**Discussion**

This study was conducted to determine the relationship between knowledge and breastfeeding behavior towards adopting of the Lactational Amenorrhea Method (LAM) as a natural contraceptive. This technique involves the exploitation of biological hormones released in mothers during exclusive breastfeeding babies.<sup>30</sup> In addition, the breast milk supply is not affected, thus assuring support for the practice of exclusive breastfeeding.<sup>31</sup> Based on the study results, a relationship was established between knowledge and respondent behavior towards LAM. Table 4 shows the mother’s knowledge as good despite the behavior not being good. Moreover, breastfeeding is known to be highly beneficial for both mother and baby.

Most mothers acknowledge breast milk as the best food for babies. This outcome is similar to study conducted by several experts, where breast milk was preferred as the primary source of nutrition.<sup>32-34</sup> In addition, Table 2 shows that the mothers to be informed of the various nutritional components, important and needed to protect newborns from various diseases. Breast milk also tends to increase the baby’s immune system against various in-

fections, therefore, reducing the probability of sickness. Breast milk contains fat, carbohydrates, protein, vitamins, and minerals.<sup>35</sup> This study showed the participant's knowledge about exclusive breastfeeding from birth to six months, including any drugs or vitamins. Also, all mothers were aware of the capacity for this practice to prevent breast cancer. The study conducted by Franca-Botelho and Anstey highlighted the lower risk of breast cancer in mothers engaged in breastfeeding.<sup>36,37</sup>

The propensity to suppress ovulation was also discussed,<sup>30</sup> as breastfeeding delays the return of fertility due to the release of a gonadotropin-releasing hormone (GnRH) and luteinizing hormone (LH) from the hypothalamus and pituitary, respectively. Furthermore, the plasma concentrations of follicle-stimulating hormone (FSH) are sufficient to induce follicular growth. This development, alongside estradiol secretion, increases to normal while the baby sucks the mother's nipples. Therefore, the suction process prevents the formation of normal preovulation LH waves, and the follicle fails to rupture, thereby delaying conception.<sup>38</sup>

Similar to the statement of Ciampo LAD & Ciampo IRLD, exclusive breastfeeding induces a period of infertility. This infertility occurs due to the delay of ovarian activity, resulting from high prolactin levels and the release of GnRH.<sup>39</sup> The baby sucks the mother's nipples. This stimulates the sensory nerves in the hypothalamus to release prolactin, as well as the anterior pituitary to secrete prolactin hormones required for delayed ovulation.<sup>40</sup>

The advantages of using LAM include economic benefit, absence of any side effects, and the use of drugs or devices is not needed.<sup>41</sup> In addition, the results showed the mother's knowledge about the benefits of LAM as good, although some assume this technique is ineffective. This supposition is the main reason mothers tend to disuade from LAM contraception. Based on the study results, the respondent's behavior was not good because 31% eventually using milk bottles. Hence, the three LAM criteria were not fulfilled, which leads to the onset of menstruation within the first six months postpartum.

The return of fertility in exclusively breastfeeding mothers occurs at about 15 weeks, while others wean or pump the breast milk, leading to increased fertility after five weeks postpartum.<sup>42</sup> Moreover, this inappropriate application through pumping or expressing has been implicated in the reduced effectiveness of LAM. The results were similar to Labook's study, where expressing breast milk more than once impacted LAM effectiveness. Hence, mothers are prompted to adopt additional contraceptive methods.<sup>17</sup> In addition, there is no problem with FSH and LH eggs maturation while pumping or milking. This phenomenon is attributed to the absence of nipple suction, which is expected to signal the mother's brain to

inhibit hormone activities. Hence, direct breastfeeding is advised. Moreover, support from husbands and families is needed to facilitate the LAM's correct application.

The mothers are also expected to prepare for the transition period from LAM to other contraceptive methods, as additional contraception is needed after the baby is six months old. This plays a crucial role in pregnancy prevention. Furthermore, several factors estimated to inhibit this process have been considered in IEC. These include counseling about the risk of pregnancy during lactational amenorrhea and the importance of using additional contraception, as well as additional information on the risk of pregnancy after LAM.<sup>43</sup> This study only discussed the correlation between knowledge and behavior in LAM as a natural contraceptive method without assessing the mother's knowledge and behavior towards the quantitative implementation. However, in-depth information on the application technique while assessing the individual's perceptions, attitudes, and practices was not investigated.

## Conclusion

Based on the results and discussion, a correlation was established between maternal knowledge and behavior in applying of LAM as a natural contraceptive method. The mothers were significantly informed about LAM, despite the poor implementation. Despite this outcome, it is supposedly important to balance good knowledge with good behavior. In addition, the participants are not confident about using LAM alone, and additional contraception is predominantly exploited as an option within the first six months postpartum. This attitude potentially affects the use of LAM, and an in-depth understanding of the application is needed for mothers to actually experience the effects.

## Abbreviations

LAM: Lactational Amenorrhea Method; IUD: Intrauterine Device; GnRH: Gonadotropin-Releasing Hormone; LH: Luteinizing Hormone; FSH: Follicle-Stimulating Hormone.

## Ethics Approval and Consent to Participate

The ethical approval was obtained from the Ethical Commission, Universitas 'Aisyiyah Yogyakarta (Number: 05/KEP-UNISA/VII/2017). The research permit was obtained from the administrative leaders from Moyudan Sub-District, Sleman District, Yogyakarta Province. Before the interview, the interviewers received signed information from the respondents consenting to a willingness to participate in the study.

## Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance.

### Availability of Data and Materials

This data is available at the Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta. However, after a reasonable request, these are available from the authors with permission of the Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta.

### Authors' Contribution

M and RBJ wrote the first draft of the manuscript and compiled the journal publication. M was also involved in determining the design study, data management, and data analysis. RBJ was involved in data collection and management of data. RBJ was in charge of sending manuscripts to reviewers. RBJ and SRN studied the literature and updated the literature. SRN was in charge of research instruments and validation. All authors contributed to reviewing the manuscript, script revision, read, and approved the final manuscript.

### Acknowledgment

The authors are grateful to the breastfeeding mothers in Moyudan Sub-district, Sleman District, Yogyakarta Province, Indonesia, for their contribution to this research. The authors also wish to acknowledge Universitas 'Aisyiyah Yogyakarta and 'Aisyiyah Moyudan Primary Clinic for providing logistics and a venue for this study.

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# Integrated Model of a Family Approach and Local Support in Tuberculosis Case Finding Efforts in People with HIV/AIDS

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## Abstract

The human immunodeficiency virus (HIV) remains a major global public health problem. People with HIV/acquired immune deficiency syndrome (AIDS) are more susceptible to opportunistic infections such as tuberculosis (TB). Therefore, families and community leaders need to help monitor people living with HIV/AIDS (PLWHA). This study aimed to analyze an integrated family approach and local support model to detect TB cases in PLWHA. This study used a case-control study in Kupang City, East Nusa Tenggara Province, in July 2020. The sample comprised 100 people (50 PLWHA with TB case and 50 controls) using total random sampling. The variables related to TB case finding in PLWHA were family employment status, duration of HIV/AIDS, family knowledge of TB, and family support. The data were analyzed using multiple logistic regression. The families with PLWHA with an extended illness duration (OR = 0.81; 95% CI = 0.69–0.95; p-value = 0.01), families who did not work (OR = 3.31; 95% CI = 1.16–9.41; p-value = 0.025), families who had good knowledge (OR = 4.79; 95% CI = 1.70–13.51; p-value = 0.003), and families who provided good support (OR = 3.03; 95% CI = 1.05–8.76; p-value = 0.04) were better able to detect TB in PLWHA.

**Keywords:** acquired immune deficiency syndrome, family approach, human immunodeficiency virus, local support, tuberculosis

## Introduction

The human immunodeficiency virus (HIV) continues to be a major global public health problem. HIV has claimed nearly 33 million lives to date. The virus weakens the immune system and causes swollen lymph nodes, weight loss, fever, diarrhea, and coughing. Without treatment, HIV can also develop into a severe disease such as tuberculosis (TB).<sup>1</sup> TB is the leading cause of acquired immune deficiency syndrome (AIDS)-related deaths.<sup>2,3</sup>

The risk of developing TB is estimated to be between 16 and 27 times greater in people living with HIV than in those not infected with HIV. In 2015, there were an estimated 10.4 million cases of TB globally, including 1.2 million (11%) among people living with HIV. Nearly 60% of TB cases among people living with HIV were not diagnosed or treated, resulting in 390,000 TB-related deaths among people living with HIV in 2015.<sup>4</sup> In addition, HIV coinfection has a negative impact on TB treatment outcomes.<sup>5</sup>

In 2018, 640,000 people living with HIV were living in Indonesia, 46,000 people had new HIV infections, and 38,000 had had HIV/AIDS-related deaths.<sup>6</sup> Indonesia

has the second-highest number of TB cases in the world.<sup>7</sup> The incidence of TB in Indonesia in 2018 was 316 per 100,000 population, and the death rate was 40 per 100,000 population.<sup>8</sup> In addition, the incidence of HIV-TB prevalence was 2.5%.

Kupang City, located in East Nusa Tenggara, Indonesia, has a high number of HIV/AIDS cases.<sup>9</sup> This raises the risk of opportunistic TB infection in people living with HIV/AIDS (PLWHA) and the burden on the local government.<sup>10</sup> PLWHA must have access to HIV and TB health services and treatment for HIV and TB infection as part of the universal access to prevention and care. TB prevention requires preventive interventions for HIV and TB infection.<sup>11</sup> It is essential that care programs for PLWHA include aspects of TB prevention to reduce the mortality rate of PLWHA.

According to Lawn and Churchyard's study, HIV-TB remains a major global health challenge.<sup>12</sup> Furthermore, the stigma of HIV-TB needs to be overcome, especially in areas with a high HIV prevalence.<sup>13</sup> To support TB prevention programs in PLWHA, it is necessary to obtain support from various parties, including health workers

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Received : April 19, 2021  
Accepted : September 13, 2021  
Published : November 29, 2021

and the families and community leaders of PLWHA. Previous study has shown that passive case finding for TB alone is not sufficient.<sup>14</sup> Active case finding in TB contact households should be considered to improve TB and HIV case detection.<sup>15</sup> The results of other studies have also suggested that the factors that influence the detection of active TB cases are the health system, society, and individuals.<sup>16</sup> Active case findings can contribute to the target End TB strategy.<sup>17,18</sup> Family has a crucial role to play in supporting PLWHA when seeking and obtaining treatment. A study conducted in China found that community-based active case finding is significant for high-risk groups.<sup>19</sup> In contrast, another study in Papua New Guinea determined that community-based active case finding and the initiation of TB treatment with limited resources and remote areas can have a good impact.<sup>20</sup> This study aimed to analyze the relationship between the role of the family and local support in TB case finding efforts for PLWHA in Kupang City. The results of this study were expected to help the Indonesian Government in its efforts to reduce the burden and mortality of PLWHA.

## Method

This case-control study was conducted in July 2020 in Kupang City, East Nusa Tenggara Province, Indonesia. The population of this study comprised PLWHA who were registered at the referral hospital in Kupang City. The number of PLWHA who were recorded as being on antiretroviral therapy was 1,500. The sample selection procedure began by recording all HIV/AIDS patients from 2016 to 2020 (e.g., 1,500 people). HIV/AIDS patients who had TB were selected to be in the case group. Among all the HIV/AIDS patients, 61 had TB. However, only 50 people were still alive and had addresses that the authors could find.

The controls were selected from the HIV/AIDS population who did not have TB, and 50 people were randomly selected. The patients who had died and whose home addresses were not found were excluded from the list of eligible participants. From the selected case and control groups, the authors contacted the families of each patient to serve as study subjects (respondents). Therefore, the case group consisted of families with PLWHA who had TB, and the controls were families with PLWHA who did not have TB.

The primary data were collected using a questionnaire. Enumerators who had been trained before conduct the study carried out the data collection. The outcome variable of this study was the TB case finding efforts, finding TB cases in PLWHA, and not finding TB cases in PLWHA. The independent variables included the characteristics of the family of the PLWHA (relationship with the PLWHA, sex, employment status, age, and educa-

tion), local support characteristics (gender, age, and length of time spent supporting PLWHA), the characteristics of the PLWHA (gender, age, length of time with HIV/AIDS), family knowledge about TB, health literacy, family support, service leadership, social capital, and knowledge of PLWHA about TB.

Regarding family characteristics, the relationship variables were categorized as the family of the PLWHA (husband/wife, parents, relatives) and people who were not family (other people). Gender included male and female. Employment was categorized as working (government employee, self-employed) and not working (not working, father, or housewife). Education level was categorized into low (not educated, elementary school, junior high school), medium (senior high school), and high (college). Age was measured according to the respondent's age in years.

For local support, gender was categorized as male and female. The person providing local support was measured according to the respondent's age at that time, and the length of time spent supporting the PLWHA was calculated based on the length of time the person had provided local support to the PLWHA to date. The characteristics of the PLWHA included gender (male and female), the age of the PLWHA at the time of the interview, and the length of time living with HIV/AIDS based on the time of the first diagnosis by health workers. Family knowledge about TB, family health literacy, and family support was described as good or bad, as were the leadership provided by the family (local support and social capital support). The PLWHA's knowledge of TB and coronavirus disease 2019 (COVID-19) was also categorized as good or bad. All the variables were categorized based on their median values.

The data were analyzed using univariable, bivariable, and multivariable analysis. The univariable analysis was used to describe the measured variables. The authors used the Chi-square test and independent t-test to analyze the relationships between the independent variables and the TB case finding. All the variables with a  $p$ -value  $< 0.25$  in the bivariable analysis were included in the initial multivariable model. A backward elimination procedure was used to identify the factors independently associated with a TB case finding in PLWHA. In the final model, the variables with a  $p$ -value  $< 0.05$  were considered statistically significant.

## Results

Eighty-one percent of the respondents were families with a blood relationship with PLWHA, 62% of the respondents were women, 61% were working, and 62% had moderate education. The average age was 43.09 years with a standard deviation of 13.45 years. In addition, 54% of the local support was female, with an aver-

**Table 1. Family Characteristics, Local Support, and People Living with HIV/AIDS**

| Variable                                | Category                     | n  | %  | Mean   | SD    |
|---|------------------------------|----|----|--------|-------|
| Characteristics of PLWHA families       |                              |    |    |        |       |
| Relationship with PLWHA                 | Families                     | 81 | 81 |        |       |
|   | Family but not blood-related | 19 | 19 |        |       |
| Sex                                     | Male                         | 38 | 38 |        |       |
|   | Female                       | 62 | 62 |        |       |
| Family employment status                | Working                      | 61 | 61 |        |       |
|   | Not working                  | 39 | 39 |        |       |
| Age (years)                             |                              |    |    | 43.09  | 13.45 |
| Family education                        | Lower                        | 38 | 38 |        |       |
|   | Medium                       | 62 | 62 |        |       |
|   | Higher                       | 0  | 0  |        |       |
| Characteristics of local support        |                              |    |    |        |       |
| Sex                                     | Male                         | 46 | 46 |        |       |
|   | Female                       | 54 | 54 |        |       |
| Age (years)                             |                              |    |    | 48.25  | 13.27 |
| Length of time supporting PLWHA (years) |                              |    |    | 2.62   | 1.75  |
| Characteristics of PLWHA                |                              |    |    |        |       |
| Sex                                     | Male                         | 46 | 46 |        |       |
|   | Female                       | 54 | 54 |        |       |
| Age (years)                             |                              |    |    | 35.11  | 8.69  |
| HIV/AIDS duration (years)               |                              |    |    | 4.38   | 3.62  |
| Family and local support                |                              |    |    |        |       |
| Family knowledge of TB                  | Good                         | 59 | 59 | 9.270  | 2.06  |
|   | Bad                          | 41 | 41 |        |       |
| Health literacy of families             | Good                         | 57 | 57 | 1.300  | 1.16  |
|   | Bad                          | 43 | 43 |        |       |
| Family support                          | Good                         | 58 | 58 |        |       |
|   | Bad                          | 42 | 42 | 0.870  | 1.19  |
| Leadership providing local support      | Good                         | 52 | 52 |        |       |
|   | Bad                          | 48 | 48 | 13.160 | 7.76  |
| Family-supported social capital         | Good                         | 56 | 56 |        |       |
|   | Bad                          | 44 | 44 | 10.590 | 5.22  |
| Knowledge of PLWHA                      |                              |    |    |        |       |
| PLWHA knowledge of TB                   | Good                         | 45 | 45 |        |       |
|   | Bad                          | 55 | 55 | 9.810  | 1.54  |

**Notes:** PLWH = People Living with HIV/AIDS; SD = Standard Deviation

age age of 48.25 ( $\pm 13.27$ ) years and an average length of time supporting the PLWHA of 2.62 ( $\pm 1.75$ ) years. More than half of the PLWHA (54%) were female. The mean age was 35.11 ( $\pm 8.69$ ) years, and the average length of time living with HIV/AIDS was 4.38 ( $\pm 3.62$ ) years (Table 1).

Regarding of family knowledge about TB, 41% had bad knowledge, 43% had bad family health literacy, and 42% of the PLWHA received poor family support. Concerning local support, 48% of the local support provided by leadership was poor, and 44% of the local support social capital was poor. In addition, the knowledge about the COVID-19 among the family and local support and PLWHA were very good at 72% and 68%, respectively. However, 55% of the PLWHA had poor knowledge about TB (Table 1).

The distribution of respondent characteristics based on cases and controls groups can be seen in Table 2 and 3. The family of PLWHA who were able to find TB cases and who were not were 74% and 88%, respectively. Of

74% of the family of PLWHA who were able to find TB cases, 68% succeeded in finding it in women. While the ones who were not able to find TB cases but were women were 56%. The PLWHA families who were able to find TB cases and did not find working TB were 50% and 72%, respectively. In addition, PLWHA families who were able to find TB cases and had medium education were slightly larger (66%) than PLWHA families who were unable to find TB cases and had medium education (58%). The PLWHA families who were able to find TB cases were on average 40.54 $\pm$ 11.58 years old and PLWHA families who were unable to find TB cases were 45.64 $\pm$ 14.77 years old on average. PLWHA families who were able to find TB cases had an average length of stay of 2.58 $\pm$ 1.50 years and those who were unable to find TB cases had an average length of stay of 2.66 $\pm$ 1.98 years.

PLWHA families who are able to find TB cases have higher knowledge (76%) compared to PLWHA families who are unable to find TB cases (42%). PLWHA families

**Table 2. Bivariate Analysis of the Independent Variables and TB Case Finding Using a Chi-Square Test**

| Variable                           | Category                     | Finding TB |    | Not finding TB |    | OR   | 95% CI |       | p-value |
|------------------------------------|------------------------------|------------|----|----------------|----|------|--------|-------|---------|
|                                    |                              | n          | %  | n              | %  |      | Lower  | Upper |         |
| Characteristics of PLWHA families  |                              |            |    |                |    |      |        |       |         |
| Relationship with PLWHA            | Family but not blood-related | 13         | 26 | 6              | 21 | 2.58 | 0.89   | 7.45  | 0.126   |
|                                    | Family                       | 37         | 74 | 44             | 88 |      |        |       |         |
| Sex                                | Male                         | 16         | 32 | 22             | 44 | 0.60 | 0.24   | 1.48  | 0.305   |
|                                    | Female                       | 34         | 68 | 28             | 56 |      |        |       |         |
| Employment status                  | Not working                  | 25         | 50 | 14             | 28 | 2.57 | 1.12   | 5.90  | 0.04    |
|                                    | Working                      | 25         | 50 | 36             | 72 |      |        |       |         |
| Education                          | Low                          | 17         | 34 | 21             | 42 | 0.71 | 0.32   | 1.60  | 0.537   |
|                                    | Medium                       | 33         | 66 | 29             | 58 |      |        |       |         |
| Characteristics of local support   |                              |            |    |                |    |      |        |       |         |
| Sex                                | Male                         | 22         | 44 | 24             | 48 | 0.85 | 0.39   | 1.87  | 0.841   |
|                                    | Female                       | 28         | 56 | 26             | 52 |      |        |       |         |
| Characteristics of PLWHA           |                              |            |    |                |    |      |        |       |         |
| Sex                                | Male                         | 24         | 48 | 22             | 44 | 1.18 | 0.54   | 2.58  | 0.841   |
|                                    | Female                       | 26         | 52 | 28             | 56 |      |        |       |         |
| Family and local support           |                              |            |    |                |    |      |        |       |         |
| Health literacy of family          | Good                         | 27         | 54 | 30             | 60 | 0.78 | 0.35   | 1.73  | 0.686   |
|                                    | Bad                          | 23         | 46 | 20             | 40 |      |        |       |         |
| Family support                     | Good                         | 37         | 74 | 21             | 42 | 3.93 | 1.69   | 9.15  | 0.002   |
|                                    | Bad                          | 13         | 26 | 29             | 58 |      |        |       |         |
| Leadership providing local support | Good                         | 25         | 50 | 27             | 54 | 0.85 | 0.39   | 1.87  | 0.841   |
|                                    | Bad                          | 25         | 50 | 23             | 46 |      |        |       |         |
| Family-supported social capital    | Good                         | 26         | 52 | 30             | 60 | 0.72 | 0.33   | 1.60  | 0.546   |
|                                    | Bad                          | 24         | 48 | 20             | 40 |      |        |       |         |
| Family knowledge of COVID-19       | Good                         | 35         | 70 | 37             | 74 | 0.82 | 0.34   | 1.97  | 0.824   |
|                                    | Bad                          | 15         | 30 | 13             | 26 |      |        |       |         |
| Knowledge of PLWHA                 |                              |            |    |                |    |      |        |       |         |
| PLWHA knowledge of TB              | Good                         | 30         | 60 | 15             | 30 | 3.50 | 1.53   | 8.01  | 0.005   |
|                                    | Bad                          | 20         | 40 | 35             | 70 |      |        |       |         |
| PLWHA knowledge of COVID-19        | Good                         | 35         | 70 | 22             | 66 | 1.20 | 0.52   | 2.79  | 0.83    |
|                                    | Bad                          | 15         | 30 | 17             | 34 |      |        |       |         |

Notes: PLWHA = People Living with HIV/AIDS; CI = Confidence Interval; OR = Odds Ratio

**Table 3. Bivariate Analysis of the Independent Variables and TB Case Finding Using the Independent t-Test (n = 50)**

| Variable                        | Category       | Mean  | SD    | SE   | p-value |
|---------------------------------|----------------|-------|-------|------|---------|
| Family age                      | Finding TB     | 40.54 | 11.58 | 1.64 | 0.058   |
|                                 | Not finding TB | 45.64 | 14.77 | 2.09 |         |
| Local support age               | Finding TB     | 44.60 | 15.19 | 2.15 | 0.006   |
|                                 | Not finding TB | 51.90 | 9.88  | 1.40 |         |
| Length of time supporting PLWHA | Finding TB     | 2.58  | 1.50  | 0.21 | 0.820   |
|                                 | Not finding TB | 2.66  | 1.98  | 0.28 |         |
| PLWHA age                       | Finding TB     | 35.48 | 7.37  | 1.04 | 0.672   |
|                                 | Not finding TB | 34.74 | 9.89  | 1.40 |         |
| HIV/AIDS duration               | Finding TB     | 5.34  | 2.77  | 0.39 | 0.004   |
|                                 | Not finding TB | 5.42  | 4.07  | 0.58 |         |

Notes: PLWHA = People Living with HIV/AIDS; SD = Standard Deviation; SE = Standard Error

who were able to find TB cases had lower health literacy (54%) compared to PLWHA families who were unable to find TB cases (60%).

Using a Chi-square statistical analysis, the variables having a significant relationship with the TB status of PLWHA were employment status (p-value = 0.04), family knowledge about TB (p-value = 0.01), family support (p-value = 0.002), and knowledge of PLWHA about

TB (p-value = 0.005) (Table 2). Based on Table 3, using an independent sample t-test analysis, the variables that were significantly related to the TB status of the PLWHA were the age of local support (p-value = 0.006) and length of time with TB (p-value = 0.004).

As shown in Table 4, after being controlled for other variables, the variables related to TB case finding for PLWHA were employment status, length of time living

**Table 4. Multiple Logistic Regression Analysis with TB Case Finding Outcome**

| Variable                  | Category    | AOR  | 95% CI |       | p-value |
|---------------------------|-------------|------|--------|-------|---------|
|                           |             |      | Lower  | Upper |         |
| Family employment status  | Not working | 3.31 | 1.16   | 9.41  | 0.025   |
|                           | Working     | Ref  |        |       |         |
| Local support age (years) |             | 0.97 | 0.93   | 1.00  | 0.08    |
| HIV/AIDS duration (years) |             | 0.81 | 0.69   | 0.95  | 0.01    |
| Family knowledge of TB    | Good        | 4.79 | 1.70   | 13.51 | 0.003   |
|                           | Bad         | Ref  |        |       |         |
| Family support            | Good        | 3.03 | 1.05   | 8.76  | 0.04    |
|                           | Bad         | Ref  |        |       |         |

Notes: PLWHA = People Living with HIV/AIDS; CI = Confidence Interval; AOR = Adjusted Odds Ratio

with HIV/AIDS, family knowledge of TB, and family support. The PLWHA with unemployed families had a 3.31 times higher likelihood of detecting TB than those with working families (OR = 3.31; 95% CI = 1.16–9.41; p-value = 0.025). The longer the PLWHA had HIV/AIDS, the lower the risk of finding TB in the PLWHA (OR = 0.81; 95% CI = 0.69–0.95; p-value = 0.01). The PLWHA with good family knowledge was 4.79 times more likely to detect TB than those with poor family knowledge (OR = 4.79; 95% CI = 1.70–13.51; p-value = 0.003). The families who provided good support had a 3.03 times higher likelihood of finding TB in the PLWHA than those who provided poor family support (OR = 3.03; 95% CI = 1.05–8.76; p-value = 0.04).

**Discussion**

Based on the study findings, after being controlled for other variables, the variables associated with TB case finding among PLWHA were HIV/AIDS duration, employment status of the PLWHA’s family, family support, and family knowledge of TB. Living with HIV/AIDS for a more extended period, PLWHA with an unemployed family, families with good support, and PLWHA with good family knowledge of TB were better able to detect TB in the PLWHA. In this study, HIV/AIDS duration increased the risk of PLWHA getting TB. Because TB is an opportunistic infection, a study showed that it is likely to be experienced by PLWHA.<sup>21</sup> Researchers at Dr. Kariadi Semarang Hospital found that the most opportunistic infection was TB.<sup>22</sup> TB and HIV are closely related and often result in HIV-TB coinfection.<sup>22</sup> This may be due to the decreased CD4 levels in PLWHA, which increases their risk of developing TB.

This study also showed that the families of PLWHA who did not work and had good family support could detect TB in the PLWHA compared to the families of PLWHA who were working. This is in line with the study findings in India indicating that the family plays a considerable role in controlling TB.<sup>23</sup> The families of PLWHA

who do not work can supervise and monitor TB treatment among PLWHA. This condition is beneficial because the long duration of TB treatment requires strong family involvement in terms of care, nutrition, and livelihood support to improve treatment adherence.<sup>23</sup> Families who do not work are likely to see the progress of the PLWHA every day. In addition, families who support PLWHA when they know the PLWHA’s condition will take the PLWHA to a healthcare facility more quickly. TB screening in PLWHA will therefore take place sooner. Social trust in family members can play an important role as both a lack of trust and support are barriers to obtaining higher TB screening rates.<sup>24</sup>

The TB treatment in PLWHA requires the intense involvement of the families of PLWHA. The factors that positively influence adherence to TB treatment are a belief in the severity of TB in the presence of HIV infection and family support.<sup>25</sup> Families of PLWHA who do not work can supervise the treatment of PLWHA. In addition, such families can look after PLWHA at any time and monitor their progress. Therefore, it is possible that if PLWHA experiences symptoms of TB, the family would take them to healthcare services immediately.

The result showed that the families who had good knowledge of TB could detect TB in PLWHA more quickly than those with less knowledge. A study has similarly indicated that knowledge and literacy are factors that shape TB preventive behaviors.<sup>26</sup> Efforts are needed to provide more information to the families of PLWHA so that they will be able to recognize TB symptoms in PLWHA and detect the disease early. Early detection of TB in PLWHA is very effective in reducing mortality. Comprehensive education, including the cognitive and psychological aspects of the disease, is needed for the early detection of TB.<sup>27</sup> Knowledge about TB and lower education are related to inappropriate treatment-seeking behaviors.<sup>27-29</sup> Families who know about and understand TB symptoms are likely to take PLWHA to seek treatment immediately. PLWHA who have a coinfection

would therefore be evaluated immediately by a doctor and receive TB treatment promptly. This can help reduce the mortality rate of PLWHA.

All the procedures and instruments used in this study were validated. The field workers were also trained prior to the survey to ensure that they had a common understanding of the operational definitions of the variables. Despite these strengths, this study was subject to bias because of a case-control study design and the number of samples used is very small (50 respondents). The authors selected the control group from the same population as the case group. In other words, they were also PLWHA patients who were registered between 2016 and 2020, although they did not have TB. Furthermore the authors did not have data on the patients who were still alive and for whom residential addresses could not be found or those who had died. The authors then applied a simple random sampling technique to ensure that the ratio of patients and controls was 1:1. Therefore, a recommendation for future study is to have a clear sampling frame and the number of controls to be greater than the number of patients.

### Conclusion

After controlling for the other variables, a long duration of HIV/AIDS, the employment status of the families of PLWHA, family support, and family knowledge of TB were associated with TB case finding in PLWHA. Living with HIV/AIDS for a more extended period, PLWHA with an unemployed family, families with good support, and PLWHA with good family knowledge of TB were better able to find TB in the PLWHA. The results of this study highlight the importance of health education among the families of PLWHA as this can help with the early detection of TB in PLWHA. In addition, the study also highlights the role of family and local support to support PLWHA. Therefore, the Indonesian Government needs to consider the role of families and local support in its program to detect TB in PLWHA.

### Abbreviations

HIV: Human Immunodeficiency Virus; AIDS: Acquired Immune Deficiency Syndrome; PLWHA: People with HIV AIDS; TB: Tuberculosis; COVID-19: coronavirus disease 2019.

### Ethics Approval and Consent to Participate

This study passed the ethical committee review of the Faculty of Public Health, Universitas Airlangga, Number 75/EA/KEPK/2020.

### Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

For those who need the data, please get in touch with the corresponding author of this manuscript.

### Authors' Contribution

CUW contributed to the conception of the manuscript and writing the manuscript. EA contributed to writing the manuscript. Furthermore, all authors contributed to reviewing the manuscript and approved the submitted version.

### Acknowledgment

The authors would like to express their sincere appreciation to the participants of this study. The authors also wish to thank AIDS Prevention Commission and Health Office in Kupang City. This study was funded by "Hibah SIMLITABMAS Dikti."

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# Predictors of the COVID-19 Social Distancing Practice among Undergraduate Health Students in Samarinda City, Indonesia: A Cross-Sectional Study

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## Abstract

Social distancing is a health protocol recommended by the World Health Organization (WHO) for reducing the spread of COVID-19. Undergraduate health students play an important role in the dissemination of accurate information. This study identified predictors that influenced the COVID-19 social distancing practice and examined the sources of social distancing information among undergraduate health students in Samarinda City, Indonesia. This cross-sectional online survey study (March-April 2021) involved 422 undergraduate students from medicine, public health, and pharmacy faculties at Mulawarman University. Binary logistic regression was conducted to identify factors associated with the COVID-19 social distancing practice. The results showed that age (AOR = 1.47; 95% CI = 1.97–2.22, p-value = 0.045), sex (AOR = 2.26; 95% CI = 1.38–3.69, p-value = 0.001), and attitude (AOR = 2.61; 95% CI = 1.75–3.90; p-value < 0.001) was significantly associated with social distancing practices. The top three sources of COVID-19 social distancing information used were social media (80.6%), websites (14.0%), and television (3.8%). The study findings encourage the government to disseminate more health information on social media and education programs to this target population.

**Keywords:** COVID-19, social distancing practice, undergraduate health student

## Introduction

Currently, coronavirus disease 2019 (COVID-19) has infected 235 million people all over the world.<sup>1</sup> The community has consistently tracked new variants, and violations of health guidelines have hampered the government and related health authority efforts in controlling the spread of the COVID-19.<sup>2</sup> The World Health Organization (WHO) recommends that citizens practice social distancing.<sup>3,4</sup> Social distancing calls for maintaining a distance of at least one meter from the next person and avoiding groups and crowded places.<sup>1</sup> Citizens worldwide have been urgently encouraged to implement social distancing in controlling the COVID-19 transmission.<sup>5–8</sup> Nevertheless, the protocols have faced several problems during their implementation.<sup>3–9</sup> Violation of social distancing has contributed to the massive increase in COVID-19 case numbers worldwide. Asymptomatic active carriers have been primarily found in already positive cases of COVID-19.<sup>9</sup> Health guidelines such as social distancing are still supposed to be implemented correctly, even when people have received the second shot of the COVID-19 vaccine. Vaccines only minimize the symptoms of the illness, not completely counteract the

virus. Therefore, compliance with social distancing will still be needed during the “new normal” era.<sup>10,11</sup>

General characteristics may impact the practice of social distancing; indeed, several studies have supported this assumption.<sup>12–17</sup> Previous analytical studies have found that age and sex were associated with prevention practices of the COVID-19.<sup>12,13</sup> A cross-sectional study conducted in Jakarta, Indonesia, indicated that undergraduate female students tended to apply good physical distancing behavior 3.4 times more than male students.<sup>14</sup> Another cross-sectional study also revealed an association between gender and practice toward COVID-19 among medical students in India.<sup>15</sup> The results of a study examining university students in the United Kingdom determined that gender and social distancing behavior were associated.<sup>16</sup> Household income has likewise been found to influence the COVID-19 practices in Bangladesh.<sup>17</sup> A study examining the COVID-19 social distancing policy in Jakarta, Indonesia, concluded that those with good levels of knowledge would show positive attitudes and practice social distancing compared with those who do not.<sup>3</sup>

Health students are considered future leaders of

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Received : June 08, 2021  
Accepted : October 09, 2021  
Published : November 29, 2021

health promotion. This population tends to avoid health risk behavior and is more likely to endorse the benefits of positive behaviors.<sup>18</sup> Health students are exposed to accurate information related to health rather than non-health students due to a lack of health risk awareness.<sup>19,20</sup> However, studies regarding social distancing and factors influencing it among Indonesian undergraduate students are still inadequate, especially students in the health domain. The previous studies did not yet focus on undergraduate students that were predominantly filled with young people. This matter was considered a study limitation, suggesting that further research was required.<sup>15,21</sup> These predictors and their effects on social distancing practice among undergraduate health students have not been investigated in Indonesian. For these reasons, the authors aimed to examine the predictors of social distancing practice and the sources of social distancing information that students often use. Thus, the study findings are beneficial for management, program evaluation, and promotion of social distancing in controlling the COVID-19 transmission.

## Method

This study was designed as an online-based, cross-sectional survey study. Undergraduate health students at Mulawarman University, Samarinda City, Indonesia was the target population. The online questionnaires were distributed through research assistants at each health faculty, including (1) Faculty of Medicine, (2) Faculty of Public Health, and (3) Faculty of Pharmacy. Participants were asked to read information sheets and consent forms before answering the online questionnaire through the Google Form link and followed up every three days until the end of the data collection period.

The participants were recruited using convenience sampling that met the eligibility. The minimum sample size was 418 subjects calculated using an infinite population formula with the proportion of practicing social distancing = 0.55.<sup>15</sup> The data was collected from March to April 2021. Undergraduate medical students aged 18 years and above willingly signed informed consents. They were currently enrolled in the Faculty of Medicine, Faculty of Public Health, and Faculty of Pharmacy and were included in the study. Participants who do not own smartphones, have no access to the internet, and are unable to fill the questionnaire were excluded.

This study used an online, self-administered questionnaire adapted from a previous related study.<sup>10,21-24</sup> There were five sections in the questionnaire, including a general characteristic section represented by six items, knowledge related to social distancing by 24 items, attitude toward social distancing section by 16 items, the practice of social distancing by nine items, and a section of reasons for not practicing social distancing in one item.

The validity of questionnaires was tested using the Item-Objective Congruence Index method with three experts. The reliability of questionnaires regarding attitude and knowledge was tested with Cronbach's alpha coefficients and Kuder-Richardson Formula 20, respectively. Cronbach's alpha coefficient of attitude was 0.73, and the knowledge scale was 0.65. Finally, questionnaires were translated in Bahasa Indonesia with a back-translation method.

The current study examined the practice of social distancing among undergraduate health students as a dependent variable. It included keeping a distance of at least one meter from other people, avoiding crowded places and groups, and staying at home. The independent variables were chosen by a literature review from previous studies.<sup>3,21-24</sup> The independent variables included knowledge, attitude, age, type of faculty, sex, length of time spent in the university, and family income. The details of the variables are shown in the results tables. Variable knowledge was measured by calculating the median score, as data is non-normally distributed indicated by Shapiro Wilks test was under p-value (0.05), therefore this variable categorized as good knowledge (if participants score more or equal than median) or poor knowledge (if participants score less than median). The attitude was measured with a five-point Likert scale. All answers were computed to obtain total scores; then, median scores resulting from non-normally distributed data were calculated to categorize as positive or negative attitudes. For practice, it was measured by a 3-point Likert scale. All answers to practice questions were computed to obtain median scores due to non-normally distribution and categorized as good practice (if participants score more or equal than median) or poor practice (if participants score less than median). The results of the source of information are shown in the charts.

Bivariate and multivariable analyses of the data were performed for this study. The data distribution was checked with scatter plots and a Shapiro. Categorical data were calculated as frequencies and percentages. Bivariate analysis with Chi-square test was initially performed to screen the significant factors with significance level  $p\text{-value} < 0.25$ . Next, significant factors were included in the binary logistic regression model. Finally, multivariable analysis using binary logistic regression was conducted to identify the final important factors associated with dependent variables, with the calculation of adjusted odds ratio (AOR) and  $p\text{-value} < 0.05$  considered statistically significant. The data were analyzed using the SPSS version 22 software (SPSS Inc., Chicago IL).

## Results

Four hundred and twenty-two participants were involved in this study. The average age was 21 years old

(range 18–25 years), and the standard deviation was 1.76. Approximately 50.5% were in the range of age 18–21 years old. Some 45% came from the Faculty of Pharmacy, 76.8% were female students, and 71.8% studied at the university for three years or above. In addition, 53.3% came from families with household incomes of ≤3,100,000 IDR per month (Table 1). As shown in Figure 1, the sources of information used by participants were social media (80.6%), followed by official websites provided by the WHO/Indonesia COVID-19 taskforce (14.0%), television (3.8%), and by-mouth from friends/family/relatives/lecturers (1.7%).

The bivariate analysis results in Table 2 showed the significant association of two variables from general characteristics toward social distancing practice. Those were age (p-value = 0.040) and sex (p-value = 0.001). Attitude level toward social distancing was also significantly associated statistically with social distancing practice with a p-value of <0.001. Nevertheless, the knowledge variable was still input into the binary logistic regression model as it was considered an important predictor due to Knowledge-Attitude-Practice theory.

The findings of binary logistic regression indicated that age, sex, and attitude were significant predictors of the COVID-19 social distancing practice. Older students aged 21–25 years were 1.47 times more likely to have good social distancing than students from 18–21 years (AOR = 1.47; 95% CI = 1.97–2.22). Female students were 2.26 times more likely to have good practice in social distancing than males (AOR = 2.26; 95% CI = 1.38–3.69). Health students with positive attitudes toward social distancing practice were 2.61 times more likely to

have good practice in social distancing than health students with negative attitude (AOR = 2.61; 95% CI = 1.74–3.90). However, there was still no significant association between knowledge and social distancing practice (Table 3).

Table 1. General Characteristic of Participants (n = 422)

| Characteristic                          | Category        | n   | %    |
|---|-----------------|-----|------|
| Age (Mean±SD: 21±1.76)                  | 18–21 years old | 214 | 50.5 |
|   | 22–25 years old | 208 | 49.3 |
| Faculty                                 | Medicine        | 121 | 28.7 |
|   | Public health   | 111 | 26.3 |
|   | Pharmacy        | 190 | 45.0 |
| Sex                                     | Male            | 98  | 23.2 |
|   | Female          | 324 | 76.8 |
| Length of study spent in the university | <3 years        | 119 | 28.2 |
|   | ≥3 years        | 303 | 71.8 |
| Family income                           | <3.100.000 IDR  | 197 | 46.7 |
|   | ≥3.100.000 IDR  | 225 | 53.3 |

Notes: SD = Standard Deviation; IDR = Indonesian Rupiah

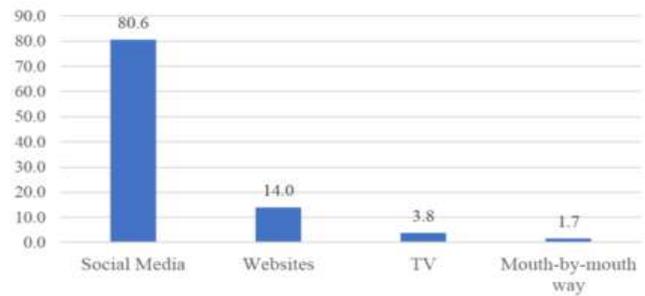


Figure 1. Sources of Information related to Social Distancing

Table 2. Bivariate Analysis of Association between General Characteristics, Knowledge, and Attitude toward Practice of Social Distancing (n = 422)

| Variable                              | Category       | The Practice of Social Distancing |            | COR  | 95% CI    | p-value <sup>a</sup> |
|---------------------------------------|----------------|-----------------------------------|------------|------|-----------|----------------------|
|                                       |                | Poor                              | Good       |      |           |                      |
|                                       |                | n (%)                             | n (%)      |      |           |                      |
| Age (years)                           | 18–21          | 107 (52.7)                        | 107 (48.6) | 1    |           | 0.040*               |
|                                       | 22–25          | 95 (47.3)                         | 113 (51.4) | 1.17 | 1.80–2.72 |                      |
| Sex                                   | Male           | 61 (30.2)                         | 37 (16.8)  | 1    |           | 0.001*               |
|                                       | Female         | 141 (69.8)                        | 183 (83.2) | 2.14 | 1.34–3.40 |                      |
| Faculty                               | Medicine       | 54 (26.7)                         | 67 (30.5)  | 1    |           | 0.288                |
|                                       | Public Health  | 49 (24.3)                         | 62 (28.2)  | 1.02 | 0.60–1.17 |                      |
|                                       | Pharmacy       | 99 (49.0)                         | 91 (41.4)  | 0.74 | 0.46–1.17 |                      |
| Spent time in the university          | <3 years       | 53 (26.2)                         | 66 (30.0)  | 1    |           | 0.391                |
|                                       | ≥3 years       | 149 (73.8)                        | 154 (70.0) | 0.83 | 0.54–1.27 |                      |
| Family income                         | <3.100.000 IDR | 90 (44.6)                         | 107 (48.6) | 1    |           | 0.401                |
|                                       | ≥3.100.000 IDR | 112 (55.4)                        | 113 (51.4) | 0.84 | 0.57–1.24 |                      |
| Knowledge regarding social distancing | Poor           | 68 (33.7)                         | 77 (35.0)  | 1    |           | 0.773                |
|                                       | Good           | 134 (66.3)                        | 143 (65.0) | 0.94 | 0.63–1.40 |                      |
| Attitudes toward social distancing    | Negative       | 119 (58.95)                       | 78 (35.0)  | 1    |           | <0.001*              |
|                                       | Positive       | 83 (41.1)                         | 142 (64.5) | 2.61 | 1.76–3.86 |                      |

Notes: <sup>a</sup>Bivariate analysis (Chi-square test), \*Selection of significant factors at p-value <0.25, CI = Confidence Interval, IDR = Indonesian Rupiah

**Table 3. Multivariable Logistic Regression Predicting Social Distancing Practice (n = 422)**

| Variable                              | Practice of Social Distancing |      |                      |                  |           |
|---------------------------------------|-------------------------------|------|----------------------|------------------|-----------|
|                                       | $\beta$                       | SE   | p-value <sup>b</sup> | AOR <sup>b</sup> | 95% CI    |
| Age (18–21 years old <sup>ref</sup> ) | 0.88                          | 0.21 | 0.045*               | 1.47             | 1.97–2.22 |
| Sex (Male <sup>ref</sup> )            | 0.81                          | 0.24 | 0.001*               | 2.26             | 1.58–3.69 |
| Knowledge (Poor <sup>ref</sup> )      | -0.05                         | 0.21 | 0.806                | 0.94             | 0.62–1.44 |
| Attitude (Negative <sup>ref</sup> )   | 0.96                          | 0.32 | <0.001*              | 2.61             | 1.74–3.90 |

Notes: <sup>b</sup>AOR = Adjusted Odds Ratio, SE = Standard Error, CI = Confidence Interval, \*Significance level at p-value<0.05,

### Discussion

This study's findings showed that age, sex, and attitude were significant predictors of social distancing practice among undergraduate health students. According to the age, the results indicated that older health students tended to have good social distancing practice compared to younger ones. Similar to the previous studies, they reported that older individuals were more likely to pay attention than younger individuals.<sup>13,24</sup> It also implied that older people tended not to expose themselves to certain risky social behaviors. In this study, sex was also associated with social distancing practice. Similar to a recent study in India,<sup>15</sup> that examined how practice scores were affected by gender, a study in Indonesia,<sup>14</sup> also explained that female students were more likely to comply with social distancing because women generally emphasize the notion of health-related to relaxation, rest, feeling well, and nutrition. Their naturally cautious natures shaped females to adopt healthy behaviors. Supporting these arguments, a study in China,<sup>24</sup> revealed that males were more careless than females. Regarding that matter, this study only assessed five variables from general characteristics, suggesting that more general characteristic factors could be included in future studies.

This study revealed that those with positive attitudes were associated with good social distancing practice. This finding is consistent with the previous studies.<sup>12,14,25</sup> This is linked to the behavioral model, which stated that attitude could drive behavior or form the intention to behave.<sup>26,27</sup> The finding of this attitude predictor toward social distancing practice is possibly helpful for policy-makers and healthcare professionals to further health interventions, raising awareness of health guidelines compliance. However, there was no significant association between knowledge and practice of social distancing. This study's results conflicted with other previous studies that found this variable was the protective factor of social distancing practice.<sup>3,12,14,24</sup> Nevertheless, some studies reported no relationship between knowledge and preventive behavior.<sup>27,28</sup> The possible reason was that adolescent health behaviors are highly determined by the living context.<sup>29</sup> This implies that knowledge contains essential

aspects for health behavior but is insufficient; supportive adolescent living contexts and school settings are also important.<sup>29,30</sup> This study suggests that comprehensive prevention programs should be designed in living environments and academic settings.

Interestingly, this study found that social media was the main source of social distancing information used by participants. These findings were in line with three other studies from different settings.<sup>31-33</sup> College students mainly were familiar with Facebook for information updates of the COVID-19.<sup>32,33</sup> Science content in social media were perceived as share-worthy content that spreads quickly. Generation Z and Millennials are highly concerned about the COVID-19 infection among themselves and their family members. Therefore, they tended to follow newly updated information during uncertain periods closely.<sup>34</sup> However, WHO keeps fighting the infodemic of COVID-19 mis- or disinformation widely proliferating online media sources.<sup>35</sup> Local health authorities should actively design health promotions through this platform to eliminate hoaxes and myths about COVID-19 prevention measures. Social distancing promotion strategies involving health students may be more effective if considerations are given to specific high-risk populations, such as men in general and university students below 20 years old. Health campaigns through social media platforms should be an efficient way to educate social media users with accurate information by trustful authorities.

The limitation of this study was its questionable generalizability due to only one university in Samarinda City. Thus, further studies should involve more academic institutions from other universities or cities besides Samarinda to be more representative and reflect the situation throughout the entire country. The use of the online questionnaire platform can limit the ability of groups without internet access to respond to online questionnaires. The method of recruiting research subjects with probability sampling techniques should be considered to achieve the generalization and background diversity of samples. Further studies should be conducted to facilitate the comprehensive overview of health protocols that var-

ious states and countries implemented to finally accelerate efforts to eradicate COVID-19.

## Conclusion

In summary, general characteristics such as age, sex, and attitudes were the important predictors of the COVID-19 social distancing practice among undergraduate health students. The findings of this study imply that there is an urgent need to initiate a campaign comprehensively targeting specific high-risk populations along with health education programs in both residential and academic settings. This study found that social media was the most frequent information source about social distancing for students. Thus, a more tailored health education program could be efficiently run through this platform.

## Abbreviations

WHO: World Health Organization; COVID-19: coronavirus disease 2019; ICTF: Indonesia COVID-19 Taskforce; IDR: Indonesian Rupiah; AOR: Adjusted Odds Ratio; SD: Standard Deviation; CI: Confidence Interval.

## Ethics Approval and Consent to Participate

This study was conducted with ethical approval from the research ethics committee of the University of Mulawarman, Samarinda, Indonesia (No.25/KEPK-FK/III/2021) and the University of Muhammadiyah Jakarta, Indonesia (No.059/PE/KE/FKK-UMJ/II/2021).

## Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

## Availability of Data and Materials

The datasets used are available from the corresponding author on reasonable request.

## Authors' Contribution

SHA performed the data collection and designed and drafted the initial manuscript. PV conceptualized the research, performed the statistical analysis, interpreted results, and finalized the manuscript.

## Acknowledgment

The authors would like to acknowledge the participants involved for their valuable responses that contribute to this study.

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# Knowledge, Attitude, and Practices of Health Personnel in Responding to the COVID-19 Pandemic in Indonesia

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## Abstract

The COVID-19 pandemic, originated in China, has spread to worldwide, including Indonesia. Until July 2021, the growth rate has been gradually increasing, and cases have been found in all 34 provinces of Indonesia. This cross-sectional study aimed to investigate the knowledge, attitude, and practices (KAP) of health personnel in the primary health care towards the COVID-19 pandemic in Indonesia using online self-report questionnaire. A total of 440 respondents contributed to this online survey. The average level of KAP were 7.7 out of 10.0, 14.3 out of 15.0, and 31.9 out of 36.0, respectively. There was no significant association between respondents' characteristics (sex, marital status, and age) and their KAP for all variables showed  $p$ -value>0.05. It can be concluded that the level of KAP was good, despite the respondents' characteristics that had no association with KAP.

**Keywords:** COVID-19, health personnel, Indonesia, knowledge distribution

## Introduction

The original coronavirus originated in Wuhan, China, at the end of 2019 and was called as coronavirus disease 2019 (COVID-19).<sup>1-4</sup> The virus had spread rapidly to more than 200 countries, and the World Health Organization (WHO) declared this disease as a global pandemic.<sup>5,6</sup> Until July 2021, the new variant of the virus had spread rapidly to all countries worldwide. It has negatively impacted society in terms of the economy, public health, and daily life activities, and many people have become unemployed. By July 10, 2021, the number of accumulated confirmed COVID-19 cases totaled 185 million globally.<sup>7</sup> On the same date in Indonesia, the total confirmed cases were 2,455,912, with 64,631 total deaths.<sup>7</sup> The number of recovered cases reached 53,945, and the test cases for the whole country totaled 1,310,924, equal to 4,790 cases per 1 million population.<sup>7</sup> The first case in Indonesia was reported in Jakarta, the capital city of Indonesia, and the number of morbidity and mortality increased sharply. Since then, the frontline workers, including health personnel, have taken care of the COVID-19 patients.

COVID-19 has disrupted public health measures and systems throughout the world. Many health personnel had passed away due to the lack of personal protective

equipment (PPE), the lack of awareness of the harmful nature of the disease, accidental operations, and other factors.<sup>8</sup> To control the spread of COVID-19, public health personnel need to be strengthened.<sup>9</sup> Some public health personnel might be carriers, and others are persons under investigation (PUI). Knowledge, attitudes, and practices (KAP) constitute important components for health personnel to care for patients with COVID-19 and PUI groups. Health personnel needs to understand the changing situation and adjust their normal behaviors to stem the COVID-19 pandemic.

Sufficient protection and prevention may prevent the spread of the virus. Providing facilities plays a crucial role in interventions and mitigation measures undertaken according to the appropriate guidelines. The COVID-19 pandemic is spreading unpredictably due to many influencing factors. It continues to cause morbidity, mortality, and normal life disturbance; it is also a burden on health systems.<sup>10,11</sup> This survey constitutes an overall assessment of general information that could represent the Indonesian experience in responding to the COVID-19 outbreak. Assessing the KAP related to COVID-19 among health personnel would benefit the government or involved organizations in performing any intervention according to the obtained results. Moreover, recommen-

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Received : May 07, 2021  
Accepted : October 22, 2021  
Published : November 29, 2021

dations from health personnel would be important information to strengthen the COVID-19 response. This study aimed to determine the KAP of health personnel responding to the COVID-19 pandemic in Indonesia.

### Method

A community-based cross-sectional study was conducted among health personnel in all 34 provinces in Indonesia. The data were collected in May 2020 after obtaining ethical approval from the Health Research Ethics Committee, the National Institute of Health Research and Development (Certificate of Approval No. LB.02.01/KE.330/2020). The authors used an online self-reported questionnaire (Google Form) and were distributed to respondents with a consent form. The first page of the questionnaire informed all respondents about the background and objectives of the study and provided the consent form according to ethical requirements. Respondents could withdraw anytime without giving reasons if they did not wish to participate. Completing the questionnaire would not affect their jobs; all data were kept confidential, and the results were presented in general terms.

A self-report questionnaire was used to collect the data based on the respondent’s own experiences and KAP. The validity and reliability of the self-report questionnaire were tested on 30 volunteers in Yogyakarta. The respondents answered the questions in the Google Form. The values of Cronbach’s alpha for the knowledge and attitude items were 0.890 and 0.823, respectively.

The target population consisted of health personnel in primary health care in each province of Indonesia. The inclusion criteria comprised the following: 1) working in a primary health care (PHC) and 2) achieving the minimum standard of a professional in a PHC from the Ministry of Health of the Republic of Indonesia; this included doctor or primary care doctors, dentists, nurses, midwives, public health workers, sanitarians, medical laboratory technology experts, nutritionists, and pharmacists. The self-report questionnaire consisted of four sections: the general characteristics of the respondents (sex, age, marital status, education, and position), as well as the knowledge of, attitudes towards, and practices regarding the COVID-19 disease.

Based on data from the Ministry of Health of the Republic of Indonesia, the number of health personnels in PHCs is 400,908. The following equation was used to estimate the sample size (n) (Formula 1). The equation indicated that a sample size of 384 was needed. To compensate for missing cases, the sample sizes added 10%. Thus the required sample size at least 422. After data collection, the authors checked and cleaned the completed of questionnaires. Totally 440 of eligible respondents were received which more than expected for this study.

$$n = \frac{z_{1-\alpha/2}^2 P(1-p)N}{d^2(N-1) + z_{1-\alpha/2}^2 P(1-p)}$$

Notes: n: Minimum Sample Size, N: Population, d: Margin of Error (5%),  $Z_{1-\alpha/2}$ : Z Table Score, P: Estimated Proportion

#### Formula 1. Estimate of Sample Size for Cross-Sectional Study

The questionnaire was distributed through social media. The sample was selected by proportional random sampling based on the province of origin.

The data were checked and cleaned for the missing information before being analyzed using statistical tests. The questionnaire consisted of general characteristics, questions about the level of knowledge (LK), the level of attitude (A), and the level of practice (using PPE (UP) and personal hygiene (PH)). Each questionnaire was grouped by province. The eligible questionnaires were collected online, and the cross-sectional surveys were tabulated, analyzed, and statistically interpreted. Descriptive statistics and correlation analysis were employed to determine the frequencies of each question under the variable levels of the KAP of health personnel towards COVID-19 in respect to demographic variables. The Pearson correlation was used to analyze the direction and magnitude of the correlation between each variable (LK, A, and level of practice). The mean scores for each variable (LK, A, UP, PH) obtained concerning their characteristics were analyzed and compared using the independent sample t-test, one-way analysis of variance (ANOVA) to identify the difference between categorical independent variables and numeric dependent variables. In detail, the t-test aimed to see the differences between sex (male and female) and the mean of KAP, and the ANOVA test aimed to see the differences between marital status (single, married, and divorced) and the mean of KAP. The ANOVA test also aimed to see the differences between age groups (20–29, 30–39, 40–49, and 50–59) and the mean of KAP. The statistical software SPSS of Mahidol University, licensed version-18, was used to analyze the data.

### Results

A total of 440 eligible samples were analyzed in this study. The average age was 30.4 years, with a standard deviation of 5.7. The minimum age was 22, and the maximum age was 57 years. The majority of respondents were female (69.8%), with 55% married, 41.4% single, and 2.3% divorced. Most graduated at the Diploma III (51.8%); the second rank was senior high school or Diploma I and II (25.7%), as detailed in Table 1.

Ten questions related to the COVID-19 were asked. The average score was 7.7 of 10, with minimum and

maximum scores of 4 and 10, respectively. More than 50% of respondents could answer correctly. However, some respondents provided wrong answers: they did not know that COVID-19 could spread from human to human (36.1%) and lacked knowledge about the common methods to prevent the spread, like washing hands regularly (45.5%). Health personnels who checked, provided care, delivered the patient, and cleaned the COVID-19 ward without any standard PPE could be included in the PUI group, even without symptoms (44.8%). One interesting issue involved the emergency cases: most respondents (81.1%) indicated that they should help patients without any PPE implementation. Health personnels were not required to apply “5 moments of hand hygiene” in handling patients with COVID-19 because they experienced an emergency condition. The “5 moments of hand hygiene” was a procedure issued as a guideline by the Ministry of Health of the Republic of Indonesia. The answers to the other issues raised, shown in Table 3, were at good levels (percentage of correct answers higher than 90%). Participants achieved a mean knowledge score of 55%.

Participants of this study project were asked to respond to five attitude statements. About 98% agreed that health workers must avoid touching/rubbing the eyes, nose, or mouth with potentially contaminated gloves or bare hands. Regarding the three negative attitudes in this questionnaire, the respondents had a good attitude toward responding to COVID-19 preventive measures: about 88% disagreed with working with patients of COVID-19 without PPE, 86.6% disagreed with re-using gloves for the next activity, even in urgent or emergency

cases and 95.2% disagreed with re-using surgical disposal masks. However, most had a positive attitude towards COVID-19 mitigation measures or prevention approaches, as presented in Table 2. Most health personnel had positive attitudes towards mitigating COVID-19 (more than 85%).

Twelve statements were used to assess health personnel practices, as presented in Table 3. Health personnel did not perform many activities appropriately: they did not wear standard masks when providing services at the PHC (10.3%), did not wear a gown (21.9%), did not wear eyeglasses or protect their eyes when providing health services at the PHC (23.4%), and did not wear boots (25.9%). These manners would induce the transmission of the disease to others at the PHC or even

**Table 1. General Characteristics of Respondents (n = 440)**

| Variable            | Category                      | n                | %    |
|---------------------|-------------------------------|------------------|------|
| Sex                 | Male                          | 127              | 28.9 |
|                     | Female                        | 307              | 69.8 |
|                     | No identification             | 6                | 1.4  |
| Age (year), n = 440 | Mean±SD (Min–Max)             | 30.4±5.7 (22–57) |      |
| Marital status      | Single                        | 182              | 41.4 |
|                     | Married                       | 242              | 55.0 |
|                     | Divorced                      | 10               | 2.3  |
|                     | No identification             | 6                | 1.4  |
| Education           | Senior high school/Diploma I/ |                  |      |
|                     | Diploma II/or equivalent      | 113              | 25.7 |
|                     | Diploma III                   | 228              | 51.8 |
|                     | Bachelor degree               | 91               | 20.6 |
|                     | Master degree or higher       | 2                | 0.5  |
|                     | No identification             | 6                | 1.4  |

Note: SD = Standard Deviation

**Table 2. Knowledge and Attitude of Respondents in Each Question**

| Level of Knowledge Statement   | Correct (n) | %    |
|--|-------------|------|
| LK1 COVID-19 is a new disease for which there is yet to be confirmed case among humans.  | 403         | 91.6 |
| LK2 COVID-19 can spread from human to human through airborne or droplet transmission.  | 281         | 63.9 |
| LK3 The people at highest risk of spreading this disease are those who intimately contact patients with COVID-19, including health personnels taking care of patients with COVID-19.               | 428         | 97.3 |
| LK4 The standard recommendation to prevent the spread of infection is by washing hands regularly with clean running water.   | 240         | 54.5 |
| LK5 Health personnels who check, take care of, deliver the patients, and clean the ward of COVID-19 cases without any standard PPE can be included in the PUI group even without showing symptoms. | 243         | 55.2 |
| LK6 Limiting the number of health personnels in the ward when one has no direct concerns is one step of prevention.  | 428         | 97.3 |
| LK7 Before taking specimens from patients with COVID-19, health personnels must take universal precautions.  | 416         | 94.5 |
| LK8 Health personnels must use full PPE and standard masks when taking specimens of patients with COVID-19.  | 407         | 92.5 |
| LK9 Before using PPE, coveralls, watches, jewelry must be removed.   | 428         | 97.3 |
| LK10 Health personnels are not required to apply “5 moments of hand hygiene” when handling COVID-19 patients who require emergency care.   | 83          | 18.9 |
| Level of Attitude Statement  | Agree (n)   | %    |
| A1 Health personnels must avoid touching/rubbing the eyes, nose, or mouth with potentially contaminated gloves or bare hands.  | 431         | 98.0 |
| A2 Due to PPE limitations, health personnels are allowed to handle patients with COVID-19 without using PPE due to their responsibility.   | 51          | 11.6 |
| A3 In urgent conditions, gloves that have been used are allowed to be re-used.   | 59          | 13.4 |
| A4 Surgical masks can be re-used until they break.   | 21          | 4.8  |
| A5 When working in the COVID-19 ward, gloves must be changed for each patient.   | 409         | 93.0 |

Notes: LK = Level of Knowledge, A = Level of Attitude, PPE = Personal Protective Equipment

**Table 3. The Practice of Using Personal Protective Equipment and Personal Hygiene of Respondents in Primary Health Care**

| Using PPE Practice Statement  | Always |      | Sometimes |      | Never |      |
|---|--------|------|-----------|------|-------|------|
|   | n      | %    | n         | %    | n     | %    |
| UP1 I follow the standards of prevention and control of COVID-19 infections.  | 376    | 85.5 | 39        | 8.9  | 25    | 5.7  |
| UP2 If patients are isolated, I follow transmission-based precautions, e.g., avoiding direct contact with patients and exposure to droplets.                      | 389    | 88.4 | 24        | 5.5  | 27    | 6.2  |
| UP3 I wash my hands before and after providing health services at the PHC.  | 410    | 95.2 | 21        | 4.8  | 9     | 2.1  |
| UP4 I wash my hands before and after using gloves.  | 375    | 85.2 | 57        | 13.0 | 8     | 1.9  |
| UP5 I wear gloves whenever I provide health services at the PHC.  | 376    | 85.5 | 50        | 11.4 | 14    | 3.2  |
| UP6 I wear a standard acceptable mask when I provide health services at the PHC.  | 345    | 78.4 | 50        | 11.4 | 45    | 10.3 |
| UP7 I wear a gown when I provide health services at the PHC.  | 260    | 59.1 | 84        | 19.1 | 96    | 21.9 |
| UP8 I wear glasses or eye protection when I provide health services at the PHC.   | 244    | 55.5 | 93        | 21.1 | 103   | 23.4 |
| UP9 I wear (rubber) boots when I provide health services at the PHC.  | 234    | 53.2 | 92        | 20.9 | 114   | 25.9 |
| UP10 I take off my (rubber) boots without touching them with my hands.  | 294    | 66.8 | 86        | 19.5 | 60    | 13.7 |
| UP11 I take off my eye protection by pulling the rope from the back of my head.   | 317    | 72.0 | 61        | 13.9 | 62    | 14.1 |
| UP12 I remove the mask from the back of my head, first removing the lower strap from the top of my head, then removing the upper strap from the back of the head. | 310    | 70.5 | 106       | 24.1 | 24    | 5.5  |

| The Facilities Supporting COVID-19 Work Question |   | Yes (n) | %    |
|--|---|---------|------|
| PH1  | Are hand sanitizers/hand rubs available at your workplace during this pandemic?                     | 414     | 94.1 |
| PH2  | Do you easily wash your hands with running water and soap during this pandemic?                     | 425     | 96.6 |
| PH3  | Do you have hand sanitizers/hand rubs and handwashing facilities in your home during this pandemic? | 387     | 88.0 |
| PH4  | Do you have handwashing guides/posters in your workplace/home during this pandemic?                 | 405     | 92.0 |
| PH5  | Is PPE available for handling COVID-19?   | 311     | 70.7 |

Notes: PPE = Personal Protective Equipment, UP = Using PPE, PH = Personal Hygiene, PHC = Primary Health Care

**Table 4. The Pearson Correlation Coefficient of Knowledge, Attitude, and Practice**

| Variable        | Knowledge Score | Attitude Score | Practice Score |
|-----------------|-----------------|----------------|----------------|
| Knowledge score | 1               | -0.303**       | -0.051         |
| Attitude score  |                 | 1              | 0.025          |
| Practice score  |                 |                | 1              |

Notes: \*p-value < 0.05, \*\*p-value<0.01, \*\*\*p-value<0.001

among their family members.

Five questions were asked to all participants. The first question was concerning the availability of hand sanitizers in the workplace during the COVID-19 pandemic. It was found that 5.9% of respondents indicated that they were unavailable. The accessibility to water and soap for handwashing in the workplace was 96.6%, preparing hand sanitizers and handwashing at home was 88%, providing guidelines of handwashing in the workplace or home was 92%, and 70.7% of respondents indicated that PPE was unavailable during the COVID-19 pandemic. Details about PPE issues are presented in Table 3.

The Pearson correlation was tested to understand the correlation of each variable (ratio or interval scale only). It was found that the coefficient correlation between knowledge and attitude was -0.303, which means that a higher level of knowledge will affect a lower attitude with a weak correlation (based on the Pearson coefficient interval). The coefficient correlation between knowledge

and practice was -0.051, which means higher knowledge will affect lower practice with a very weak correlation. The coefficient correlation between attitude and practice was 0.025, which means higher knowledge will affect higher practice with a very low correlation. However, there was no significant correlation between knowledge & practice and attitude & practice (Table 4).

No association of respondent characteristics (sex, marital status, age group) with KAP was found. This result indicated that respondents had similar knowledge levels, attitudes, and practices concerning the COVID-19. The mean KAP score for each category did not differ significantly, as shown in Table 5. The respondents reported that the most important and needed PPE were hazmat suits (44.3%), surgical or medical-grade masks (43.9%), boots (27.5%), goggles (26.3%), and other small proportions such as nurse caps (3.9%), face shields (5.9%), and aprons 2.3%). Fifteen percent indicated that they received proper and sufficient PPE.

Table 5. Comparison of General Characteristics of Respondents and Mean of Knowledge, Attitude, and Practices

| Variable           | Category | n   | %    | Knowledge |      |         | Attitude |      |         | Practice |      |         |
|--------------------|----------|-----|------|-----------|------|---------|----------|------|---------|----------|------|---------|
|                    |          |     |      | Mean      | SD   | p-value | Mean     | SD   | p-value | Mean     | SD   | p-value |
| t-test results     |          |     |      |           |      |         |          |      |         |          |      |         |
| Sex                | Male     | 127 | 29.3 | 7.85      | 1.33 | 0.26    | 14.02    | 1.83 | 0.06    | 32.13    | 4.65 | 0.43    |
|                    | Female   | 307 | 70.7 | 7.69      | 1.41 |         | 14.36    | 1.29 |         | 31.76    | 4.16 |         |
| ANOVA test results |          |     |      |           |      |         |          |      |         |          |      |         |
| Marital status     | Single   | 182 | 42.1 | 7.74      | 1.26 | 0.97    | 13.29    | 2.43 | 0.60    | 31.73    | 4.31 | 0.87    |
|                    | Married  | 242 | 56.0 | 7.72      | 1.49 |         | 13.25    | 2.25 |         | 31.94    | 4.34 |         |
|                    | Divorced | 8   | 1.9  | 7.63      | 0.91 |         | 15.00    | 0.00 |         | 32.00    | 3.38 |         |
| Age group          | 20-29    | 265 | 63.8 | 7.65      | 1.36 | 0.283   | 14.31    | 1.44 | 0.49    | 32.05    | 4.06 | 0.14    |
|                    | 30-39    | 117 | 28.2 | 7.81      | 1.50 |         | 14.20    | 1.55 |         | 31.09    | 4.80 |         |
|                    | 40-49    | 26  | 6.3  | 7.96      | 1.43 |         | 14.62    | 0.98 |         | 32.50    | 4.23 |         |
|                    | 50-59    | 7   | 1.7  | 7.00      | 0.82 |         | 14.71    | 0.76 |         | 33.29    | 3.64 |         |

Note: SD = Standard Deviation

## Discussion

As COVID-19 has just emerged, constituting a relatively new disease has caused devastating effects on human life. The publication of disease information and its transmission remains limited. More scientific support is needed. This condition is similar to the study in Malaysia,<sup>12</sup> or other areas like China, Bangladesh, Northwest Ethiopia, and Nigeria.<sup>13-16</sup> Most respondents had good knowledge about COVID-19 according to the average score; however, some questions might need further consideration because many indicated wrong answers. The study in Nigeria also stated the same results, which found that the levels of knowledge among health personnels were 7.1 out of 8.16. Some misunderstood COVID-19 transmission (human to human), so this requires education and knowledge dissemination about the COVID-19 features. As the current pandemic is still currently active, the responsible organizations might have to promote the campaigns of COVID-19 to all PHCs more.<sup>15</sup> Common methods to prevent the disease from spreading, such as washing hands regularly and the awareness of PPE use for everyone in the health center, need further promotion.

Knowledge of COVID-19 among healthcare workers (HCWs) is essential. A study in India found that HCWs are important assets for building capacity and devising preparedness strategies to control the COVID-19.<sup>17</sup> Another study conducted in South Nigeria found that most health personnel felt they were at high risk of being infected, lacked social insurance, and needed provision for PPE.<sup>18</sup> Any strategies to eradicate the COVID-19 will be effective if HCWs have sufficient knowledge of the virus. A study in Malaysia found low levels of knowledge in HCWs and insufficient PPE, so the mortality rate remains high.<sup>19</sup> The study in Saudi Arabia found the inter-relationship between KAP, which specifically showed

that knowledge is the most important variable and could affect attitude and practice.<sup>20</sup> Another study in Saudi Arabia also found a high level of knowledge among PHCs, but the level of anxiety was also high at the same time.<sup>21</sup>

The respondents had good attitudes towards reducing the transmission of COVID-19, with an average score of 14.3 and minimum and maximum scores of 5 and 15, respectively. A few were unaware of and unconcerned with the disease transmission resulting from limited PPE in some health centers. They were concerned with and had awareness about using PPE whenever they took care of patients and on the job duty. This indicated a good point of health personnel's perceptions, showing the awareness, promotion, and campaigns launched by central and locally involved organizations. In addition, the internet and social media are easily accessible. They might be factors in personnel perceiving the globally critical situation as well as the ease of transmission and harmfulness of this disease.<sup>22</sup> The study conducted in Wuhan, China, in March 2020 and the one conducted in the Kingdom of Saudi Arabia in May 2020 stated that vaccines were still unavailable, so preventive measures are the best approach.<sup>4,23</sup> In Indonesia, the first batch of COVID-19 vaccines from AstraZeneca arrived in March 2021 through the COVAX initiative.<sup>24</sup> This implies much participation in the preventive measures stipulated by the Indonesian government and WHO guidelines. The attitude in terms of motivation, discipline, and leadership led to the good performance of health personnel during the COVID-19 pandemic in Indonesia.<sup>25</sup>

The health personnel did not perform in a good manner regarding many activities. They did not wear standard masks when providing services at the PHC (10.3%), did not wear a gown (21.9%), did not wear eyeglasses or eye protection when providing health services at the PHC

(23.4%), and did not wear boots (25.9%). Their manners would induce the transmission of the disease to others at the PHC or even among their family members. This indicates that some HCWs require a greater awareness of COVID-19; therefore, more health education and health campaigns should be regularly implemented.<sup>23</sup> The average score of practice was 31.9, with a minimum of 19 and a maximum of 36, indicating that many health personnel did not implement appropriate practices required for COVID-19 transmission prevention. It might be due to the emergency situation, lack of PPE, and a limited number of personal hygiene facilities like hand sanitizers. This finding was important for local and central governments to consider because health personnel should serve as a role model for the general population, as reported by the study conducted in Nigeria.<sup>22</sup>

There was no association between knowledge & practices and attitudes & practices among the respondents. According to the governmental training, self-learning from social media, and the guidelines recommended by the Indonesian Government and other organizations, this might be the equivalent of knowledge. Interestingly, a negative association was found among the respondent's knowledge level and attitudes towards the COVID-19. One important aspect was the mindset of health personnel that needs to be focused on in more detail. Therefore, awareness campaigns should be regularly implemented.

There are many vulnerable practices, which may lead to COVID-19 transmission. One study found that the exposure of HCWs to members of the household as well as social interactions between HCWs and members tend to increase the risk of COVID-19 infection among household members.<sup>26</sup> Concerning the COVID-19 prevention practice among HCWs, most of them decided to resign due to insufficient PPE, which causes high levels of stress and fear of transmission.<sup>27-30</sup> HCWs with direct contact with the patients and the kitchen staff mainly were found to be asymptomatic carriers of COVID-19.<sup>31-35</sup> Another study was recommended to provide more PPE to increase the prevention practices among HCWs.<sup>36</sup> It is reasonable to state that PPE is the most important factor in increasing protection against and preventing COVID-19 transmission. A study in the USA found the long-term care (LTC) with inadequate supplies of PPE and COVID-19 tests could be causing a high number of cases among HCWs.<sup>37</sup> Sufficient effort from all sectors is needed to reduce mortality in the line of duty of HCWs.<sup>38</sup> Strict regulation is one way to ensure the availability of PPE.<sup>39</sup>

This investigation of the KAP of health personnel in Indonesia towards COVID-19 might be the first study covering the whole country. The data collection was conducted online in one month. The readiness of organizations and people, as well as the availability of hardware facilities and PPE support, might be limited in some a-

reas. However, the results may benefit authorized units to set preventive strategies to control the spread of COVID-19.

### Conclusion and Recommendations

In summary, this study obtained the baseline information of the KAP of Indonesian health personnel working in PHCs towards COVID-19. The findings indicate that many health personnel lack knowledge about the disease's characteristics and transmission; they implement improper practices when taking care of patients. However, most have good attitudes concerning disease prevention. Concerning PPE requirements, HCWs need more hazmat suits, medical-grade masks, goggles, and boots to respond effectively to COVID-19. Some categories mentioned in this study might benefit the government, especially authorized units such as the central government, The Ministry of Health, and local municipalities. The results can be used for further intervention and education or training programs for health personnel.

### Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; KAP: Knowledge, Attitude, Practice; PPE: Personal Protective Equipment; PUI: Person Under Inspection; PHC: Primary Health Care; LK: Level of Knowledge; A: Attitude; UP: Using PPE; PH: Personal Hygiene; SPSS: Statistical Package for the Social Sciences; HCWs: Healthcare Workers; LTC: Long-term Care.

### Ethics Approval and Consent to Participate

Ethics approval was obtained from the Health Research Ethics Committee, National Institute of Health Research and Development (Certificate of Approval No. LB.02.01/KE.330/2020). All of the respondents could refuse to participate in the study and were given an agreement form before filling in the online questionnaires.

### Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

The data of this study's findings are available upon reasonable request to the corresponding author. However, the data are not available to the public regarding the participants' privacy and security.

### Authors' Contribution

DS and S designed and conceptualized the study, developed the instrument for collecting the data, and fixed the methodology. Other authors assisted in analyzing and interpreting the data, finding the supporting journals, cleaning the data, preparing the questionnaire, visualizing and interpreting the results, and finalizing the manuscripts.

## Acknowledgment

The authors thanked the fast response of ethical approval from the Health Research Ethics Committee, National Institute of Health Research and Development, The Ministry of Health of the Republic of Indonesia.

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# The Seroprevalence of *Toxoplasma gondii* in Cats at the House of Maternal Women with Toxoplasmosis in Badung, Indonesia

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## Abstract

Toxoplasmosis is a zoonotic disease caused by infection with the parasite called *Toxoplasma gondii* (*T. gondii*). The health and social impacts of the infection are enormous, including miscarriage, hydrocephalus, blindness, and mental retardation. The occurrence of toxoplasmosis in maternal women cannot be separated from cats around their houses. This study aimed to determine the seroprevalence of the parasite in cats found in the human carriers residences and identify the risk factors of toxoplasmosis in maternal women in Badung District, Bali Province, Indonesia. A total of 80 cat serum samples were obtained from two residential groups, 40 from the housing where the maternal women were infected and another 40 from where there were no identified sufferers of the disease. All the samples were examined using the enzyme-linked immunosorbent assay (ELISA) method to detect the presence of antibodies *T. gondii* in feral cat serum. The results showed that 47.5% of the examined subjects had the said antibodies. As much as 65% came from housing with cases of toxoplasmosis in maternal mothers, and 30% came from residences with none. The presence of feral cats is a major risk factor for the transmission of *T. gondii* to humans.

**Keywords:** cats, maternal women, risk factor, *Toxoplasma gondii*, toxoplasmosis

## Introduction

Human toxoplasmosis is an emerging disease in both developed and developing countries with a varying prevalence.<sup>1-5</sup> In Indonesia, this disease has been reported in various regions with seroprevalences ranging from 3.1% to 64%.<sup>6-12</sup> In Bali, Sukaryawati,<sup>13</sup> reported a 41.8% of seroprevalence in Mengwi Subdistrict, Badung District, and a recent study found a rate of 10.9% in pregnant women.<sup>10</sup> The previous study on toxoplasmosis among blood donors in Bali showed a seroprevalence of 35.9%, while among the women blood donors were about 63.9%. Furthermore, the seroprevalence of toxoplasmosis in blood donors in Badung District was 29.2%; in Tabanan District, 38.6%; in Gianyar District, 25.0%; while in Denpasar City, Klungkung City, and Bangli District were 41.1%, 25.0%, and 8.31%, respectively. In each district of Bali Province, the seroprevalence of toxoplasmosis among women was reported: Badung District, 33.3%; Tabanan District, 66.5%; Gianyar District, 82.5%; while in Denpasar City, Klungkung City, and Bangli District was 71.1%, 81.5%, and 16.7%, respectively.<sup>14</sup> Another study determined the seroprevalence

of human toxoplasmosis in the Gianyar District to be 56.7%.<sup>15</sup> In Bali Province, the seroprevalence for toxoplasma in animals, was also reported to be 30% in cats,<sup>16</sup> 5.26% in pigs,<sup>17</sup> and 24.8% in local chickens.<sup>18</sup>

Several epidemiological studies indicated that the presence of a cat in residence or premises increases the risk of *T. gondii* infection, especially in pregnant women.<sup>19-22</sup> The presence of cats will pollute the surrounding environment with feces containing oocysts of the parasite.<sup>23</sup> As reported before, the areas where there are many of the aforementioned animals roaming in the streets, markets, and public places are contaminated by the oocysts.<sup>24,25</sup> In addition to cats which are widely highlighted as a risk factor for toxoplasmosis, eating habits increase the risk of infection with *T. gondii* in humans.<sup>26</sup> In Europe, for instance, more infections occur as a result of consuming meat and its processed products that have not been completely cooked,<sup>27</sup> while in Brazil, most of the infections are due to ingestion of oocysts that contaminate drinking water or vegetables.<sup>28,29</sup> Similar findings are also reported in several developing countries.<sup>30</sup> In Indonesia, including Bali Province, it has been

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Received : April 19, 2021  
Accepted : October 18, 2021  
Published : November 29, 2021

reported that eating habits, such as the consumption of *lawar*, a kind of food made from raw meat mixed with some vegetables and undercooked satay, determine the occurrence of these parasitic infections.<sup>6,10,11,31,32</sup>

The concept of one health/eco-health focuses on three main aspects in epidemiology related to toxoplasmosis,<sup>11</sup> namely; the humans, the animals that serve as definitive hosts (such as cats), and other warm-blooded organisms that serve as intermediate hosts, as well as the environment contaminated by infective oocysts from *T. gondii*. Extant studies on the epidemiology of toxoplasmosis have only focused on one aspect. However, this study focused on three; the socio-demography of maternal women, the presence of cats as a source of infection, and the environment contaminated by the feces containing *T. gondii* oocysts.<sup>16</sup> This type of epidemiological study, especially in maternal women, which focuses on the three aforementioned aspects, has never been carried out. In addition, studies conducted on toxoplasmosis thus far in this category of individuals and its relationship with the presence of cats as a source of transmission have never been investigated on the status of the associated infection by serological, coproscopic, and molecular tests.

**Method**

This study used a case-control approach while the maternal women checked their pregnancy at a clinic or laboratory in Denpasar City, Bali Province. All the positive maternal women recorded in the laboratory were used as a sampling frame, then they were selected using a simple random sampling. Those that were randomly selected as samples were divided into two groups; those that were positive for toxoplasmosis serologically (cases) and those that were negative (control). The control group was selected from the nearest neighbors of the selected sample cases. In addition, a study was carried out on cats at the home or premises of the selected maternal women. All the cats were trapped and maintained in a cage for the obtainment of samples. The number of samples was calculated by the Formula 1.<sup>33</sup>

By assuming a type I error ( $Z\alpha$ ) of 5% and a type II ( $Z\beta$ ) error of 20%, the proportion of toxoplasmosis cases in Mengwi Subdistrict, Badung District, in 2011 was about 78%,<sup>13</sup> and the proportion of toxoplasmosis among the control group was 50%; the magnitude of the discordance or discrepancy ( $\pi$ ) was 0.38, and the minimum sample size for each group was 40. Therefore, the sample size of both cases and controls was 80.

$$N1 = N2 = \frac{(Z\alpha + Z\beta)^2 \pi}{(P1 - P2)^2 \pi} = \frac{(1.96 + 0.84)^2}{(0.78 - 0.50)^2} = 0.38 = 38 \text{ samples}$$

Formula 1. Estimate of Sample Size

The required data for the samples were obtained using a structured questionnaire. Before the examination, each of the subjects had approved their participation by signing informed consent. A total of 80 blood and fecal samples from cats were examined. Whole blood samples of 3 mL each were obtained from the cephalic vein, allowed to clot within sixty minutes, and separated by centrifugation; the serum was stored at freezing temperatures before being examined. Meanwhile, fecal samples were collected when the cats defecated in the cage. Each cage was cleaned and disinfected before being used for keeping the cat.

The feces and blood serum examination were carried out at the Center for Animal Disease (CSAD) laboratory, Faculty of Veterinary Medicine, Udayana University, and at the Denpasar Veterinary Investigation Center's laboratory of the Ministry of Health Agriculture of the Republic of Indonesia. Fecal samples were examined by using concentration flotation techniques to investigate the oocysts of the parasite.<sup>16</sup> The ELISA test was conducted on the serum samples. The presence of specific gamma immunoglobulin (IgG) antibodies against *T. gondii* was determined separately by the use of indirect ELISA tests (Human-GmbH, Wiesbaden, Germany [Ger]).<sup>34</sup>

The statistics were conducted by calculating the odds ratio (OR) value of each examined risk factor, and by bivariate analysis using the Chi-square test ( $\chi^2$ ) to evaluate the significance of the association between the toxoplasmosis incidents on maternal women and the risk factor to obtain the  $\chi^2$ , 95 % confidence interval (CI), and OR values. The statistically significant risk factors were related to the toxoplasmosis incidents on the maternal women (p-value<0.25), followed by the multivariate analysis using the logistic regression test to obtain the OR and p-value<0.05 values, as well as the final model of the regression. The discovered molecule-based data were used to strengthen the result of the microscopic test to ensure that the oocyst found belonged to the *T. gondii*. All the statistical analysis was conducted with the Stata version 12.1 software.

**Results**

Table 1 shows the proportion and seroprevalence of *T. gondii* in cats living with maternal mothers in Bali Province. The authors found that 17.5% of cats were infected by *T. gondii*; 30% were from housing with cases

Table 1. The Proportion of *T. gondii* in Cats (n = 80)

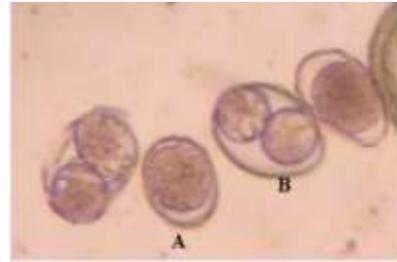
| Description          | Positive |      | Negative |      |
|----------------------|----------|------|----------|------|
|                      | n        | %    | n        | %    |
| Proportion (oocysts) | 14       | 17.5 | 66       | 82.5 |
| Seroprevalence       | 38       | 47.5 | 42       | 52.5 |

of toxoplasmosis in maternal mothers, and 5% were from residences with none. While the seroprevalence of *T. gondii* in cats was found to be 47%, out of which 65% occurred in the case study area and 35% in the control area. In Figure 1, it was found that the oocysts of *T. gondii* were in two forms, e.g., sporulated and un-sporulated oocysts.

Table 2 shows the sociodemographic characteristics of the respondents. In the case group, most of them (60.0%) were over 31 years old. While in control, most of them (60.0%) were below that age. When considered based on the level of education, most (50.0%) of the respondents in the case group attained high school, while most of the respondents (52.5%) in the control group went to college. From the occupational point of view, most of them in the case group (35.0%) and the control (32.5%) were housewives. When observed from the history of miscarriage, most of the respondents in the case group (80.0%) admitted having had one, and most of the control (82.5%) claimed to have had none. From the status of antenatal care, most of them (72.5%) in the case

group were examined by a doctor, while in the control group, most (62.5%) of them also received a similar level of care in their pregnancy.

Table 3 shows the behaviors and habits at risk of toxoplasma infection in maternal cases and control groups. The result indicated that out of 80 maternal women studied, 52.5% had frequent contact with the ground in their daily activities. In contrast, the remaining 47.5% stated that they never or rarely had such contact. Information about water sources used for daily activities



Notes:  
A: Un-sporulated Oocysts of *T. gondii*; B: Sporulated Oocysts of *T. gondii*

Figure 1. The Oocysts Forms Identified from Feral Cats' Feces in the Bali Area

Table 2. Sociodemographic Characteristics

| Variable           | Category              | Case n (%) | Control n (%) | Total n (%) |
|--------------------|-----------------------|------------|---------------|-------------|
| Age                | Under 31 years of age | 40         | 60            | 50          |
|                    | Over 31 years of age  | 60         | 40            | 50          |
| Level of education | Primary school        | 15         | 2.5           | 8.75        |
|                    | Junior high school    | 12.5       | 7.5           | 10          |
|                    | Senior high school    | 50         | 37.5          | 43.75       |
|                    | Graduate              | 22.5       | 52.5          | 37.5        |
| Subject occupation | Farmer                | 5          | 0             | 2.5         |
|                    | Government staff      | 5          | 15            | 10          |
|                    | Private employees     | 25         | 35            | 30          |
|                    | Entrepreneur          | 30         | 20            | 25          |
|                    | Housewife             | 35         | 30            | 32.5        |
| Had a miscarriage  | Ever                  | 80         | 17.5          | 48.75       |
|                    | Never                 | 20         | 82.5          | 51.25       |
| Antenatal care     | Doctor                | 72.5       | 62.5          | 67.5        |
|                    | Midwife               | 15         | 25            | 20          |
|                    | Primary health care   | 12.5       | 5             | 8.75        |
|                    | Clinic                | 0          | 7.5           | 3.75        |

Table 3. Behaviors and Habits at Risk of Toxoplasma Infection in Maternal Case and Control Groups

| Risk Factor for Toxoplasmosis         | Category         | Case |       | Control |       | p-value |
|---------------------------------------|------------------|------|-------|---------|-------|---------|
|                                       |                  | n    | %     | n       | %     |         |
| Contact with ground                   | Yes              | 25   | 62.50 | 17      | 42.50 | 0.073   |
|                                       | No               | 15   | 37.50 | 23      | 57.50 |         |
| Water sources                         | Non-tap water    | 18   | 45    | 23      | 57.50 | 0.263   |
|                                       | Tap water        | 22   | 55    | 17      | 42.50 |         |
| The habit of washing food ingredients | Yes              | 38   | 95    | 39      | 97.50 | 0.556   |
|                                       | No               | 2    | 5     | 1       | 2.50  |         |
| Drinking water                        | Boiled           | 35   | 87.50 | 37      | 92.50 | 0.456   |
|                                       | Not boiled       | 5    | 12.50 | 3       | 7.50  |         |
| Daily food                            | Self-cook        | 36   | 90    | 35      | 87.50 | 0.724   |
|                                       | Do not self-cook | 4    | 10    | 5       | 12.50 |         |

**Table 4. The Presence of Cats in or around the House and Its Relation with the Incidence of Toxoplasmosis in Maternal Mothers**

| The Presence of Cat      | Category            | Case |      | Control |      | p-value |
|--------------------------|---------------------|------|------|---------|------|---------|
|                          |                     | n    | %    | n       | %    |         |
| Cat maintenance          | Maintain            | 8    | 20   | 4       | 10   | 0.21    |
|                          | Not keeping (feral) | 32   | 80   | 36      | 90   |         |
| The gender of cats       | Male                | 19   | 47.5 | 16      | 40   | 0.499   |
|                          | Female              | 21   | 52.5 | 24      | 60   |         |
| The age of cats          | >1 year             | 10   | 25   | 11      | 27.5 | 0.799   |
|                          | 0-1 year            | 30   | 75   | 29      | 72.5 |         |
| Handling of cat feces    | Cleaned             | 11   | 27.5 | 12      | 30   | 0.81    |
|                          | Not cleaned         | 29   | 72.5 | 28      | 70   |         |
| Examination of cat feces | Positive            | 12   | 30   | 2       | 5    | 0.003*  |
|                          | Negative            | 28   | 70   | 38      | 95   |         |
| Cat serum examination    | Positive            | 26   | 65   | 12      | 30   | 0.002*  |
|                          | Negative            | 14   | 35   | 28      | 70   |         |

**Table 5. Independent Variables Affecting the Incidence of Toxoplasmosis in Maternal Mothers and the Final Model of Logistic Regression**

| Variable  | OR     | p-value | 95% CI       | R <sup>2</sup> | GOF   |
|---|--------|---------|--------------|----------------|-------|
| Maternal education level  | 0.503  | 0.029   | 0.272–0.932  |                |       |
| Cats positive with toxoplasmosis by serological test                      | 5.542  | 0.003   | 1.816–16.916 | 26%            | 0.304 |
| Positive cat feces contained <i>T. gondii</i> oocysts by microscopic test | 14.153 | 0.003   | 2.523–79.394 |                |       |

Notes: OR = Odds Ratio, CI = Confidence Interval, GOF = Goodness of Fit Test

like bathing, washing, cooking, and others was obtained from the regional drinking water company (tap), wells, rivers, and springs. The four sources were grouped into two, namely, tap and non-tap sources. As much as 51.25% of the water used by the respondents was from non-tap (wells, rivers, springs) sources, and the remaining 48.75% was from the tap. *Toxoplasma sp.* infection is avoidable when the food or water consumed is free of *T. gondii* oocyst contamination. This is achievable with the habit of washing meat, vegetables, or other foodstuffs before cooking or eating them. Among the maternal women interviewed, 96.25% stated that they always wash meat, vegetables, or other food ingredients before cooking or consumption, while the remaining 3.75% have the habit of not washing them.

Table 4 shows the presence of cats in or around the house of maternal women. The presence of cats at home or around the house of the subjects in the case group indicated that 80% were feral or not kept, and it was observed to be 90% in the control group. The statistical analysis showed no significant relationship between raising cats and the incidence of toxoplasmosis in maternal women (p-value = 0.499 > α = 0.05). Most of the cats residing in and around their houses were under one year old, which was 75% in the case group and 72.5% in the control group. Statistically, the relationship between cat age and the incidence of toxoplasmosis in maternal women was not significant (p-value = 0.799 > α = 0.05).

In this study, information on handling cat feces in or around the house was also extracted; as many as 72.5% of them from the case group stated that they did not usually clean the feces. Also, 70% of maternal women from the control group stated the same behavior. The results of this study statistically did not show a significant relationship between handling cat feces and the incidence of toxoplasmosis (p-value = 0.81 > α = 0.05).

Table 5 shows the independent variables that affected the incidence of toxoplasmosis in maternal women and is the final logistic regression model. The results indicated that the level of maternal education, the presence of toxoplasmosis-positive cats evaluated by serological tests, and their feces by coproscopy, which contained *T. gondii* oocysts that contaminated the environment were risk factors for the incidence of toxoplasmosis in maternal women in Bali Province.

### Discussion

This study revealed that a difference exists between the subjects' groups based on the age of maternal women. Several studies on the relationship between age and the incidence of toxoplasmosis have been reported with various results. In Thailand, it has been reported that the highest prevalence of toxoplasmosis in pregnant women was between 20–40 years of age.<sup>35</sup> Another study conducted in Korea and China by Rai, *et al.*, discovered that the highest prevalence occurred in the age group over 40

years.<sup>36</sup> Recent report in the Wasit Province of Iraq gave the highest infection rate as 19.9% in women aged 20–29 years, but with no significant difference between the ages studied.<sup>37</sup> The results of this study and two others in Asia showed that the incidence of toxoplasmosis in pregnant women was not influenced by age.<sup>35,42</sup> This agreed with Fromont, *et al.*,<sup>38</sup> which stated that individuals are at risk of contracting toxoplasmosis throughout their lifetime. According to these findings, each age group had a high risk of toxoplasmosis infection. Therefore, early detection, prevention, and treatment programs should target all age groups.

The statistical test results in the education level variable revealed that the value of OR = 3.4, which means that maternal women who attended only elementary and junior high schools were at risk of contracting toxoplasmosis. This was about 3.4 times greater than those with sufficient education (senior high school and college graduates). The results of this study were in line with that conducted by Ferreira, *et al.*,<sup>39</sup> in which a low level of education greatly influenced the incidence of toxoplasmosis in residents of a Brazilian Amazonian village. According to the study of Lopes, *et al.*,<sup>40</sup> a relationship exists between education level and economic status on the incidence of toxoplasmosis in pregnant women in Parana, Brazil. However, this result is in contrast to that obtained from the study by Kapperud, *et al.*,<sup>41</sup> which reported that the level of education did not significantly influence (OR = 1.8, p-value = 0.08) the incidence of toxoplasmosis in pregnant women in Norway. This may be influenced by many factors, including climate, the population density of cats—especially the feral ones, sociocultural status, level of education, knowledge, and healthy living behaviors.<sup>42,43</sup> Since a low educational level contributes to an increased likelihood of being infected by toxoplasmosis, health promotion programs must aim at targeting those who have low educational levels. Their low educational levels notwithstanding, adequate knowledge related to risk and prevention behavior of toxoplasmosis transmission could reduce the risk of toxoplasmosis infections.

Miscarriage is one of the symptoms of *T. gondii* infection in pregnant women,<sup>44-46</sup> therefore, the history of this occurrence was also analyzed in this study. Generally, the results obtained indicated that 48.75% of all the participating maternal women had experienced miscarriages. In the group of those infected with *T. gondii* (cases), 80% had a positive history of a miscarriage, while in the uninfected group (control), 10.75% had such experience. This data statistically shows a very significant difference (p-value = 0.003) with an OR of 18.8, which means that those infected with *T. gondii* have nearly 19 times the risk of miscarriage compared to the uninfected ones. This study's results were much higher than

those obtained from a study conducted in Sudan by Mohamed, *et al.*,<sup>47</sup> who discovered that pregnant women who contracted toxoplasmosis had a three times greater risk of experiencing miscarriage than those who were not infected. Another study by Khurana, *et al.*,<sup>48</sup> in Sri Lanka reported that miscarriage in pregnant women was caused by *T. gondii* infection. Ekanayake and Kurukulasuriya reported that 34% to 58.5% of pregnant women in Sri Lanka that were infected experienced spontaneous abortion.<sup>49</sup> Since miscarriage occurred due to toxoplasmosis infection; health programs should promote the early detection in women, especially prior to conception. A detection conducted in late pregnancy could increase the likelihood of a miscarriage and maternal problems. Therefore, toxoplasmosis screening among all women of reproductive age is an essential priority in health programs.

The habit of washing meat and vegetables before they are processed has a significant role in preventing toxoplasmosis in humans, especially when consuming raw items.<sup>50,51</sup> The results obtained in this study indicated that 3.75% of the respondents were still in the habit of not washing before cooking. Kapperud, *et al.*,<sup>41</sup> agree that consuming raw vegetables and fruits that are dirty (not washed) causes a higher contraction rate of toxoplasmosis infection. Various studies on habit or lifestyle have been reported as risk factors for *T. gondii* infection in humans, but the reports vary by region or country.<sup>20,42,43,52</sup> This is due to the different modes of transmission of the disease, as most toxoplasmosis occurrences in urban areas in Brazil occur due to ingestion of oocysts that contaminate drinking water or vegetables.<sup>28,29</sup> Similar observations have been reported in several other developing countries such as Turkey,<sup>30</sup> Armenia, and Colombia.<sup>53</sup> In contrast, the mode of transmission of toxoplasmosis in humans in developed countries such as in Europe is mostly by consuming meat or processed products that have not been cooked completely.<sup>27</sup> Based on these findings, it is essential to promote hygienic behavior among members of the society regardless of their location in urban or rural areas, by publicizing prevention messages, especially those relating to food processing and storage, and making adequate clean water accessible along with prioritizing the provision of better sanitation facilities in the society.

As many as 85% of the respondents have both domestic and feral cats around their houses. Cat gender was balanced between the groups: 56.25% female and 43.75% male, and most of them were feral or not adequately maintained. These conditions are expected to continuously increase the population of stray cats in Bali Province, a medium for spreading toxoplasmosis.<sup>16</sup> Judging from the cats' ages, 73.75% of them were less than one year old and, when infected with *T. gondii*, there

is a likelihood of a broader and faster spread in Bali Province. In addition, cats under one year of age do not have antibodies against the parasite. Thus, they are easily infected. Tenter, *et al.*,<sup>54</sup> stated that cats less than one-year-old produce *T. gondii* oocysts in greater numbers than adult cats. Kapperud, *et al.*,<sup>41</sup> supports this observation by finding that pregnant women who have daily contact with kittens aged less than one year old are four times more likely to contract toxoplasmosis than those who do not. The existence of cats among humans is inevitable, so it is essential to prevent contamination from cat feces by controlling the population of cats. In collaboration with the local authority, communities could sterilize the cats to reduce their population. Promoting healthy pet ownership could also be an empowering approach by communities to prevent the spread of toxoplasmosis infections.

This study provided an in-depth understanding of the risk factors of toxoplasmosis infection among maternal women in Bali Province. It is noteworthy that the issue of toxoplasmosis has not been well explored in Bali Province. Therefore, this study provided recent updates relating to the status of zoonosis in Bali Province, which has hitherto been neglected but can potentially cause serious public health impacts. Although this study better comprehends the seroprevalence and risk factors of toxoplasmosis among maternal women, it can still not depict the situation in other parts of Bali Province. Furthermore, this study's sample size was small; thus, it is essential to conduct further study targeting a broader population, such as women of reproductive age from other parts of Bali Province.

### Conclusion

The proportion of oocysts and the seroprevalence of *T. gondii* in cats was 17.5% and 47.5%, respectively. A low education level and the presence of toxoplasmosis in cat feces determined by both serological and microscopic tests increase the risk of toxoplasmosis infection among pregnant women in Bali Province. In response to these findings, health prevention programs should target individuals with low educational levels and promote cleanliness and hygienic behavior. Moreover, encouraging women of reproductive age to participate in toxoplasmosis screening programs is also essential, especially to prevent the risk of miscarriage and the maternal health problems that may occur. In addition, controlling the cat population and providing better sanitation access is essential to prevent the transmission of toxoplasmosis.

### Abbreviations

*T. gondii*: *Toxoplasma gondii*; ELISA test: Enzyme-Linked Immunosorbent Assay; IgG: Gamma Immunoglobulin; CI: Confidence Interval; OR: Odds Ratio; GOF: Goodness Of Fit Test.

### Ethics Approval and Consent to Participate

Ethics approval was obtained from Griffith University Human Research Ethics Committee (GU ref no: 2019/424) and the Universitas Airlangga (ref no: 15494-KEPK). All participants gave informed written consent.

### Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

### Availability of Data and Materials

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

### Authors' Contribution

MS conceived the idea, sampling design, data collection, and analyzed and interpreted the study results. MS, NPAH, KKA performed the data collection, critically analyzed and interpreted the study results, drafted the manuscript, and submitted it. NMA, NTS, MD gave their expert opinion in the sampling design and critically analyzed the data for important intellectual content. KKA and SGP gave her input in the manuscript drafting.

### Acknowledgment

The authors would like to express the gratitude to the Rector of Udayana University for the funding and support to this study.

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# Are We Passing on Violence to the Next Generation?: Gender Norms and Gender-based Violence Attitudes among Early Adolescents in Indonesia

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## Abstract

Intensification of gender norms during puberty affects adolescents' perceptions and behavior related to violence. This study examined the association between gender norms and gender-based violence (GBV) among early adolescents considering socio-ecological variables using cross-sectional data from 3,618 Indonesian Global Early Adolescent Study pupils. Chi-square tests with simple and multiple logistic regression analyses examined how different factors' levels predict GBV. Among boys, GBV attitudes were found high (53%). Furthermore, they also had high heteronormative expectations, threatened feelings, experiences of violence, porn access, and 5+ adverse childhood experiences (ACEs). Logistic regression results revealed that adolescent boys having one or two scores of gender norms at the above-median are 1.3 times more likely to commit GBV and even 2.2 times higher if all were above median [AOR (CI) = 1.3 (1.1-1.6); 2.2 (1.7-2.8)], respectively. Boys, having 5+ ACEs, and stronger endorsement on heteronormative relationships were also more likely to commit GBV [AOR (CI) = 1.5 (1.3-1.7); 1.5 (1.2-1.9); 1.5 (1.3-1.7)], respectively. This research concluded that unequal gender norms intensified during puberty strongly correlate to attitudes towards GBV among early adolescents. Strengthening the individual aspects by providing a more conducive environment, such as comprehensive sexual education at school, is essential to prevent GBV.

**Keywords:** adolescent health, adverse childhood experiences, gender-based violence, gender norms

## Introduction

The high prevalence and long-term health consequences of gender-based violence (GBV), especially violence against women and girls, make it an important public health problem and a violation of human rights. The World Health Organization (WHO) called violence against women and girls "A global health problem of epidemic proportions." While individual and family-level factors have been identified to affect GBV victimization and perpetration, the social contexts that endorse gender inequality, stereotypical gender norms, and rigid gender roles are recognized to perpetuate such violence strongly.<sup>1,2</sup>

Children are socialized from birth on gender-related norms, rules, and expectations by their family, peers, community members, and media. Distinct gender attitudes have formed in early adolescence and may begin to influence adolescents' behavior during social interactions or in an interpersonal relationship.<sup>3</sup> As maturing into adolescence and adulthood, young people often assume

and reinforce rigid and unequal gender norms and roles, creating a social power imbalance and justification for GBV.

Both girls and boys are negatively affected by unequal gender norms. Since childhood, many young people have been subjected to bullying, physical and emotional violence, and abuse by their parents, other family members, teachers, and peers. Boys are more often exposed to health risks and violence due to pressure to conform to negative masculinity ideals such as the social promotion of dominance and aggression.<sup>4,5</sup> On the other hand, girls are threatened by specific forms of violence such as sexual coercion, female genital mutilation, and forced marriage.<sup>6</sup>

The study on GBV in early adolescence in Indonesia is still scarce; most of the studies are small with limited geographic representation.<sup>5</sup> Regarding the prevalence of bullying, the 2015 Global School-based Student Health Survey, a nationally representative survey of 13-15 years old students, estimated that 24% of male students and

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Received : October 19, 2020  
Accepted : May 06, 2021  
Published : November 29, 2021

19% of female students were bullied in one or more days during the 30 days before the survey; and 36% of male students and 13% of female students were in a physical fight in the last 12 months. The same survey estimated that 5% of boys and 3% of girls have ever been teased or harassed sexually in the last 30 days, and 5% of boys and 3.5% of girls have ever experienced forced sexual intercourse.<sup>7,8</sup>

A study by Plan International among students in grades 6-8 in Jakarta City and Serang District, Indonesia, found that 21% of boys and 17% of girls reported experiencing sexual violence (e.g., suffered sexual comments/whistled, showed sexual photo/video, touched body/kissed/fondled/asked for these acts) at school in the last six months.<sup>9</sup> The study examined the association between the perpetration of any form of violence and attitudes towards gender norms and experiences of violence, revealed no difference in the odds of perpetrating violence between those with high attitudes and those with low/moderate attitudes.<sup>9</sup> The complex and interrelated factors that drive sexual abuse and GBV are presented using a social-ecological framework, which identifies the factors at individual, family, peer, and community levels. This study examined the extent and correlates of GBV in early adolescence in Indonesia, particularly focusing on the effect of attitudes toward gender norms and roles on GBV attitudes by adjusting for other socio-ecological factors (individual, family, peer, and community).

## Method

This study was a cross-sectional study using The Global Early Adolescent Study (GEAS-Indonesia) baseline data among students in grade 7 in three cities; Semarang, Denpasar, and Bandar Lampung. This study was a longitudinal cohort follow-up and quasi-experimental study to explore gender norms and health in early adolescence. GEAS-Indonesia is adapted for impact evaluation of the discovery learning process by exploring gender norms and healthy sexuality among early adolescents 10-14 years of age. This project aimed to explore what young adolescents feel, believe, and perceive concerning their bodies and emerging sexuality. The GEAS-Indonesia survey measure comprises three cross-cultural components: a 10-module health instrument, a vignettes-based measure of gender equality, and an assessment of gender norms. Together, these instruments assess a range of socio-ecological influences at the family, peer, school, and neighborhood level in addition to behaviors and outcomes related to adolescent health and well-being, including school retention, adolescent empowerment; violence, and adverse experiences; mental health, sexuality, and sexual health. Further details about this research could be found at <https://www.geastudy.org/>.

This study used all samples collected by GEAS-

Indonesia, which was conducted in three sites: Semarang (Central Java Province, n = 1,318), Denpasar (Bali Province, n = 1,484), and Bandar Lampung (Lampung Province, n = 816). It was proposed to get a clear and diverse description of the growing up process among adolescents based on three different social contexts. There are substantial differences between the three sites in cultural-religious influence (i.e., more conservative Islamic society in Sumatra than Java and a more open Hindu culture in Bali) and the impact of globalization (modern media, online communities, access to entertainment, and tourism).

Gender norms as the independent variable were created by three groups of questions related to sexual double standards, stereotypical gender roles, and traits. They were summarized in a measure ranging from 1 to 5. Adolescents of 10-14 years old gave responses for each of the questions using a 5-point Likert scale. First, the group of sexual double standard questions was suggestive of differential values assigned to boys' versus girls' romantic involvement. Such values encourage boys to have relationships to gain social status while restraining girls who risk their social reputation by engaging in early sexual relationships (Median = 2.77). The second group concerned stereotypical gender traits, which were examined in a series of questions contrasting boys' toughness with girls' vulnerabilities (Median = 3.89). Last, the group of questions related to stereotypical gender roles contained a series of items portraying the division of gender roles and male authority in the household (Median = 4). Total scores for each group of questions were summarized and categorized into a binary scale which included upper the median and under the median. Upper median scores indicated stronger endorsement on traditional gender norms, while under median scores indicated less endorsement. The final step involved categorizing all responses into one overall score: 1 = all under median, 2 = one or two upper medians, and 3 = all upper median. Attitudes toward GBV as the main dependent variable was measured using adolescent reports concerning sanctions for challenging the normative gender roles contained in two questions which are "Is it okay to tease a girl who acts like a boy?" (Median = 2), and "Is it okay to tease a boy who acts like a girl?" (Median = 3). Afterward, those questions were converted into scores and categorized into under median and upper median.

The main predictor at the individual level, type of sex, was categorized as binary data consisting of boys and girls. At the same time, age was respondent's current age at last birthday, which is categorized into <12 years old, 12 years old, and >12 years old. Pubertal status was collected by asking whether respondents had ever got wet dreams or menstruation (categorized as Yes and No). Experience of watching pornography was categorized as

Yes and No. Adverse childhood experiences (ACEs) were collected through a series of questions related to stressful or traumatic experiences, including violence, neglect, family dysfunction, domestic violence, and family drug abuse which were categorized into “Never,” “1-2 experiences,” “3-4 experiences,” and “5 or more experiences.” There were four statements related to the perceived acceptability of heteronormative romantic relationships during adolescents. The four statements were combined into a single indicator averaging responses to the four questions and then categorized into upper and under the median.

Parent-child closeness was examined through child perceptions on how comfortable they talked with their caregiver, which was responded to by “1 = Don't care at all” and “2 = Don't really care” categorized as No, “3 = Somewhat care” and “4 = Very much care” categorized as Yes. Parental awareness was collected through adolescent perceptions of whether parents know their school achievement, the name of friends, and where they went when going out. The responses were varied with “Very true” and “Somewhat true” categorized as Yes, and “Not true” and “Absolutely not true” categorized as No. Those who responded Yes for all items were categorized as Yes for parental awareness and the rest as No. The wealth index is a composite measure of household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities which are then divided into five quintiles that represent very poor, poor, middle-income, rich, and very rich. Family structure is the parent's current married situation divided into complete/both parents, mother only, father only, and other. Siblings are adolescents' siblings, categorized as having no siblings, male-only, female-only, and both sexes.

Predictors at the peer and community levels consist of average time spent with friends last week, categorized as “no time,” “1-2 times a week,” “3-4 times a week,” and “almost every day.” At the same time, social control was measured through adolescent perceptions of whether people around them would intervene if they did vandalism, broke the property, bullying, and/or fought with others. Those who responded with “Very true” and “Somewhat true” for all questions were categorized as Yes, and the rest as No. Similar categories were also used for social cohesion, which was collected through a series of questions regarding pupils' perceptions of whether people know their names, take care of each other, care about them, and be trusted. Perceptions of safety in the community and at school and access to social media were collected in two responses, Yes and No. The last question was about the time spent on social media regularly for any purposes categorized into “less than or equal to 2 hours” and “more than 2 hours.”

This study involved questions with no more than a minimal risk level. In other words, this study provided minimal risk for respondents because it was observational. The respondents filled out the questionnaires independently so that the principles of confidentiality and volunteerism were guaranteed. Participants completed a self-filled questionnaire on sensitive topics, including issues related to their sexual and romantic experiences, which might make some participants uncomfortable. The trained data collectors assisted how to complete an electronic questionnaire and reminded participants that they had the right to stop anytime if they experienced discomfort. A referral system was offered and provided for all respondents who needed it.

This analysis was conducted with descriptive statistics to determine the distribution of the data by looking at the proportion of each group in each predictor. The type of predictors was classified based on the socio-ecological levels such as individual, family, peer, and community. The results are presented as frequency tables. Inferential analysis using Chi-square tests was used in bivariable analysis to examine the proportional difference of GBV according to specific predictors. In contrast, simple and multiple logistic regression tests were used to examine how different the levels of predictors predicted and influenced gender norms' correlation to GBV attitudes. At the individual level, the correlation was adjusted by sex, age, pubertal status, heteronormative perception, experience accessing porn, violence, and ACEs. Family level modeling was considered with parent-child closeness and awareness, wealth index, family structure, and the number of siblings. Child perceptions on social cohesion and control, experience feeling threatened at school and neighborhood, access to social media and time spent were included at the environment level. The Akaike information criterion (AIC), a mathematical method for evaluating how well a model fits the data, was generated from the results and was measured to determine parsimonious models. As described above, in this study, five models/levels of predictor (individual; family; peer; school, community, and social media; and total model) were developed. AIC was used to determine which model best explained the relationship of independent and dependent variables. The lowest number of AIC determined the best or parsimonious model. All tests used STATA 15 (Serial number: 401506209499) with a 95% confidence interval (CI) and significance of  $p$ -value < 0.05.

## Results

There were 4,684 students (2,207 boys and 2,477 girls) who consented to participate in the GEAS-Indonesia baseline and completed the interview. However, due to the inclusion criteria, the “don't know” and “don't want to answer” responses and any missing

data in the selected variables of this study were dropped from the dataset. The final data of 3,618 students (1,626 boys and 1,992 girls) were included in the analysis.

The analysis revealed that the proportion of boys was significantly higher in perceiving GBV than girls (Table

1). Simple logistic regression analysis indicated that boys were found 1.9 times higher in the group who had high GBV attitudes (OR = 1.9; 95% CI = 1.6-2.1) (Table 2). In addition, the adolescents aged 12 years old had the highest proportion of endorsing the GBV attitudes (Table

**Table 1. Distribution of Gender-based Violence Attitudes and Their Association with other Domains of Early Adolescent Health**

| Level                      | Variable                             | Category                 | Gender-Based Violence Attitude |              | p-value*     |        |
|----------------------------|--------------------------------------|--------------------------|--------------------------------|--------------|--------------|--------|
|                            |                                      |                          | Under Median                   | Upper Median |              |        |
|                            |                                      |                          | n (%)                          | n (%)        |              |        |
| Total                      |                                      |                          | 1,956 (54.1)                   | 1,662 (45.9) |              |        |
|                            | Gender norms                         | All below median         | 444 (22.7)                     | 253 (14.0)   | <0.001       |        |
|                            |                                      | One or two above median  | 1,278 (65.3)                   | 1,040 (62.6) |              |        |
| Individual                 | Sex                                  | All above median         | 234 (12.0)                     | 389 (23.4)   | <0.001       |        |
|                            |                                      | Boy                      | 742 (37.9)                     | 884 (53.2)   |              |        |
|                            |                                      | Girl                     | 1,214 (62.1)                   | 778 (46.8)   | 0.030        |        |
|                            | Age                                  | <12 years old            | 122 (6.2)                      | 76 (4.6)     |              |        |
|                            |                                      | 12 years old             | 1,428 (73.0)                   | 1,201 (72.3) |              |        |
|                            |                                      | >12 years old            | 406 (20.8)                     | 385 (23.2)   | 0.309        |        |
|                            | Pubertal status                      | No                       | 879 (44.9)                     | 775 (46.6)   |              |        |
|                            |                                      | Yes                      | 1,077 (55.1)                   | 887 (53.4)   |              |        |
|                            |                                      | Ever watched pornography | No                             | 1,672 (85.5) | 1,289 (77.6) | <0.001 |
|                            |                                      |                          | Yes                            | 284 (14.5)   | 373 (22.4)   |        |
|                            | Adverse childhood experiences (ACEs) | Never                    | 392 (20.0)                     | 276 (16.6)   | <0.001       |        |
|                            |                                      | 1-2 experiences          | 717 (36.7)                     | 481 (28.9)   |              |        |
|                            |                                      | 3-4 experiences          | 521 (26.6)                     | 430 (25.9)   |              |        |
|                            |                                      | 5 or more experiences    | 326 (16.7)                     | 475 (28.6)   |              |        |
|                            | Violence experiences                 | No                       | 974 (49.8)                     | 699 (42.1)   | <0.001       |        |
|                            |                                      | Yes                      | 982 (50.2)                     | 963 (57.9)   |              |        |
|                            | Heteronormative expectations         | Under median             | 1,175 (60.1)                   | 707 (42.5)   | <0.001       |        |
|                            |                                      | Upper median             | 781 (39.9)                     | 955 (57.5)   |              |        |
| Family                     | Parent-child closeness               | No                       | 687 (35.1)                     | 649 (39.0)   | 0.015        |        |
|                            |                                      | Yes                      | 1,269 (64.9)                   | 1,013 (61.0) |              |        |
|                            | Parental awareness                   | No                       | 665 (34.0)                     | 623 (37.5)   | 0.029        |        |
|                            |                                      | Yes                      | 1,291 (66.0)                   | 1,039 (62.5) |              |        |
|                            | Wealth index                         | Very poor                | 375 (19.2)                     | 339 (20.4)   | 0.769        |        |
|                            |                                      | Poor                     | 373 (19.1)                     | 314 (18.9)   |              |        |
|                            |                                      | Middle                   | 387 (19.8)                     | 335 (20.2)   |              |        |
|                            |                                      | Rich                     | 451 (23.1)                     | 384 (23.1)   |              |        |
|                            |                                      | Very rich                | 370 (18.9)                     | 290 (17.4)   |              |        |
|                            | Family structure                     | Both parent              | 1,763 (90.1)                   | 1,506 (90.6) | 0.799        |        |
| Mother only                |                                      | 121 (6.2)                | 93 (5.6)                       |              |              |        |
| Father only                |                                      | 44 (2.3)                 | 35 (2.1)                       |              |              |        |
| Other                      |                                      | 28 (1.4)                 | 28 (1.7)                       |              |              |        |
| Have siblings              | No sibling                           | 167 (8.5)                | 123 (7.4)                      | 0.002        |              |        |
|                            | Male sibling only                    | 517 (26.4)               | 413 (24.9)                     |              |              |        |
|                            | Female sibling only                  | 389 (19.9)               | 276 (16.6)                     |              |              |        |
|                            | Both male and female                 | 883 (45.1)               | 850 (51.1)                     |              |              |        |
| Peer                       | Average time spent with friends      | No time                  | 163 (8.3)                      | 125 (7.5)    | 0.010        |        |
|                            |                                      | 1-2 times a week         | 955 (48.8)                     | 737 (44.3)   |              |        |
|                            |                                      | 3-4 times a week         | 191 (9.8)                      | 188 (11.3)   |              |        |
|                            |                                      | Almost every day         | 647 (33.1)                     | 612 (36.8)   |              |        |
| Community                  | Social control                       | Under median             | 772 (35.9)                     | 744 (43.6)   | <0.001       |        |
|                            |                                      | Upper median             | 1,381 (64.1)                   | 963 (56.4)   |              |        |
|                            | Social cohesion                      | No                       | 745 (38.1)                     | 626 (37.7)   | 0.794        |        |
|                            |                                      | Yes                      | 1,211 (61.9)                   | 1,036 (62.3) |              |        |
|                            | Feeling threatened in community      | No                       | 1,427 (73.0)                   | 1,155 (69.5) | 0.022        |        |
|                            |                                      | Yes                      | 529 (27.0)                     | 507 (30.5)   |              |        |
|                            | Feeling threatened at school         | No                       | 1,640 (83.8)                   | 1,309 (78.8) | <0.001       |        |
|                            |                                      | Yes                      | 316 (16.2)                     | 353 (21.2)   |              |        |
|                            | Access to social media               | No                       | 153 (7.8)                      | 109 (6.6)    | 0.144        |        |
|                            |                                      | Yes                      | 1,803 (92.2)                   | 1,533 (93.4) |              |        |
| Time spent on social media | ≤2 hours                             | 1,357 (69.4)             | 1,179 (70.9)                   | 0.306        |              |        |
|                            | >2 hours                             | 599 (30.6)               | 483 (29.1)                     |              |              |        |

Notes: Median of Social Control, \*Chi-square analysis (α = 0.05)

1). There is a trend of the odds ratio (OR) association between age groups and GBV attitudes. The OR tended to increase with the increase in age (Table 2). However, the pubertal experiences did not develop with the GBV attitude in both the Chi-square tests and simple logistic regression analysis (Table 1 and Table 2).

Table 1 shows that adolescents who had any violent experiences also had a higher proportion in endorsing GBV. The same pattern was found among those who had

ACEs, and the proportion approximately increased when adolescents experienced more ACEs. There was a probability of finding adolescents who had the high endorsement of GBV, which was 1.4 times higher in the group who had experienced any violence; moreover, it was about two times higher in groups who had experienced five or more ACEs (Table 2). On the contrary, those who felt threatened at school and community had a lower GBV attitude (Table 1). However, the simple logistic re-

Table 2. Multivariable Analysis of Association between Gender-based Violence Attitudes and Multiple Domains in Early Adolescent Health

| Variable                                    | Null model (Unadjusted) OR (95% CI) | Individual Model OR (95% CI) | Family Model OR (95% CI) | Peer Model OR (95% CI) | Community, School, and Social Media Model OR (95% CI) | Total Model OR (95% CI) |
|---|-------------------------------------|------------------------------|--------------------------|------------------------|---|-------------------------|
| <b>Gender norms</b>                         |                                     |                              |                          |                        |   |                         |
| All below median                            | Ref                                 | Ref                          | Ref                      | Ref                    | Ref   | Ref                     |
| One or two above median                     | 1.6 (1.3-1.9)***                    | 1.3 (1.1-1.6)**              | 1.6 (1.3-1.9)***         | 1.5 (1.3-1.8)***       | 1.5 (1.3-1.9)***                                      | 1.3 (1.1-1.6)**         |
| All above median                            | 3.2 (2.5-4.0)***                    | 2.2 (1.7-2.8)***             | 3.2 (2.5-4.0)***         | 3.1 (2.5-3.9)***       | 3.1 (2.5-3.9)***                                      | 2.3 (1.8-2.9)***        |
| <b>Sex</b>                                  |                                     |                              |                          |                        |   |                         |
| Boy   | 1.9 (1.6-2.1)***                    | 1.5 (1.3-1.7)***             |                          |                        |   | Ref                     |
| Girl  | Ref                                 | Ref                          |                          |                        |   | 1.5 (1.2-1.7)***        |
| <b>Age</b>                                  |                                     |                              |                          |                        |   |                         |
| <12 years old                               | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| 12 years old                                | 1.3 (1.0-1.8)*                      | 0.8 (0.6-1.0)                |                          |                        |   | 0.7 (0.5-1.0)           |
| >12 years old                               | 1.5 (1.1-2.1)**                     | 1.0 (0.8-1.2)                |                          |                        |   | 1.0 (0.8-1.2)           |
| <b>Pubertal status</b>                      |                                     |                              |                          |                        |   |                         |
| No  | 1.1 (0.9-1.2)                       | 1.1 (0.9-1.2)                |                          |                        |   | 1.0 (0.9-1.2)           |
| Yes   | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| <b>Ever watched pornography</b>             |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| Yes   | 1.7 (1.4-2.0)***                    | 1.1 (0.9-1.3)                |                          |                        |   | 1.1 (0.9-1.3)           |
| <b>Adverse childhood experiences (ACES)</b> |                                     |                              |                          |                        |   |                         |
| Never                                       | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| 1-2 experiences                             | 0.9 (0.8-1.2)                       | 0.9 (0.7-1.1)                |                          |                        |   | 0.9 (0.7-1.1)           |
| 3-4 experiences                             | 1.2 (1.0-1.4)                       | 1.0 (0.8-1.3)                |                          |                        |   | 1.0 (0.8-1.2)           |
| 5 or more experiences                       | 2.1 (1.7-2.5)***                    | 1.5 (1.2-1.9)**              |                          |                        |   | 1.4 (1.1-1.8)**         |
| <b>Violence experiences</b>                 |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| Yes   | 1.4 (1.2-1.6)***                    | 1.1 (0.9-1.2)                |                          |                        |   | 1.0 (0.9-1.2)           |
| <b>Heteronormative expectation</b>          |                                     |                              |                          |                        |   |                         |
| Under median                                | Ref                                 | Ref                          |                          |                        |   | Ref                     |
| Upper median                                | 2.0 (1.8-2.3)***                    | 1.5 (1.3-1.7)***             |                          |                        |   | 1.5 (1.3-1.7)***        |
| <b>Parent-adolescent closeness</b>          |                                     |                              |                          |                        |   |                         |
| No  | 1.2 (1.0-1.3)**                     |                              | 1.2 (1.0-1.3)*           |                        |   | 1.1 (0.9-1.3)           |
| Yes   | Ref                                 |                              | Ref                      |                        |   | Ref                     |
| <b>Parental awareness</b>                   |                                     |                              |                          |                        |   |                         |
| No  | 1.2 (1.0-1.3)*                      |                              | 1.2 (1.0-1.3)*           |                        |   | 1.1 (0.9-1.2)           |
| Yes   | Ref                                 |                              | Ref                      |                        |   | Ref                     |
| <b>Wealth index</b>                         |                                     |                              |                          |                        |   |                         |
| Very poor                                   | 1.1 (0.9-1.4)                       |                              | 1.1 (0.9-1.4)            |                        |   | 1.1 (0.9-1.4)           |
| Poor  | 1.1 (0.9-1.3)                       |                              | 1.0 (0.8-1.3)            |                        |   | 1.0 (0.8-1.3)           |
| Middle                                      | 1.1 (0.9-1.4)                       |                              | 1.1 (0.9-1.4)            |                        |   | 1.1 (0.9-1.3)           |
| Rich  | 1.1 (0.9-1.3)                       |                              | 1.1 (0.9-1.3)            |                        |   | 1.1 (0.9-1.3)           |
| Very rich                                   | Ref                                 |                              | Ref                      |                        |   | Ref                     |
| <b>Family structure</b>                     |                                     |                              |                          |                        |   |                         |
| Both parent                                 | 1.1 (0.8-1.5)                       |                              | 1.1 (0.8-1.5)            |                        |   | 1.2 (0.9-1.6)           |
| Mother only                                 | Ref                                 |                              | Ref                      |                        |   | Ref                     |
| Father only                                 | 1.0 (0.6-1.7)                       |                              | 1.1 (0.6-1.8)            |                        |   | 1.0 (0.6-1.7)           |
| Other                                       | 1.3 (0.7-2.3)                       |                              | 1.3 (0.7-2.4)            |                        |   | 1.4 (0.8-2.6)           |
| <b>Have siblings</b>                        |                                     |                              |                          |                        |   |                         |
| No sibling                                  | 1.0 (0.8-1.4)                       |                              | 1.0 (0.8-1.4)            |                        |   | 1.0 (0.8-1.4)           |
| Male sibling only                           | 1.1 (0.9-1.4)                       |                              | 1.2 (0.9-1.4)            |                        |   | 1.1 (0.9-1.3)           |
| Female sibling only                         | Ref                                 |                              | Ref                      |                        |   | Ref                     |
| Both male and female                        | 1.4 (1.1-1.6)**                     |                              | 1.3 (1.1-1.6)**          |                        |   | 1.2 (1.0-1.4)           |
| <b>Average time spent with friends</b>      |                                     |                              |                          |                        |   |                         |
| No time                                     | Ref                                 |                              |                          | Ref                    |   | Ref                     |
| 1-2 times a week                            | 1.0 (0.8-1.3)                       |                              |                          | 1.0 (0.8-1.3)          |   | 1.0 (0.7-1.2)           |
| 3-4 times a week                            | 1.3 (0.9-1.7)                       |                              |                          | 1.2 (0.9-1.7)          |   | 1.1 (0.8-1.6)           |
| Almost every day                            | 1.2 (0.9-1.6)                       |                              |                          | 1.2 (0.9-1.5)          |   | 1.0 (0.7-1.2)           |
| <b>Social control</b>                       |                                     |                              |                          |                        |   |                         |
| Under median                                | 1.4 (1.2-1.6)***                    |                              |                          |                        | 1.4 (1.2-1.6)***                                      | 1.3 (1.2-1.5)***        |
| Upper median                                | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| <b>Social cohesion</b>                      |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| Yes   | 1.0 (0.9-1.2)                       |                              |                          |                        | 1.0 (0.8-1.1)   | 1.0 (0.8-1.1)           |
| <b>Feeling threatened in community</b>      |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| Yes   | 1.2 (1.0-1.4)*                      |                              |                          |                        | 1.1 (1.0-1.3)   | 1.0 (0.9-1.2)           |
| <b>Feeling threatened at school</b>         |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| Yes   | 1.4 (1.2-1.7)***                    |                              |                          |                        | 1.4 (1.1-1.6)***                                      | 1.2 (1.0-1.4)*          |
| <b>Access to social media</b>               |                                     |                              |                          |                        |   |                         |
| No  | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| Yes   | 1.2 (0.9-1.6)                       |                              |                          |                        | 1.2 (0.9-1.6)   | 1.3 (0.9-1.7)           |
| <b>Time spent on social media</b>           |                                     |                              |                          |                        |   |                         |
| ≤2 hours                                    | Ref                                 |                              |                          |                        | Ref   | Ref                     |
| >2 hours                                    | 0.9 (0.8-1.1)                       |                              |                          |                        | 0.9 (0.8-1.1)   | 0.9 (0.8-1.1)           |
| AIC   |                                     | 4759.2                       | 4890.7                   | 4890.2                 | 4857.5  | 4763.8                  |

Notes: \*\*\*p-value < 0.001; \*\*p-value < 0.01; \*p-value < 0.05

gression analysis revealed that for adolescents who had the high endorsement of GBV, there were 1.4 and 1.2 times higher probability found in the group of those who felt threatened at school and their community, respectively (Table 2).

Access and time spent using social media were not significantly associated with GBV attitude in the two types of analysis. However, experience in watching porn was strongly and significantly correlated (Table 1 and Table 2). Those who said they have not watched porn intentionally or not ever had a lower proportion in endorsing GBV (Table 1). It was significantly proved that there was a 1.7 times higher probability of finding adolescents who had the high endorsement of GBV in the group of those who had ever watched porn than those who had never (Table 2). The expectations of heteronormative relationships were also significantly associated with the GBV attitude among early adolescents (Table 1 and Table 2). If they had a high proportion of endorsement of the heteronormative expectations, the proportion of endorsing GBV was also increased (Table 1). The simple logistic regression analysis revealed that in the group of those who had high expectations of a heteronormative relationship, there were two times higher probability of finding adolescents who had the high endorsement of GBV (Table 2).

At the family level, the closeness and awareness of their parents, based on adolescents' recognition, were significantly associated with GBV attitude, as were the existence of siblings in the household (Table 1). There was a 1.2 times higher probability to find adolescents who had the high endorsement of GBV in the group of those who recognized no parental closeness and awareness (Table 2). Furthermore, the existence of both male and female siblings increased the probability 1.4 times higher to find adolescents who had the high endorsement of GBV, compared to those who had no sibling or had male or female siblings only in the household (Table 2).

At the peer and community level, only the variables of social control and time spent with friends were significantly correlated with GBV attitudes using Chi-square tests (Table 1). However, only social control was still substantial after using the analysis of simple logistic regression analysis. Those who felt that they had low social control in their community were 1.4 times more likely found in the group who had the high endorsement of GBV (OR = 1.4; 95% CI = 1.2-1.6) (Table 2).

Analysis of the main variables revealed that adolescents who had the high endorsement of GBV mainly were boys who had one or two scores of gender norms below its median (63%). However, the proportion of those who had scored at all above median was about 1.7 higher than those who were at all below median, and the result was significant (Table 1). This finding means that the per-

ceived GBV among early adolescents is increased if they had the highest endorsement of gender norms; moreover, it is even higher if they at least have one score of gender norms above the median. It could be said that if adolescents have a strong endorsement of at least one type of gender norms, e.g., sexual double standard, stereotyped gender traits, and stereotyped gender roles, they will have a higher probability of having a solid endorsement of GBV. This finding was also supported by the simple logistic regression analysis results that indicated a 1.6 times higher probability of finding adolescents who had the high endorsement of GBV in the group of those who had one or two scores of gender norms below the median. In comparison, the probability increased by 3.2 (two times higher than before) to find those particular adolescents in the group who had a score of all gender norms above the median (Table 2).

Five models were created based on the social-ecological variables included in this study. All models were proposed to predict the relationship of GBV attitudes and gender norms in different levels of other predictors. Those were: (1) individual model (sex, age groups, pubertal experiences, ever watched porn, ACEs, violence experiences, and heteronormative expectation); (2) family model (parental closeness, parental awareness, wealth index, family structure, and have siblings); (3) peer model (time spent with friends); (4) community, school and social media model (social control, social cohesion, feeling threatened in community, feeling threatened at school, access to social media and time spent on social media); (5) total model that combined all of the variables contained in models 1 to 4. Parsimonious or the best prediction model was chosen between those models by using the AIC through multiple or multivariable logistic regression analyses. Finally, the individual model was selected as a parsimonious model since it had the lowest score of AIC.

As shown in Table 2, after considering variables on the individual model, it could be indicated that the OR of the association of GBV attitude and gender norms decreased, but it was still significant. There was a 1.3 times higher probability of finding adolescents who had high GBV attitudes in the group of those who had one or two scores of gender norms at under median (Adjusted OR (AOR) = 1.3; 95% CI = 1.1-1.6). A higher probability (2.2 times higher) was also indicated among those particular adolescents in the group whose gender scores were all at above median (AOR = 2.2; 95% CI = 1.7-2.8). This finding means that the probability of endorsing GBV will increase if the gender norms score increases. On the other hand, a strong endorsement of sexual double standards, stereotypical gender traits, and roles led adolescents to perceive strong GBV as well.

Other variables that were still significant in the mul-

tivariable analysis were sex, ACEs, and heteronormative expectations. Those three variables had the same probability, which was 1.5 times higher to find adolescents who had high GBV attitude in the group of those who were boys (AOR = 1.5; 95% CI = 1.3-1.7), have experienced five or more ACEs (AOR = 1.5; 95% CI = 1.2-1.9) and had a stronger endorsement on the heteronormative relationship (AOR = 1.5; 95% CI = 1.3-1.7) (Table 2).

## Discussion

This study found that GBV attitudes have a strong association with gender norms. Results showed that the more adolescents have negative perceptions of gender norms, the higher the probability of endorsing GBV attitudes. Based on these findings, it is important to provide proper socialization about gender norms, such as implementing comprehensive sexuality education, which would potentially build a more conducive environment for adolescents to develop a more positive attitude related to gender.

Realization of the importance of gender norms socialization comes from social standards that reflect gender inequality, affecting several aspects of human life, including individual, family, peer, and community experiences. Study indicated that men and boys are the main perpetrators of GBV, while girls and women mostly become the victims. It is understood that gender equality does not mean that men and women are the same or that differences do not exist. However, while they are physically different, their needs and contributions should be valued equally, unconstrained by stereotypes and prejudices. For example, based on equal human rights, gender equality will allow both men and women (as well as adolescents) equal access to social goods, services, opportunities, education, and resources, regardless of gender.<sup>1,10</sup>

Over the last five decades, both women and men worldwide have been more likely to endorse egalitarian gender-role attitudes than people in the past.<sup>1</sup> This trend leads to the increase in the general human and economic development because women are becoming more empowered, such as having a higher presence in the public sphere (e.g., in paid work, higher education), with increased roles in self-decision making concerning birth control, and family size.<sup>1,10</sup> This trend demonstrates that gender-role attitudes among the community could lead to gender equality and positively impact the community itself. Unfortunately, not all people and communities fully understand gender equality because the socialization of gender norms that they receive might be full of stereotypes and prejudices, which make the position of one gender higher than the other in every single aspect of life. The disparities of perceived gender roles among community members cannot be avoided as the main causes of GBV, and again primarily, women and girls are among

the most vulnerable and disadvantaged.<sup>1,10</sup>

In the context of Indonesian culture, especially in the three data collection sites, which were Semarang, Denpasar, and Bandar Lampung City, the patrilineal system upholds that being a man or having a son is a privileged position because he is expected to be the family's successor socially, culturally, and economically. Since they were born, boys are taught that men need to be strong leaders, and women must follow their orders. This type of GBV introduces unfair subordination because the aspirations of women do not matter. At the same time, a man's needs must be fulfilled, for example, the need for education, where women will face many barriers from family and community to engage in it, compared to men, which further affects women's lack of independence. Since they are less educated, they have lower power and authority in the family and community, even deciding about their own body, such as choosing family planning methods, seeking qualified health services, as well as for deciding what source of food they may consume. This neglect may lead to the low status of the women's health.<sup>1,11</sup>

Besides subordination, perceived conservative gender norms could also bring other impacts, including GBV. Due to its persistent prevalence, GBV is still an important and global public health issue faced by many girls and women. It is projected that one in three women globally will face some form of abuse or violence in their childhood, adolescence, or adulthood, which brings acute and chronic impacts on women's health.<sup>1,12,13</sup> This study discovered that gender norms were strongly associated with GBV attitudes after considering other socio-ecological predictors. It was shown that the individual model, which contains the personal type of predictors, was the most proper model to predict the association between those variables. It could be said that individual variables are the proximal predictors that might directly affect adolescents to perceive, experience, and endorse GBV.

The link between gender inequality and gender-role attitudes is commonly found in adolescents since they are strongly formed in this stage of age. The high endorsement of GBV among young adolescents could affect how they act and react regarding certain issues related to gender traits and roles. Among their peers, some studies also indicated that the GBV attitudes followed by actions might stay with them until adulthood.<sup>1,3</sup> One of the examples is the perpetration of intimate partner violence (IPV).<sup>1</sup> The results of a study conducted by McCarthy, *et al.*,<sup>14</sup> suggested that acceptance of violence against women or beliefs about the sexual entitlement of men were most consistently associated with IPV perpetration.

As expected, men are revealed to be more accepting of traditional gender norms than women. It is also shown in this study. This study found that boys have a higher

probability of being found in the adolescent group with a high endorsement of GBV. Several studies also indicated that gender norms that lead to GBV attitudes were varied by gender. Injunctive attitudes toward gender norms could synergistically increase the risk of violence perpetration, especially among adolescents.<sup>1,15</sup> Other studies revealed that boys who endorsed gender role discrepancy and experienced the associated stress generally had a greater risk of engaging in sexually violent actions.<sup>1,16</sup> In other words, boys who had stressful experiences about being perceived as sub-masculine, as a means of demonstrating their masculinity to self or others, might be more likely to engage in sexual violence.

Swapping the gender of boys and girls is not a scientifically feasible solution to solve the problems of how the boys behave and make them more understanding. Rather than that, it is better to encourage the development of mindsets and perceptions that are more open and accepting of the concept of gender equality. Involving them in prevention actions is one of the possible answers. If they are aware of the impact of inequality in gender attitudes for both genders, they might be more capable of choosing non-violence in their actions. The results of the study conducted by Nagamatsu, *et al.*, concluded that the more knowledge a person has about equal and positive gender relationships, the greater ability they have to recognize the signs of violence.<sup>1,17</sup> It means that if gender equality wanted to be implemented appropriately, empower not only women/girls but also involve men/boys in all related programs. Numerous health organizations highlight engaging men and boys in preventing violence against women as a potentially impactful public health prevention strategy.<sup>1,18</sup>

This study also indicated that adolescents who have experienced five or more ACEs had a greater probability of being found in the group of adolescents with high GBV attitudes. Similar results were reported in a study by Yount, *et al.*,<sup>19</sup> that found men who had more childhood exposure to violence were more likely to perpetrate violence. It could be said that violence perpetration could be triggered by childhood experiences related to violence and other inappropriate circumstances. Even though in this study, the variable of violence experience was not significantly associated with GBV attitudes, and ACEs are not identical to violence, however, with the support of evidence-based methods, scientific assumptions can conclude that the provision of a conducive environment from childhood is significant in preventing GBV and sexual violence attitudes.

Contrarily, a systematic review conducted by Kågesten, *et al.*,<sup>20</sup> revealed that the interpersonal variables (family and peers) were major influences on the formation of gender attitudes of young adolescents. They found that gender attitudes appeared to be linked to par-

ents' gender-related attitudes and pressures, education level of mothers, parental work status as well as siblings' composition, including age, sex, and attitudes.<sup>20</sup> In this study, family and peer models were not chosen as the parsimonious model. However, there were variables, especially in the family model, that were significant in predicting GBV attitudes, such as parent-adolescent closeness and parental awareness, as well as the existence of both male and female siblings in the household. From those findings, the family condition, such as parenting type, can be associated with GBV perceptions among adolescents.

This study considered parental closeness and awareness as protective factors against GBV attitudes among young adolescents. Meanwhile, another study also found the same result, but with a different point of view. It indicated that parent-to-child psychological violence, including family stress and perceptions of family communication, during adolescence was a key predictor of peer violence actions and could possibly trigger the IPV throughout adulthood.<sup>21,22</sup> The authors realize that in the stage of ages 10-14 years old, young adolescents can not decide how to act and react appropriately independently. However, other persons, such as their parents, caregivers, siblings, or other family members, will influence their perceptions and behavior. While individual factors might be the most significant determinants to be addressed in GBV prevention, involving other aspects, specifically family factors, is also relevant to developing a more conducive environment for young adolescents.

According to the socio-ecological framework, an individual's development is influenced not only by the family level but also by the school and community levels, which can also predict gender norm socialization among early adolescents. In this study, only the variables of social control and feeling threatened at school remained significant. The lower score of social control and a higher level of feeling threatened increased the probability of finding adolescents who endorsed GBV attitudes. The study conducted by León-Moreno, *et al.*,<sup>23</sup> reported that victimization was directly and indirectly associated with violence at school through revenge motivation. Another study suggested that the girls as carriers of a social multiplier effect were able to reduce violence in the school environmental context, particularly among boys, who are at greater risk.<sup>24</sup> The conclusions found that involving and empowering more male students in gender equality-type interventions could possibly affect the gender-based violence cases at school.

These findings are also relevant in Indonesia, as revealed in the second wave of Youth Voices Research (YVR), a qualitative study supporting and supporting GEAS-Indonesia findings.<sup>25</sup> The results showed that junior high school students were factually experienced bul-

lying and physical violence, particularly boys, while the girls were more engaged in verbal and social violence. The motivation was mainly to show the power by creating pressure for those who they thought deserved revenge. The results also reported that this had not happened only among peers. Some teachers also often abuse the students by discriminating based on their appearance and socioeconomic background and comparing them with other students whom they think are better. It was reported that teachers did that to motivate students. However, the students felt saddened and mentally burdened as a result.

On the other hand, community exposure is also important to be recognized, especially in Indonesia, where the social interactions in the neighborhood are generally still considered good. Community violence has been linked to several internalizing and externalizing symptoms of peer violence, which could negatively impact adolescents' mental health.<sup>26</sup> As mentioned before, a more conducive environment for adolescents, including programs at the community and neighborhood levels, is supported by this study's results, which found that high social control in the neighborhood could potentially prevent GBV violence.

Considering the increasing prevalence of bullying, there is growing concern about the impacts of GBV and inequality in gender norms in general. As found in the study by Shakya, *et al.*, gender expression of adolescents was correlated with health and any risk factors that lead to health issues in adulthood. For example, due to high masculinity norms, smoking and substance abuse, fast food, and soda consumption could lead to high blood pressure, high cholesterol, migraines, depression, and physical limitations (e.g., health problems limiting their daily activities) in adulthood.<sup>27,28</sup> Those findings support the importance of socialization of positive gender norms that could be started in early adolescence.

Since this study used secondary data from the GEAS-Indonesia survey, there were some limitations, especially variables. For instance, this study only analyzed the GBV attitudes but not the actual practices among adolescents to confirm the data. However, this study was able to reveal the fact that GBV attitudes exist among adolescents. The results from this study can be used as a starting point for exploring more specific aspects regarding the influence of gender norms on GBV behavior in adolescents. From the beginning, this study was not intended to compare GBV attitudes and gender norms based on the three implementation regions of GEAS-Indonesia. This situation is due to the limited data and would require deeper information about the contextual conditions in each region.

## Conclusion

In conclusion, the socialization of gender norms is es-

sential to form the GBV attitudes among adolescents. The socialization of negative gender norms could come from their social environment, specifically from family, peers, community, and school. Strengthening the individual aspects by providing a more conducive environment is considered essential to prevent GBV among adolescents. A socialization program such as comprehensive sexual education (CSE) needs to be implemented to help early adolescents navigate unequal gender norms that emerge during their transition to adulthood and prevent any negative impacts, including health problems in the future. It will provide complete, regular, proper, appropriate sexuality education, including equal gender norms for early adolescents, to be better prepared to face their maturity process in gender-equal ways. Complementary programs that target the other social agents in each level of the socio-ecological model, such as parents and community/religious leaders, need to be promoted for better outcomes.

## Abbreviations

GBV: Gender-Based Violence; WHO: World Health Organization; GEAS-Indonesia: The Global Early Adolescent Study Indonesia, ACEs: Adverse Childhood Experiences; AIC: the Akaike Information Criterion; CI: Confidence Interval; OR: Odds Ratio; AOR: Adjusted Odds Ratio; IPV: Intimate Partner Violence; YVR: Youth Voices Research; CSE: Comprehensive Sexual Education.

## Ethics Approval and Consent to Participate

The Global Early Adolescent Study (GEAS)-Indonesia study was approved by the Institutional Review Board at the Bloomberg School of Public Health Johns Hopkins University, Maryland, the United States of America, and the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.

## Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

## Availability of Data and Materials

The dataset supporting the conclusions of this article is available upon request at <https://www.geastudy.org/>.

## Authors' Contribution

IGAAM was a research coordinator in the Denpasar site of GEAS-Indonesia and was responsible for data cleaning and analysis, creating tables, and interpreting results in the manuscript development. AWP was accountable for providing the dataset of GEAS-Indonesia as the data collection manager in the three sites. IC was involved in questionnaire development and as a bridge of coordination between personnel of GEAS-Indonesia, and the center of GEAS study, the School of Public Health, John Hopkins University. SAW, the principal investigator of GEAS-Indonesia, gave several scientific insights, which started from

planning, data collection, analysis, and the execution of this manuscript. All authors were involved in providing their expertise and insights in the discussion and conclusion sections.

### Acknowledgment

The authors thanked all the women and men who participated in the GEAS-Indonesia survey, as well as the funder that supported the entire study. The Global Early Adolescent Study (GEAS)-Indonesia supported the Bill and Melinda Gates Institute through a sub-grant for Rutgers NL.

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# The Effectiveness and Safety of Favipiravir in COVID-19 Hospitalized Patients at Tertiary Referral Hospital, Bali, Indonesia

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## Abstract

COVID-19 is a major public health problem, with still questionable specific cure. Favipiravir is a COVID-19 antiviral that is potentially a therapy for COVID-19. This study aimed to analyze its effectivity and safety in moderate to critical hospitalized patients. This study was a retrospective cohort in a tertiary referral hospital in Denpasar City, Bali Province, Indonesia, from August 2020 to January 2021. There was a total of 192 patients; 96 in the favipiravir group and 96 in the non-favipiravir group (remdesivir/oseltamivir). Effectivity was measured by assessing the clinical condition at the end of the isolation period of 14 days. The favipiravir group showed better clinical conditions than the non-favipiravir group (79.2% vs. 56.3%; adjusted RR = 2.196; 95% CI = 1.084 – 4.451; p-value = 0.029), seen from being free of fever and respiratory problems. Stratification analysis demonstrated that the clinical improvement was significantly different in the severe/critical group in favor of favipiravir (RR = 1.573; 95% CI = 1.139-2.172). The most common non-serious adverse events (AE) found in the use of favipiravir were gastrointestinal disturbances (12.5%). In brief, favipiravir is effective in severe/critical cases, and less serious AE were found in its use. Appropriate treatment is expected to help in reducing the public health burden.

**Keywords:** COVID-19, effectivity, favipiravir, safety

## Introduction

As of March 2020, coronavirus disease 2019 (COVID-19) has been declared a global pandemic by World Health Organization (WHO). By October 19, 2021, there have been 240 million cases and 4.9 million deaths.<sup>1</sup> The mortality and morbidity of COVID-19 have been dramatically increasing, making this disease a major global public health burden.<sup>2</sup> Health expenditure was found to be associated with case fatalities,<sup>3</sup> which medication use would be one of the factors that contribute to the increase of health expenditure.<sup>4</sup> Therefore, comprehensive measures need to be taken to solve pandemics effectively and efficiently by ensuring a good quality of health services from preventive to curative actions. Inappropriate treatment is of concern that needs to be addressed to help reduce morbidity and mortality.

To date, substantial researches about COVID-19 treatment are still ongoing. Several potential antivirals have been tested and recommended to treat COVID-19 in several countries, including Indonesia.<sup>5</sup> Favipiravir was first used in Japan to treat influenza and Ebola.<sup>6</sup> It is a prodrug with its active form of favipiravir ribofuranosyl-5'-triphosphate (Favipiravir-RTP) that binds to and

inhibits viral RNA-dependent RNA polymerase (RdRp), resulting in inhibition of viral genome transcription and replication.<sup>6,7</sup> In China, a preliminary COVID-19 antiviral trial reported that taking oral favipiravir 1,600 mg twice daily on the first day, followed by 600 mg twice daily, produced better results than oral lopinavir/ritonavir (400 mg/100 mg) twice daily.<sup>8</sup> A study in Thailand showed different results; favipiravir was no more effective for patients with severe COVID-19 compared to lopinavir/ritonavir.<sup>9</sup> In Indonesia, there are still little data regarding the effectiveness of using favipiravir in COVID-19 patients.

Indonesian Medical Association recommends favipiravir as therapy for COVID-19 patients with mild to critical conditions.<sup>10</sup> The National Food and Drug Administration of Indonesia issued an emergency use authorization (EUA) for favipiravir as a drug for patients hospitalized with mild to moderate COVID-19 symptoms.<sup>11</sup> To ensure the quality of drugs, especially for drugs that are still in emergency use, it is necessary to monitor the effectiveness and safety of their therapy.<sup>12</sup> Given the limited data about favipiravir, this study aimed to compare the effectiveness and safety of favipiravir with

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Received : October 25, 2021  
Accepted : October 31, 2021  
Published : November 29, 2021

non-favipiravir in moderate to critical COVID-19 patients at a tertiary referral hospital in Denpasar City, Bali Province, Indonesia.

**Method**

An observational study using retrospective cohort design was conducted at a tertiary referral hospital in Denpasar City, Bali Province, Indonesia. This study was carried out by adapting a previous study by Cai, *et al.*,<sup>8</sup> regarding the evaluation of the effect of favipiravir versus lopinavir/ritonavir in COVID-19 patients. In this study, the effectiveness of therapy was assessed based on the time of viral clearance and improvement of chest CT scan on day 14 after treatment. The Ethics Committee approved the study protocol of the Faculty of Medicine, Udayana University, and Sanglah Hospital (number 78/UN14.2.2.VII.14/LT/2021). Study permission was obtained from the President Director of Sanglah General Hospital, Denpasar City (number LB.02.01/XIV.2.2.1/3023/2021). The Ethics Committee ruled out the need for consent because there is no direct intervention with the patients.

The study population consisted of moderate to critical COVID-19 confirmed patients aged over 18. This study excluded patients who were pregnant/breastfeeding, had a history of hemodialysis or chronic liver disease, had switched antiviral therapy during treatment, and had incomplete medical record data. The sample calculation was calculated based on the formula of a cohort study from Sastroasmoro (Formula 1),<sup>13</sup> and the result of the study from Cai, *et al.*,<sup>8</sup> with a significance level of ( $\alpha$ ) 5%; power of study ( $\beta$ ) 80%; the proportion of improved COVID-19 patients with favipiravir ( $P_1$ ) therapy was 0.56; and the proportion of improved patients with non-favipiravir ( $P_2$ ) therapy was 0.35, the minimum samples required was 87 for each group. The amount of sample added 10% to avoid drop out. The selection of the subjects was made using total sampling until the number of required subjects was met.

Data were taken from medical records and databases covering the period of August 2020 to January 2021 since favipiravir was first used as a COVID-19 therapy at a tertiary referral hospital in Denpasar City, Bali Province, Indonesia. The patient data collected included demo-

graphic, comorbidities, history of antiviral therapy (the type of antiviral that had been given and time of antiviral administration), unexpected events encountered while receiving antiviral therapy, and the clinical outcomes (the patient's condition on the last day of isolation, x-ray, and polymerase chain reaction (PCR) test results).

In this study, pre- and post-treatment analyses were not assessed. Comparison was made by assessing the favipiravir and non-favipiravir groups based on patients' conditions on their last day of isolation. The therapeutic efficacy was assessed from the improvement in clinical conditions at the end of the isolation period, characterized by no longer showing fever symptoms and respiratory problems (cough, shortness of breath, and rapid breathing) for moderate and severe or critical symptoms patients.<sup>10</sup> The assessment of this condition was based on the physician's judgment, which was recorded in the medical record. Additional follow-up of chest X-ray and PCR test results were only performed in patients with severe or critical symptoms.<sup>10</sup> The endpoint of observation was on the last day of the isolation period, which was the 14<sup>th</sup> day calculated from the first time the patient showed symptoms of COVID-19.<sup>10</sup> The Centers for Disease Control and Prevention (CDC) also recommends isolation for at least ten days after symptom onset and three days after symptom improvement.<sup>14</sup> The safety of the therapy was assessed by observing adverse events (AE) that happened to patients after treatment of favipiravir.

This study categorized sex as male and female. Male and female have physiological differences with the presence of female's hormone (estrogen and progesterone) was associated with better immunity.<sup>15</sup> Age was categorized by group according to WHO.<sup>16</sup> The study subjects were adult patients (>18 years) and the elderly group ( $\geq 60$  years), which were age groups that were at risk of being infected and getting worsening conditions due to COVID-19.<sup>17</sup> The body mass index (BMI) category was based on the national BMI classification from the Indonesian Ministry of Health,<sup>18</sup> which was divided into thin (<18.5), normal (18.5 – 25.0), and obese (>25). The obese BMI group was associated with the risk of infection and worsening of the COVID-19 condition.<sup>19</sup> Severity category was based on the COVID-19 management guidelines 2<sup>nd</sup> edition, namely mild, moderate, and severe/critical.<sup>10</sup>

The severe and critical were included in one group, namely patients in severe condition. Comorbidities were divided into Yes and No because several studies,<sup>17,20-22</sup> have shown comorbidity is associated with the severity and mortality of COVID-19 patients.<sup>23</sup> Time of administration of antivirals is associated with the process of clearing the virus in the body and the effectiveness of therapy.<sup>24</sup> A study from Lauer, *et al.*,<sup>25</sup> stated that the average incubation period for COVID-19 is five days.

$$n = \frac{\{Z_{1-\alpha/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{p_1(1-p_1) + P_2(1-P_2)}\}^2}{(p_1 - p_2)^2}$$

Notes: n: Number of Samples,  $Z_{\alpha}$ : Level of Significance,  $Z_{\beta}$ : Power,  $P_1$ : Proportion of Effects in the Risk Group,  $P_2$ : Proportion of Effects in the Non-Risk Group Estimated Proportion,  $Q = 1-P$ .

**Formula 1. Estimated Sample Size for Cohort Study with Hypothesis Testing on Relative Risk**

Administration of antivirals within six days of symptom onset can reduce viral load and the risk of adverse inflammation-related infections.<sup>24</sup> All of the covariates were suspected as confounding variables for the clinical improvement

All data were analyzed using IBM SPSS statistic base software, version 22. Descriptive analysis was used to describe the demographic and clinical information of the patients. Categorical data were displayed in the form of proportions (%) and numerical data in the form of Mean±SD if the data were normally distributed, or median (min-max) if not normally distributed. Bivariate analysis was used to analyze the effect of antiviral therapy or those confounding variables on clinical improvement. Categorical data were analyzed using the Chi-square test or Fisher's Exact Test. Factors that had p-value<0.25 on the bivariate test were further analyzed using multivariate logistic regression analysis, reported as the adjusted risk ratio (aRR) with a 95% confidence interval (CI). The

multivariate analysis took out variables that had p-value > 0.05 from the multivariate model one by one started with the biggest p-value. If the RR of remaining variables changed >10%, the excluded variables were back to the model and considered confounding variables. Stratification analysis was done to observe further the effect of confounding variables on clinical improvement. The safety of the therapy was analyzed descriptively in terms of proportion (%). Observed unexpected events were then analyzed using the Naranjo scale to assess causality and the degree of adverse events

### Results

A total of 192 medical records of patients were evaluated. Each favipiravir and the non-favipiravir group consisted of 96 patients that met the criteria. The patient characteristics were generally the same for both groups (Table 1). Most of the patients were male, adult, and had normal BMI. Most had a history of comorbidities, the

**Table 1. Patient Characteristics during COVID-19 Therapy at a Tertiary Referral Hospital in Denpasar City, Bali, Indonesia**

| Patient Characteristic               | Category                     | Antiviral Therapy    |                          |
|--------------------------------------|------------------------------|----------------------|--------------------------|
|                                      |                              | Favipiravir (n = 96) | Non-favipiravir (n = 96) |
|                                      |                              | n (%)                | n (%)                    |
| Gender                               | Female                       | 36 (37.5)            | 35 (36.5)                |
|                                      | Male                         | 60 (62.5)            | 61 (63.5)                |
| Age, years                           | Mean±SD                      | 51.5±12.9            | 56.2±12.2                |
|                                      | Adult (18-59)                | 71 (74)              | 60 (62.5)                |
|                                      | Elderly (60)                 | 25 (26)              | 36 (37.5)                |
| Body mass index (kg/m <sup>2</sup> ) | Mean±SD                      | 23.9±3.5             | 24.3±3.2                 |
|                                      | Thin-normal (25)             | 63 (65.6)            | 62 (64.6)                |
|                                      | Overweight (>25)             | 33 (34.4)            | 34 (35.4)                |
| Degree of severity                   | Moderate                     | 46 (47.9)            | 22 (22.9)                |
|                                      | Severe                       | 50 (52.1)            | 74 (77.1)                |
| Comorbidity history                  | No                           | 41 (42.7)            | 33 (34.4)                |
|                                      | Yes                          | 55 (57.3)            | 63 (65.6)                |
| Number of comorbid diseases          | None                         | 41 (42.7)            | 33 (34.4)                |
|                                      | One                          | 38 (39.6)            | 38 (39.6)                |
|                                      | More than one                | 17 (17.7)            | 25 (26.0)                |
| Comorbid type                        | Hypertension (HT)            | 13 (13.54)           | 13 (13.54)               |
|                                      | Diabetes mellitus (DM)       | 10 (10.42)           | 11 (11.46)               |
|                                      | Cardiovascular disease (CVD) | 6 (6.25)             | 4 (4.17)                 |
|                                      | Asthma                       | 4 (4.17)             | 2 (2.08)                 |
|                                      | Tuberculosis (TB)            | 2 (2.08)             | 0                        |
|                                      | Malignancy                   | 0                    | 4 (4.17)                 |
|                                      | Immune disorders             | 1 (1.04)             | 3 (3.13)                 |
|                                      | Hematological disorders      | 1 (1.04)             | 0                        |
|                                      | Gastrointestinal disorders   | 0                    | 1 (1.04)                 |
|                                      | Gout                         | 1 (1.04)             | 0                        |
|                                      | DM+HT                        | 4 (4.17)             | 6 (6.25)                 |
|                                      | DM+CVD                       | 2 (2.08)             | 5 (5.21)                 |
|                                      | HT+CVD                       | 2 (2.08)             | 3 (3.13)                 |
|                                      | DM+HT+CVD                    | 3 (3.13)             | 1 (1.04)                 |
| Other combinations*                  | 6 (6.25)                     | 10 (10.25)           |                          |
| D-day administration of antiviral**  | Mean±SD                      | 6.3±3.10             | 6.9±3.6                  |
|                                      | ≤5                           | 48 (50)              | 38 (39.6)                |
|                                      | >5                           | 48 (50)              | 58 (60.4)                |

**Notes:** SD = Standard Deviation, \*Other combinations = more than one comorbidity other than combination mentioned above,

\*\*D-day administration of antiviral starting from the onset of the symptom.

most common being hypertension. The favipiravir group comprised an equal amount of moderate and severe/critical patients, while non-favipiravir was dominated by severe/critical patients. On average, patients in both groups received their first antiviral on day six after the first sign of symptoms.

A total of 79% of patients in the favipiravir group experienced an improvement in their clinical condition, which was free from fever and respiratory problems by the end of the isolation period compared to the non-favipiravir group (RR = 1,407; 95% CI = 1.148-1.726; p-value = 0.001) (Table 2).

Age, disease severity, and history of comorbidities were variables that significantly affect the improvement of a patient's clinical condition by the end of the isolation

period. However, multivariate analysis showed that comorbidity history and severity of COVID-19 had a statistically significant effect on improving clinical conditions. In the final model, antiviral therapy, together with comorbidity history and severity, significantly affected clinical improvement (Table 3). The result of the stratification analysis of the degree of severity is shown in Table 4. In the moderate group, clinical improvement was not significantly different, while in the severe group was significantly different.

Adverse events (AE) due to favipiravir use were observed in 21 individuals (21.9%) and the case of non-favipiravir treatment in 25 individuals (26%). The most common adverse events found with the use of favipiravir were gastrointestinal disturbances (12.5%), while with

Table 2. Factors that Influence the Improvement of Clinical Condition of COVID-19 Patients

| Risk Factor                       | Category        | Improvement in Clinical Condition <sup>a</sup> |           | p-value | RR (95% CI)                 |
|-----------------------------------|-----------------|--|-----------|---------|-----------------------------|
|                                   |                 | Stable/Worse                                   | Improved  |         |                             |
|                                   |                 | n (%)  | n (%)     |         |                             |
| Antiviral                         | Non-favipiravir | 42 (43.8)                                      | 54 (56.3) | 0.001   | 1.407 (1.148–1.726)<br>Ref  |
|                                   | Favipiravir     | 20 (20.8)                                      | 76 (79.2) |         |                             |
| Gender                            | Male            | 40 (33.1)                                      | 81 (66.9) | 0.767   | 1.031 (0.844–1.259)<br>Ref  |
|                                   | Female          | 22 (31)  | 49 (69)   |         |                             |
| Age                               | Elderly (60)    | 26 (42.6)                                      | 35 (57.4) | 0.037*  | 1.264 (0.994–1.6080)<br>Ref |
|                                   | Adult (18-59)   | 36 (27.5)                                      | 95 (72.5) |         |                             |
| Body mass index                   | Overweight      | 19 (28.4)                                      | 48 (71.6) | 0.393   | 0.916 (0.752–1.115)<br>Ref  |
|                                   | Thin-normal     | 43 (34.4)                                      | 82 (65.6) |         |                             |
| Degree of severity                | Severe          | 58 (46.8)                                      | 66 (53.2) | <0.001* | 1.768 (1.484–2.107)<br>Ref  |
|                                   | Moderate        | 4 (5.9)  | 64 (94.1) |         |                             |
| Comorbidity history               | Yes             | 46 (39)  | 72 (61)   | 0.012*  | 1.285 (1.065–1.549)<br>Ref  |
|                                   | No              | 16 (21.6)                                      | 58 (78.4) |         |                             |
| D-day administration of antiviral | >5              | 37 (34.6)                                      | 69 (65.1) | 0.390   | 1.090 (0.897–1.323)<br>Ref  |
|                                   | ≤5              | 25 (29.1)                                      | 61 (70.9) |         |                             |

Notes: RR = Risk Ratio, CI = Confidence Interval, <sup>a</sup>Reference: improved

Table 3. Logistic Regression Analysis for the Improvement of Clinical Condition of COVID-19 Patients

| Model               | Confounding Variable | Category        | p-value | RR          | 95% CI       |
|---------------------|----------------------|-----------------|---------|-------------|--------------|
| Crude               | Antiviral            | Non-favipiravir | 0.001*  | 1.407       | 1.148–1.726  |
|                     |                      | Favipiravir     |         | Ref         |              |
| Adjusted            | Antiviral            | Non-favipiravir | 0.047*  | 2.066       | 1.011–4.222  |
|                     |                      | Favipiravir     |         | Ref         |              |
|                     | Age                  | Elderly         | 0.090   | 1.888       | 0.905–3.939  |
|                     |                      | Adult           |         | Ref         |              |
|                     | Degree of severity   | Severe          | 0.000*  | 12.898      | 4.305–38.638 |
|                     |                      | Moderate        |         | Ref         |              |
| Comorbidity history | Yes                  | 0.027*          | 2.320   | 1.099–4.898 |              |
|                     | No                   |                 | Ref     |             |              |
| Adjusted            | Antiviral            | Non-favipiravir | 0.029*  | 2.196       | 1.084–4.451  |
|                     |                      | Favipiravir     |         | Ref         |              |
|                     | Degree of severity   | Severe          | 0.000*  | 12.442      | 4.189–36.960 |
|                     |                      | Moderate        |         | Ref         |              |
|                     | Comorbidity history  | Yes             | 0.022*  | 2.377       | 1.134–4.985  |
|                     |                      | No              |         | Ref         |              |

Notes: RR = Risk Ratio, CI = Confidence Interval

Table 4. Stratification of Degree of Severity on Improving the Clinical Condition of COVID-19 Patients

| Category | Antiviral       | Clinical Improvement <sup>a</sup> |           | p-value | RR (95% CI)         |
|----------|-----------------|-----------------------------------|-----------|---------|---------------------|
|          |                 | Stable/Worsened                   | Improved  |         |                     |
|          |                 | n (%)                             | n (%)     |         |                     |
| Moderate | Non-favipiravir | 0 (0)                             | 22 (100)  | 0.296   | 0.913 (0.835-0.998) |
|          | Favipiravir     | 4 (8.7)                           | 42 (91.3) |         | Ref                 |
| Severe   | Non-favipiravir | 42 (56.8)                         | 32 (43.2) | 0.010*  | 1.573 (1.139-2.172) |
|          | Favipiravir     | 16 (32)                           | 34 (68)   |         | Ref                 |

Notes: RR = Risk Ratio, CI = Confidence Interval, <sup>a</sup>Reference: improved

Table 5. The Proportion of Adverse Events in COVID-19 Patients

| Adverse Event                        | Antiviral Therapy    |                          |
|--------------------------------------|----------------------|--------------------------|
|                                      | Favipiravir (n = 96) | Non-favipiravir (n = 96) |
|                                      | n (%)                | n (%)                    |
| Less Serious Adverse Event:          |                      |                          |
| Indigestion                          | 12 (12.5)            | 6 (6.25)                 |
| Nauseous vomiting                    | 2 (2.08)             | 1 (1.04)                 |
| Constipation                         | 6 (6.25)             | 2 (2.08)                 |
| Bloating                             | 4 (4.17)             | 1 (1.04)                 |
| Diarrhea                             | 0                    | 2 (2.08)                 |
| Heartburn                            | 1 (1.04)             | 0                        |
| Numbness on cheeks and lips          | 1 (1.04)             | 0                        |
| Increased liver enzymes              | 5 (5.21)             | 14 (14.58)               |
| SGOT upgrade                         | 4 (4.17)             | 4 (4.17)                 |
| SGPT increase                        | 1 (2.08)             | 10 (10.42)               |
| Combination                          | 2 (2.08)             | 4 (4.17)                 |
| Constipation and increase in SGPT    | 1 (1.04)             | 1 (1.04)                 |
| Constipation and increased SGOT      | 0                    | 1 (1.04)                 |
| Nauseous vomiting and increased SGOT | 0                    | 1 (1.04)                 |
| Diarrhea and increased SGPT          | 1 (1.04)             | 0                        |
| Heartburn and constipation           | 0                    | 1 (1.04)                 |
| Serious Adverse Event                |                      |                          |
| Death                                | 2 (2.08)             | 15 (15.62)               |

Notes: SGOT = Serum Glutamic Oxaloacetic Transaminase, SGPT = Serum Glutamic Pyruvic Transaminase

non-favipiravir, elevated liver enzymes (15.3%) were most prevalent (Table 5). The Naranjo scale's causality analysis showed that all the observed adverse events were categorized as "possible." The possible category means that the AE may possibly be affected by favipiravir.

## Discussion

COVID-19 has been a global pandemic that needs a prompt response from stakeholders, including study institutions and health facilities. The increasing cases in Indonesia have become one of the reasons for the government to prioritize health sectors. One of the efforts that must be done is ensuring the availability of quality and safe health services.<sup>26</sup> The critical challenge for most countries to pandemic includes the rapid formulation of treatment guidelines and their dissemination to health stakeholders and communities so morbidity and mortality can be suppressed.<sup>27</sup> This study has analyzed the prom-

ising potential of favipiravir as a moderate to critical COVID-19 antiviral, as has been previously reported in other countries such as China,<sup>8</sup> India,<sup>28</sup> Iran,<sup>29</sup> and Thailand.<sup>9</sup> In this study, stable and worse conditions were classified as one condition because stable means no clinical improvement, which indicated that the drug was not effective.

This study showed that favipiravir could increase the chance of improvement in the clinical condition of COVID-19 patients by the end of their isolation period compared to non-favipiravir antivirals (79.2% vs. 56.3%; RR = 2.196; 95% CI = 1.084-4.451; p-value = 0.029). This clinical improvement was mainly characterized by free from fever and respiratory problems at the end of the isolation period of 14 days. This condition is in line with the study of Cai, *et al.*,<sup>8</sup> who showed that favipiravir therapy was able to increase clinical improvement on the 7<sup>th</sup> and 14<sup>th</sup> day, but statistically not signif-

icantly. The meta-analysis study reported significant clinical improvement on the favipiravir group on the 7<sup>th</sup> and 14<sup>th</sup> day of treatment (Day 7: RR = 1.25, 95% CI = 1.01-1.53; Day 14: RR = 1.29, 95% CI = 1.08-1.54).<sup>30</sup> In the non-favipiravir group, patients received either oseltamivir or remdesivir. A study in China, which used oseltamivir at the beginning of the COVID-19 pandemic, suggested that administering oseltamivir may reduce the risk of death in COVID-19 patients.<sup>31</sup> Oseltamivir is an effective neuraminidase inhibitor drug for treating influenza.<sup>32</sup> However, neuraminidase was not found in the SARS-CoV-2 virus, so how oseltamivir is not thought to be effective enough to treat COVID-19,<sup>32</sup> was in line with the result of this study. Remdesivir is an antiviral that acts by inhibiting RdRp on synthesis and replication of viral RNA,<sup>33</sup> which is thought to combat severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). However, the result of this study showed that patients who received remdesivir had no better clinical condition than favipiravir. This result was in line with the solidarity trial from WHO that state remdesivir have little or no effect on hospitalized COVID-19, as indicated by overall mortality.<sup>34</sup>

The study showed that the factors of age, severity, and history of comorbidities might affect the improvement of clinical conditions.<sup>17,20,22</sup> However, this study revealed that only the degree of severity and history of comorbidity were the significant factor influencing improvement in patients' conditions by multivariate analysis. In this study, 57.3% of patients in the favipiravir group had a history of comorbidities (vs. 65.6% in the non-favipiravir group). The most common comorbidities were hypertension and diabetes mellitus. This is in line with the study by Zaki, *et al.*,<sup>20</sup> stating that diabetes and hypertension are correlated with the severity of COVID-19. Hypertension and COVID-19 are related to angiotensin-converting enzyme (ACE2), which is suspected to be the portal of entry SARS-CoV-2.<sup>22</sup> Binding of SARS-CoV-2 virus to ACE2 can reduce the physiological function of ACE2 then lead to a potential mechanism for severity symptoms and multi-organ dysfunction, that can be seen in severe COVID-19 infection.<sup>35</sup> There are several possible mechanisms that can increase the risk of patients of diabetes mellitus to COVID-19 infection, such as immunological dysregulation, increased susceptibility to hyper-inflammation, and cytokine storm syndrome.<sup>21</sup> Poor glycemic control can cause a delay in the activation of T cells and NK cells which causes the delay in responding to viral infection.<sup>21,36</sup> Hyperglycemia also increases proinflammatory cytokines (e.g., Interleukin 6 (IL-6)), which causes a cytokine storm so that people with diabetes are susceptible to severe COVID-19 infection.<sup>36</sup>

Severity may affect the patients' recovery process.<sup>37</sup> This study demonstrated that clinical improvement was

more apparent in moderate cases regardless of which antiviruses were given. Patients with severe symptoms generally have systemic inflammation that can increase the risk of death.<sup>38</sup> Those with milder COVID-19 is more likely to experience clinical improvement. These results may be related to the mechanism of the pathogenesis of the SARS-CoV-2 virus. At a lower level, the virus is still in the replication phase, so the antiviral is more effective in preventing its spread.<sup>24</sup> Favipiravir works by inhibiting the RdRp of the virus,<sup>6</sup> which may reduce the number of viral replications.<sup>7</sup> The reduced number of viruses and a good immune response mean that the body does not have an inflammatory reaction, leading to clinical improvement. The more severe the degree of COVID-19, the greater the possibility of an increased inflammatory reaction. In this phase, the improvement of the condition may be influenced more by immune response-suppressing drugs (such as steroids) than by antiviral therapy.<sup>24</sup> However, this study found that after stratification analysis, favipiravir in severe cases showed significantly improved clinical condition compared to non-favipiravir. This happened probably because of the anti-inflammatory effect of favipiravir.<sup>39</sup> The respiratory distress of SARS-CoV-2 is thought not only direct viral action but also to chemical mediators induced by SARS-CoV-2. Favipiravir could partially control the inflammatory mediators.<sup>39</sup>

Adverse events (AE) were found in both the favipiravir and non-favipiravir antiviral groups (21.9% favipiravir, 26% non-favipiravir). In the favipiravir group, the most common AE was gastrointestinal disturbances (12.5%), followed by increased liver enzymes (5.21%), and numbness in the cheeks and lips (1.04%). This finding is in line with previous studies, which have found that favipiravir causes elevated liver enzymes (to a mild to a moderate degree), increased total bilirubin, increased uric acid, and gastrointestinal disturbances.<sup>40,41</sup> The most common AE in the non-favipiravir group was an increase in liver enzymes (14.6%). The use of remdesivir sometimes causes an increase in SGOT or SGPT grade 1 or 2 but is still within tolerable limits.<sup>42</sup> During the treatment process, none of the patients had their antiviral treatment discontinued due to AE. Looking at these results, AEs tend to be equal in both groups (favipiravir and non-favipiravir) with a tolerable effect.

Adverse drug reactions causality analysis using the Naranjo algorithm shows that the average causality score is 4 (possible category), which means that the adverse events were possibly related to favipiravir. This result indicated that other factors should also be considered as the cause of adverse effects, for example, the mechanism of the COVID-19 disease. The ACE2 receptor, the entry site for SARS-CoV-2, is also present in the digestive tract, thus allowing intestinal disturbances to occur due to viral infection.<sup>43</sup> Digestive symptoms commonly encountered

in COVID-19 patients are anorexia, nausea and/or vomiting, diarrhea, and abdominal pain.<sup>44</sup> In severe COVID-19 patients, serum aminotransferases may be elevated (<5x upper normal limit).<sup>44</sup> SARS-CoV-2 has the potential to cause liver dysfunction and liver enzyme abnormalities. Hyperinflammation due to cytokine storm is also a cause of liver damage due to COVID-19 infection.<sup>45</sup> Other concomitant drugs may also contribute to the adverse effects of patients since nausea, vomiting, and other effects were also common in many drugs. Further study is needed to confirm the finding by challenging and rechallenging the antivirals to the patients.

The main finding of this study is that favipiravir is promising for COVID-19 treatment, especially for severe cases. This study gives evidence to help in formulating treatment guidelines, especially in Indonesian populations, in the hope of reducing the public health burden. In terms of price, remdesivir is the most expensive antiviral at IDR 510,000 per vial. While oseltamivir is IDR 26,000/capsule and IDR 22,500/tablet for favipiravir. Formal cost-effectiveness analysis is needed, but judging from the price and availability in health facilities (tablets are easier to obtain), the use of favipiravir tends to be more promising for therapeutic effectiveness and cost. Investing in the development of treatments and evaluating their cost-effectiveness should be the focus to inform resource allocation decisions, particularly in low- and middle-income countries.<sup>46</sup> Countries are trying to reduce spending that disrupts economic and social stability, so evaluating cost-effectiveness, especially in COVID-19 antiviral therapy, is one strategy to manage human and economic losses caused by the pandemic.

In this retrospective study method, several important parameters, such as radiological results; PCR CT values; and uric acid levels, which hyperuricemia is the most common side effect of favipiravir, were not observed. Since it is a single-center study, the results cannot be generalized. However, this study provided an overview of the effectiveness and safety of favipiravir in the population of COVID-19 patients in Denpasar City, Bali Province, Indonesia. In addition, the duration of antiviral administration and supportive therapy received by patients were not included as confounding variables in the study. However, patients were taken from the same location according to the same therapeutic guidelines, so the treatment options were relatively similar. Further research could be conducted prospectively in more than one location with several other variables considered.

## Conclusion

In conclusion, this study found that favipiravir has promising effectivity for treating COVID-19, especially in severe/critical patients. Favipiravir tends to be safe with less serious AE observed. Favipiravir can be one of

the rationales and appropriate treatments choice to cure patients. It is expected that appropriate treatments will help to reduce the public health burden.

## Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; Favipiravir-RTP: Favipiravir Ribofuranosyl-5'-Triphosphate; RdRp: RNA-dependent RNA Polymerase; ADR: Adverse Drug Reaction; EUA: Emergency Use Authorization; PCR: Polymerase Chain Reaction; CDC: The Centers for Disease Control and Prevention; AE: Adverse Event; BMI: Body Mass Index; SD: Standard Deviation; aRR: Adjusted Risk Ratio; CI: Confidence Interval; CVD: Cardiovascular Disease; DM: Diabetes Mellitus; HT: Hypertension; RR: Relative Risk; SGOT: Serum Glutamic Oxaloacetic Transaminase; SGPT: Serum Glutamic Pyruvic Transaminase, SARS-CoV-2: Severe Acute Respiratory Syndrome coronavirus 2; ACE2: Angiotensin-Converting Enzyme 2; IL-6: Interleukin 6.

## Ethics Approval and Consent to Participate

The study protocol was approved by the Ethics Committee of the Faculty of Medicine, Udayana University, and Sanglah Hospital (number 78/UN14.2.2.VII.14/LT/2021). The Ethics Committee ruled out the need for consent because there is no direct intervention with the patients.

## Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

## Availability of Data and Materials

The data that support the findings of this study are available on request from the corresponding author.

## Authors' Contribution

HD, RS, and GS conceived and designed the study. HD collected, analyzed, and interpreted the data. HD, RS, GS, and HW wrote the manuscript. All authors contributed to the critical revision of the manuscript for important intellectual content and approved the final version of the manuscript.

## Acknowledgment

The abstract of this paper has been presented in the 16th APRU Multi-Hazards Symposium 2021 hosted by Disaster Risk Reduction Center Universitas Indonesia in collaboration with the Association of Pacific Rim Universities. The authors are grateful to National Agency for Research and Innovation of the Republic of Indonesia for giving financial support through PDUPT Grant No. NKB-064/UN2.RST/HKP.05.00/2021. The authors also thank the pharmacy division and medical record division at Sanglah General Hospital for the valuable support.

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# How Risky People of Getting COVID-19 based on Their Daily Activities?

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## Abstract

In Indonesia at the end of 2020, COVID-19 cases were increasing and predicted to continue, as it had not yet passed the peak of the pandemic curve. The government had implemented mobility restrictions to reduce exposure to COVID-19. This study aimed to identify the risk of people getting COVID-19 based on their daily activities. Using a cross-sectional design, this study took 315 respondents under non-probability sampling from September to October 2020. The data were analyzed using the Chi-square test with  $\alpha$  0.05. This study showed that the risk percentage of people infected with COVID-19 based on their daily activities was 15.56% at low-risk, 63.81% at moderate-low risk, 17.14% at moderate risk, and 3.9% at moderate-high risk. Factors that were significantly related to the risk of getting COVID-19 in terms of daily activities were sex, attitude, and COVID-19 preventive behavior. In brief, the risk of getting COVID-19 could be assessed from daily activities carried out during the pandemic's peak.

**Keywords:** behavior, COVID-19, daily activity, risk factor

## Introduction

The coronavirus 2019 (COVID-19) outbreak, which began on December 31, 2019, in Wuhan, China, has affected more than 200 countries globally. There were 7,941,791 cases, with 434,796 deaths, reported on June 16, 2020, just six months after the initial outbreak.<sup>1</sup> The World Health Organization (WHO) designated this outbreak a Public Health Emergency of International Concern. This virus was first reported in Indonesia in March 2020. The number of confirmed cases recorded on July 28, 2020, was 100,303, with 4,838 deaths, spread across 34 provinces, with the highest cases in East Java and DKI Jakarta Provinces.<sup>2</sup> This number was predicted to keep increasing, especially when Indonesia had not yet passed the peak of the pandemic curve.<sup>3</sup>

The previous research conducted in Wuhan, China, showed that the large-scale restrictions on intercity traffic, social distancing, staying at home, centralized quarantine, and increased medical resources had been proven to reduce new COVID-19 cases and outbreaks.<sup>4</sup> The large-scale social restrictions (LSSR) has been implemented in Indonesia since April 2020 in the forms of school and workplace closure, restrictions on religious activities, activities in public places or facilities, social

activities and culture, transportation modes, and other activities specifically related to the defense and security aspects.<sup>5</sup> This implementation impacts decreasing social mobility leading to the decrease in the rate of transmission in Jakarta as the epicenter of COVID-19.<sup>6</sup> The community has a pattern of different activity mobility wherein weekday (Monday to Friday), they will tend to move based on their respective jobs. This will be negatively correlated to their main health status in terms of the risk of transmission of COVID-19.<sup>7,8</sup>

The previous study analyzed that “stay-at-home” policies and restrictions on people’s movement along with contact tracing and isolation, use of personal protective equipment, hand hygiene, and physical distancing in public places contribute to reducing COVID-19 cases.<sup>9</sup> That contributors show that identifying the adaptation of people’s mobility behavior during the periods of new normal and LSSR is important to find out the risks of people contracting with COVID-19 as the baseline data to evaluate the policies and prepare the safety recommendations, and control the spread of COVID-19.<sup>10</sup> A survey in the UK during lockdown indicated that the day spent in the highest risk activities, like studying in the school and work far from

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Received : May 08, 2021  
Accepted : October 31, 2021  
Published : November 29, 2021

home, has likely increased from 7% in May-June to 11% in August 2020.<sup>11</sup> The finding of the study in the European Union showed that people are still less likely to be able to maintain compliance with health protocols behavior within three weeks.<sup>11</sup>

In addition, there are no comprehensive studies that contain the knowledge as a risk factor.<sup>10</sup> The other studies also found that the sociodemographic and attitude factors contributed to the preventive behavior and mobility during the COVID-19 pandemic.<sup>11,12</sup> The study in Malaysia measured the effect of daily activities on the risk of COVID-19 but was limited to one student population.<sup>7</sup> Another study in Indonesia has assessed the variation of daily activity on the risk of COVID-19 but has not involved sociodemographic variables.<sup>8,13</sup> However, there is still a lack of the study in Indonesia that analyze the risks of COVID-19 transmission based on people’s daily activities, especially in cities in Indonesia. Jakarta, Bogor, Depok, Tangerang, Bekasi, and Surabaya are the cities with high-risk status of COVID-19 in the period of September-October 2020. Therefore, this study aimed to identify the risk of people getting COVID-19 based on their daily activities and to identify the sociodemographic, knowledge, attitude, and preventive behavior factors associated with the risk of contracting with COVID-19 on people’s daily activities in Indonesia.

**Method**

The conceptual framework from this study is shown in Figure 1. The framework has been adapted from previous study about the determinant of COVID-19 and how the virus can transmit from one host to another person by physical activities.<sup>7,8</sup>

The cross-sectional study design was carried out to prove the assessment of risks against people during the COVID-19 pandemic based on their daily activities. The study population was all people living in Jakarta, Bogor, Depok, Tangerang, Bekasi, and Surabaya Cities with the high-risk status of COVID-19 in the period of September-

$$n = \frac{\{Z_{1-\alpha/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{p_1(1-p_1) + P_2(1-P_2)}\}^2}{(p_1 - p_2)^2}$$

Formula 1. Estimate Sample of Hypothesis Testing in Two Populations (Two Tails)

October 2020. The study samples were people living in the selected areas affected with COVID-19 under the following inclusion criteria: 15-64 years old (productive age), willing to become study respondents, and willing to fill out the online questionnaire. Sample calculation using a two-group hypothesis test formula with the following formula.<sup>14</sup> Sample size was calculated with a value of 5%, 1-β = 90%, and the proportion of previous studies (p1 = 0.66; p2 = 0.83).<sup>12</sup> Minimum sample was 310 respondents (with an estimated dropout of 10%).

Those 315 respondents were taken the Quota Sampling technique. Quota sampling is a non-probability sampling technique that is carried out based on fulfilling the desired sample quota and dissemination timeline, which considers the inclusion-exclusion criteria that the researcher has determined.<sup>15</sup> The data collection method using a questionnaire in the Google Forms was adjusted to the sampling technique, and the access would be closed when the minimum sample has been met.<sup>16</sup> The online questionnaire consists of five sections: demographic characteristics of the respondents (sex, age, education level, and occupation), knowledge on COVID-19, attitude, and behavior to prevent against and to protect from COVID-19 were the independent variables, while daily activities during COVID-19 pandemic was the dependent variable. Sex, attitude, and behavior were three independent variables with two categories, education was divided into four categories, while occupation and knowledge on COVID-19 were divided into three categories.

An assessment of the risks derived from daily activities carried out during the COVID-19 pandemic (read mail/receive packages/online orders, shopping at the mall, refuel of car/motorcycle, shop for groceries, buy a meal from a restaurant on a takeaway basis, hugging or shaking hands when greeting friends, work one week in an office building, dining at the indoor restaurant) has been defined by Texas Medical Association.<sup>10</sup> The assessment of risks using scales 1 to 10, consisting of scales 1 to 2 were a low-risk; scales 3 to 4 were moderate-low risk; scales 5 to 6 were moderate risk; scale 7 was the moderate-high risk; scales 8 to 10 were high-risk.

All question items in the questionnaire were declared valid (r>0.361, df = 28) and reliable (Cronbach's alpha>0.761). The dependent variable of the risks of

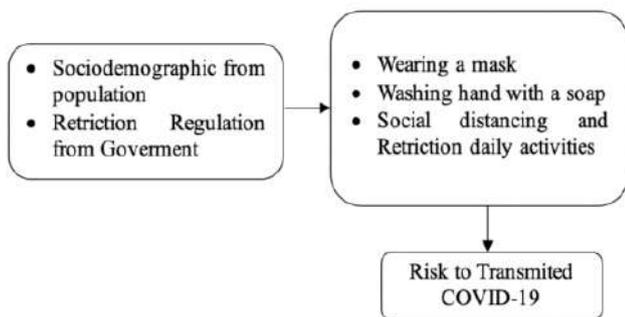


Figure 1. Conceptual Framework of Determinant of COVID-19

COVID-19 was divided into four categories based on the result of the investigations of low-risk, moderate-low risk, moderate risk, and moderate-high risk. A Chi-square, exact test, and multinomial regression were used to analyze the relationship between the dependent variable and independent variable with  $\alpha = 0.05$ , confidence interval (CI) 95%, odds ratio (OR), and prevalence ratio (PR).

**Results**

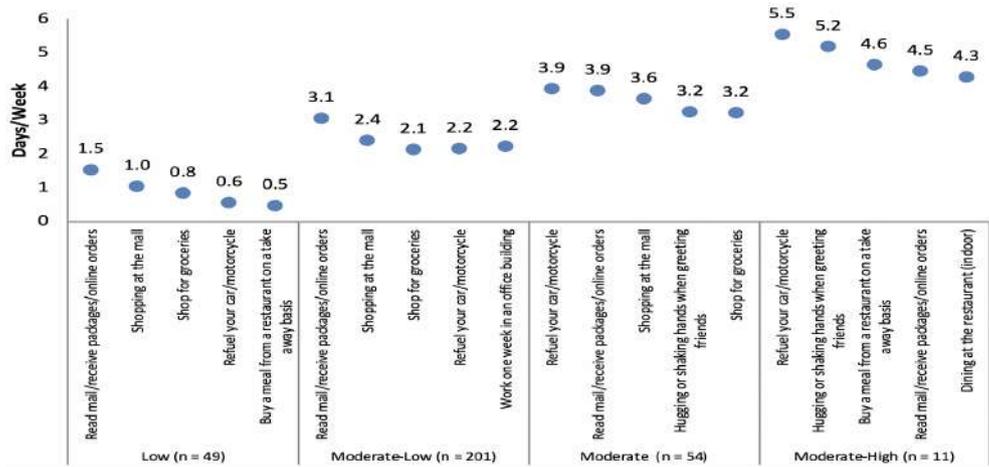
Table 1 shows that the majority of daily activities carried out by respondents in each risk category of contracting COVID-19 were the same; read mail/receive

packages/online orders, shopping at the mall, refuel your car/motorcycle, shop for groceries, buy a meal from a restaurant on a takeaway basis. In the moderate-risk and moderate-high risk groups, other daily activities were hugging or shaking hands when greeting friends. In the moderate-low risk group, other daily activities were working one week in an office building. In the moderate-high risk group, other daily activities were dining at the restaurant (indoor).

Figure 2 shows that the respondents in the low-risk category activities were in a frequency range of 0.5 to 1.5 days per week. The frequency of activity is increasingly relevant to the higher the risk category. In respondents

**Table 1. Overview of The Five Most Frequently Performed Daily Activities**

| Risk Category | 5 Most Frequently Performed Daily Activities     | Score |
|---------------|--|-------|
| Low           | Read mail/receive packages/online orders         | 34    |
|               | Shopping at the mall                             | 21    |
|               | Shop for groceries                               | 19    |
|               | Refuel your car/motorcycle                       | 14    |
|               | Buy a meal from a restaurant on a takeaway basis | 14    |
| Moderate-low  | Read mail/receive packages/online orders         | 204   |
|               | Shopping at the mall                             | 170   |
|               | Shop for groceries                               | 160   |
|               | Refuel your car/motorcycle                       | 136   |
|               | Working one week in an office building           | 102   |
| Moderate      | Refuel your car/motorcycle                       | 69    |
|               | Read mail/receive packages/online orders         | 67    |
|               | Shopping at the mall                             | 65    |
|               | Hugging or shaking hands when greeting friends   | 61    |
|               | Shop for groceries                               | 60    |
| Moderate-high | Refuel your car/motorcycle                       | 22    |
|               | Hugging or shaking hands when greeting friends   | 22    |
|               | Buy a meal from a restaurant on a takeaway basis | 22    |
|               | Read mail/receive packages/online orders         | 21    |
|               | Dining at the restaurant (indoor)                | 21    |
| Total         | Read mail/receive packages/online orders         | 103   |
|               | Shopping at the mall                             | 99    |
|               | Refuel your car/motorcycle                       | 99    |
|               | Shop for groceries                               | 94    |
|               | Buy a meal from a restaurant on a takeaway basis | 86    |



**Figure 2. Distribution of Daily Activities based on Days per Week**

Table 2. Bivariate Test for Each of Variables

| Variable        | Category     | Risks of COVID-19 |      |             |     |                   |      |               |      |               |      |                |      | p-value    |                    |                  |             |        |
|-----------------|--------------|-------------------|------|-------------|-----|-------------------|------|---------------|------|---------------|------|----------------|------|------------|--------------------|------------------|-------------|--------|
|                 |              | Low Risk          |      |             |     | Moderate-Low Risk |      |               |      | Moderate Risk |      |                |      |            | Moderate-High Risk |                  |             |        |
|                 |              | n                 | %    | OR (95% CI) | PR  | n                 | %    | OR (95% CI)   | PR   | n             | %    | OR (95% CI)    | PR   |            | n                  | %                | OR (95% CI) | PR     |
| Sex             | Female       | 45                | 18.6 |             |     | 156               | 64.5 |               | 1.18 | 38            | 15.7 |                | 1.75 | 3          | 1.2                |                  | 10.67       | <0.001 |
|                 | Male         | 4                 | 5.5  | Ref         | Ref | 45                | 61.6 | 3.2 (1.1-9.5) |      | 16            | 21.9 | 4.7 (1.5-15.4) |      | 8          | 11                 | 30.0 (5.6-160.2) |             |        |
| Education level | High         | 32                | 14.8 |             |     | 137               | 63.4 | 0.87          | 0.97 | 40            | 18.5 | 0.65           | 0.81 | 7          | 3.2                | 1.07             | 1.06        | 0.767  |
|                 | Low          | 17                | 17.2 | Ref         | Ref | 64                | 64.6 | (0.45-1.69)   |      | 14            | 14.1 | (0.28-1.53)    |      | 4          | 4.0                | (0.27-4.19)      |             |        |
| Occupation      | Non-employee | 31                | 18.7 |             |     | 100               | 60.2 | 1.73          | 1.11 | 29            | 17.5 | 1.48           | 1.20 | 6          | 3.6                | 1.43             | 1.34        | 0.402  |
|                 | Employee     | 18                | 12.1 | Ref         | Ref | 101               | 67.8 | (0.91-3.30)   |      | 25            | 16.8 | (0.67-3.27)    |      | 5          | 3.4                | (0.38-5.37)      |             |        |
| Knowledge       | Good         | 26                | 14.4 |             |     | 115               | 63.9 |               |      | 36            | 20   |                |      | 3          | 1.7                |                  |             | 0.216  |
|                 | Moderate     | 20                | 16.9 |             |     | 75                | 63.6 | 0.8 (0.4-1.6) | 0.96 | 17            | 14.4 | 0.6 (0.3-1.4)  | 0.79 | 6          | 5.1                | 2.6 (0.6-11.7)   | 2.23        |        |
|                 | Poor         | 3                 | 17.6 | Ref         | Ref | 11                | 64.7 | 0.8 (0.2-3.2) | 0.96 | 1             | 5.9  | 0.2 (0.1-2.4)  |      | 2          | 11.8               | 5.8 (0.7-49.7)   | 3.86        |        |
| Attitude        | Good         | 41                | 18.1 |             |     | 145               | 63.9 |               | 1.12 | 36            | 15.9 |                | 1.48 | 5          | 2.2                |                  | 3.94        | 0.047  |
|                 | Poor         | 8                 | 9.1  | Ref         | Ref | 56                | 63.6 | (0.9-4.5)     | 2.0  | 18            | 20.5 | (0.9-6.6)      | 2.6  | 6          | 6.8                | (1.5-25.1)       | 6.2         |        |
| Behavior        | Good         | 28                | 20.3 |             |     | 90                | 65.2 |               | 1.10 | 18            | 13   |                | 1.61 | 2          | 1.4                |                  | 4.5         | 0.030  |
|                 | Poor         | 21                | 11.9 | Ref         | Ref | 111               | 62.7 | (0.9-3.1)     | 1.6  | 36            | 20.3 | (1.2-5.9)      | 2.7  | 9          | 5.1                | (1.2-30.7)       | 6.0         |        |
| Age (Mean±SD)   |              | 26.49±8.59        |      |             |     | 24.81±5.70        |      |               |      | 23.44±4.64    |      |                |      | 27.00±7.95 |                    |                  |             | 0.330  |

Notes: OR = Odds Ratio, CI = Confidence Interval, PR = Prevalence Ratio, SD = Standard Deviation

Table 5. Multivariate Analysis

| Risk Level         | Variable             | Model |       |       |       | AOR   | 95% CI      |
|--------------------|----------------------|-------|-------|-------|-------|-------|-------------|
|                    |                      | 1     | 2     | 3     | 4     |       |             |
| Moderate-low risk  | Sex                  | 0.029 | 0.034 | 0.034 | 0.032 | 3.24  | 1.10-9.51   |
|                    | Knowledge (poor)     | 0.662 | -     | -     | -     | -     | -           |
|                    | Knowledge (moderate) | 0.267 | -     | -     | -     | -     | -           |
|                    | Attitude             | 0.177 | 0.201 | 0.112 | -     | -     | -           |
|                    | Behaviour            | 0.257 | 0.28  | -     | -     | -     | -           |
| Moderate risk      | Sex                  | 0.01  | 0.011 | 0.011 | -     | 4.63  | 1.42-15.13  |
|                    | Knowledge (poor)     | 0.189 | -     | -     | -     | -     | -           |
|                    | Knowledge (moderate) | 0.105 | -     | -     | -     | -     | -           |
|                    | Attitude             | 0.136 | 0.196 | -     | -     | -     | -           |
|                    | Behaviour            | 0.055 | 0.06  | 0.02  | -     | 2.61  | 1.16-5.86   |
| Moderate-high risk | Sex                  | 0.001 | 0.001 | 0.001 | -     | 28.86 | 5.33-156.29 |
|                    | Knowledge (poor)     | 0.141 | -     | -     | -     | -     | -           |
|                    | Knowledge (moderate) | 0.472 | -     | -     | -     | -     | -           |
|                    | Attitude             | 0.138 | 0.104 | 0.019 | -     | 5.75  | 1.34-24.74  |
|                    | Behaviour            | 0.14  | 0.165 | -     | -     | -     | -           |

Notes: The reference category is low-risk

with the moderate-high-risk category, respondents activated with a frequency of 4.3 to 5.5 days per week.

Based on the statistical test, Table 2 shows that there is a significant relationship between sex (p-value<0.001), attitude (p-value = 0.047), and behavior (p-value = 0.030) with the risks of COVID-19. Men were 30 times more likely to have a moderate-high risk of COVID-19 than women. Respondents with a poor attitude have a chance to have a moderate-high risk of COVID-19 by

6.2 times compared to respondents with a good attitude. Respondents with poor behavior have the opportunity to have a moderate-high risk of COVID-19 by 6.0 times compared to respondents with good behavior.

Multinomial regression results (Table 3) have shown that the most influential factor in moderate-low risk is gender (p-value = 0.032; AOR = 3.24). While the variables that most affect moderate risk are gender (p-value = 0.011; AOR = 4.63) and behavior (p-value =

0.002; AOR = 2.61). The variables that most affects moderate-high risk are gender (p-value = 0.001; AOR = 28.86) and attitude (p-value = 0.019; AOR = 5.75).

## Discussion

The pandemic urged the government to make policies, e.g., large-scale social restrictions (LSSR) and new normal policies, to restrict social interactions. The results of this study indicated that the majority of respondents (63.81%) had a moderate-low level of daily activity risk. The average activities that respondents still engaged in during the pandemic were: 1) read mail/receive packages/online orders; 2) shopping at the mall; 3) shopping for groceries; 4) refueling a car/motorcycle, and 5) working one week in an office building.

The LSSR and new-normal policies implemented by the government can reduce the level of macro-social mobility. The level of mobility in the public transport sector, workplaces, and retail and recreation decreased by 28%, 25%, and 15%, respectively, compared to the conditions before the pandemic in early 2020.<sup>17</sup> This is relevant to the findings of this study, where the majority of activities carried out were basic activities to meet the necessities of life, such as refueling vehicles and shopping for groceries. Also, changes in people's lifestyles due to restrictions on social interaction impacted the style of fulfilling their needs from direct physical fulfillment to online fulfillment through online ordering and shopping. The findings of this study showed that most people followed lifestyle changes, including buying takeaway food and reading online letters/receiving online packages/orders. The tendency of people to change their fulfillment behavior during the pandemic (such as shopping from home) is following the view of trend-changing transformation, where technological disruption in daily life is inevitable, and pandemics are the only alternative reasons for experiencing trend changes more rapidly.<sup>17</sup> This is also relevant to the efforts to reduce interactions to decrease the number of COVID-19 cases.

Some activities that should be restricted under government policies were also carried out, such as dining at restaurants and shopping at malls. This is different from the mobility data where the retail and recreation sectors still had not shown an increase in activity, from -14% from May 26 to July 7, 2020, to -15% between September 22 and November 3, 2020.<sup>18</sup> Respondents in the low-risk category tended to engage in activities such as shopping at the mall, shopping for groceries, and receiving online orders. Respondents in the moderate-high risk category tended to do activities such as attending open parties and weddings, hugging or shaking hands when greeting friends, and dining at restaurants (indoor). Respondents in the moderate-high risk category had the second-highest proportion with 17.2%.

This result is related to the level of compliance of respondents with the policies implemented by the government. Even though, ideally, people who live in areas with good infrastructure tend to be better at receiving preventive information about COVID-19.<sup>19</sup> The majority of respondents who still carried out activities such as shaking hands and hugging when they meet others, and walking, running, and cycling with other people (in groups) were relevant to the findings of previous cases where people often violated health protocols during the pandemic by not physically distancing and making physical contact, with a high chance of transmission of COVID-19.<sup>20</sup>

Another investigation presented related conclusions, explaining that dining in restaurants (indoor) was a moderate-high risk.<sup>21,22</sup> Being inside and around others puts a person at higher risk of vulnerability to people driving the virus. If people are outside, it's much more likely that anything in the air will disperse more quickly, meaning there is less chance of breathing in infected air particles. Dining out also means being around others who are largely not wearing masks or covering their faces since it is difficult to keep a mask on while eating. Ultimately, being around servers is also a risk since people will communicate and interact with them in close proximity pretty frequently.

Non-compliance in implementing health protocols is a key risk that must be addressed because it indicates that there is still an opportunity for the transmission rate of COVID-19 to increase. The findings of this study reflected the national data on crowd behavior (not physically distancing) and wearing masks, which decreased from 89.04% in October 2020 to 59.20% in December 2020.<sup>23</sup> Also, the existence of the LSSR and LSSR-transitional policies resulted in the lack of extensive mass activities carried out by respondents. LSSR and LSSR-transitional policies tended to focus on minimizing a large number of social interactions. This condition suited the objective of this study, as the majority of respondents did not carry out activities with large numbers of people, such as going to bars, participating in large religious gatherings, visiting stadiums, and attending large in-person music concerts. This also suited the categorization for this study, as these are activities with a high-risk level for COVID-19 transmission.<sup>10</sup>

A risk comparison of daily activities by sex shows that more than 60% of both groups were at moderate-low risk. It showed that females would have more risky categories than males and have significantly related other risky categories. Regarding the study, respondents engaged in some risky activities while knowing that the pandemic has not ended yet. The most common activities that have been included as risky categories are hugging

or shaking hands when they meet others, dining at indoor restaurants, visiting elderly family members, shopping at malls, shopping for groceries, refueling vehicles, buying takeaway food, and taking online mails/online orders. Everyone should refrain from activities that trigger risks of being infected with COVID-19. A study conducted by Drefahl, *et al.*,<sup>24</sup> showed a parallel study between men and women regarding the risk of death when suffering COVID-19. These two studies are different. However, they both measure a risk-based activity, and it's related to kind of risk categories. Both men and women are at risk of contracting COVID-19, and both are at risk of death from COVID-19. Another study on respondents aged over 18 years in Cyprus also showed a similar risk of experiencing a decline in health; in this case, stress and depression caused by COVID-19 in both men and women.<sup>25</sup> This study showed that both men and women were at high risk of impact on health conditions due to COVID-19 instead of if they had been infected or had a risk of being infected by COVID-19.

The majority of respondents in each daily risk category have higher education backgrounds. This study is similar to the study conducted in Henan, China, whose respondents' education levels are dominated by those with higher education or undergraduate levels.<sup>26</sup> A respondent with a higher education background is undoubtedly expected to be a factor that encourages behavior that prevents or encourages the risk of daily activities being in a low-risk category. Highly educated respondents will have good knowledge and attitudes, which bring an impact on good behavior. In this case, it is expected that respondents with a higher education background will have a low daily risk. This study is in line with the study results in Bangladesh, which showed that respondents with a higher education level had good behavior and were not at risk.<sup>27</sup> In this study, indeed, the knowledge figure was almost equal. Still, the positive number tended to be above 60% in attitude and behavior, which showed the harmony in the education category, impacting behavior. Looking at analytical statistics, it showed different results. This study did not show a significant relationship between educational background and risky activity. This is due to various possibilities, including that the level of education is not necessarily able to determine a person's risky activities considering there are quite a lot of other factors that determine a person's movement in life, especially during pandemic.

At the education level, it was identified that respondents with higher education or bachelor's degree education level had a higher risk of daily activities than those with senior high school education level. This study is consistent with the study by Drefahl, *et al.*,<sup>24</sup> which showed that low education levels have a potential risk to

their health. Besides, this study was also strengthened by meta-analysis and multi-cohort studies that stated that low education levels were more likely to experience death.<sup>28</sup> The education level of the respondent should have a strong correlation with their behavior. Respondents will have good knowledge to practice behaviors that do not endanger themselves and lead them to death. However, often urgent conditions and boredom are other factors that cause respondents to leave their house and, consequently, increase the risks of their daily activities. The increased risks of daily activities will potentially lead to COVID-19 and death in certain conditions.

In the category of occupation status, almost all respondents are working people. However, there is a few percent with non-employee. Occupation status is one factor that supports the high risk of respondents' daily activities, as with the study's findings, which stated that working is one factor that is considered the cause of the COVID-19 outbreak.<sup>29</sup> Respondents who work and are required to stay out of their houses will certainly increase their risk of being exposed to COVID-19. Statistics analysis also shows that the results of this study were the same as those conducted in Bangladesh in that the occupation status has no significant relationship with the risky activities category. This is quite unique considering that occupation status should be a determinant of a person's risk category. However, the status of work still needs to be deepened. In this study, it was only asked about the occupation status, which is not necessarily closely related to the main activities in the risk category level.<sup>27</sup>

In the non-employee category, the risk of daily activities tends to be varied. It was because respondents continued to carry out their daily activities to fulfill their needs. The respondent's occupation status was one of the risk factors for the high and low risks of a person being exposed to the COVID-19. Occupation status required someone to leave their houses, which will risk being infected with COVID-19. In minimizing the risks of daily activities, some policies or guidelines have been regulated under several regulations. Some occupations can be identified as hazardous jobs to COVID-19, but some are classified as low or moderate risks. However, it would be better whether companies or agencies can minimize the risks by instructing their employees to work from home.<sup>30</sup>

Students (a part from non-employee respondents) have daily activities at higher risk than the respondents who are workers. There are indications of disobedience to remain at home for students for several reasons. These reasons include feeling bored at home, feeling strong because of their young age, and even falling into neglecting the situation. With the pandemic that has lasted more than nine months and forced students to

leave their homes, there is a real risk of being exposed to COVID-19. These results have similarities to studies in Bangladesh, which showed that students' categories have balanced knowledge, attitudes, and behavior between the good and the less. The study in Bangladesh positively impacted behavior that tends to increase daily activities' risk.<sup>27</sup> Besides, this study has no significant statistical analysis either between the variables.

The results showed that the majority of the respondents had good knowledge about COVID-19. Several other studies also indicate good knowledge about COVID-19 among Indonesian people.<sup>31,32</sup> The role of information about COVID-19 provided by the government and other institutions that could be accessed via television, the internet, and public facilities may have been a factor in increasing public knowledge and interest in COVID-19. However, this study showed that knowledge had no significant relationship with daily activities that contributed to the risk of contracting COVID-19. This indicated that the protection of the public against COVID-19 through increasing public knowledge by providing information could have unintended outcomes; previous study also showed that information reliability about COVID-19 had no significant effect on changes in people's daily behavior.<sup>33</sup> Therefore, it is the people themselves who choose how they use this knowledge in their daily lives. It also suggested that offering education and information to increase knowledge is not adequate without raising public awareness of being socially responsible for adjusting daily activities in controlling the spread of COVID-19.<sup>34</sup> There needs to be the involvement of community leaders with strong influences among the public and elaborating on sociocultural aspects, such as the use of friendly and easily applied local languages in communication regarding COVID-19, which can be applied in increasing public awareness to increase their confidence in being involved in COVID-19 control.<sup>35</sup>

This study showed that the majority of respondents had a good attitude in responding to COVID-19. Around 72% of respondents agreed that preventive measures such as wearing masks and avoiding crowds could prevent the spread of COVID-19. This study also showed that attitude had a significant relationship with daily activities and the risk of contracting COVID-19. A poor attitude was likely to have a moderate-high risk of 6.15 times to a good attitude. The results of this study were consistent with previous studies, where the risk-taking attitude was an important factor in decreasing community mobility during the pandemic.<sup>36</sup> Study conducted in Malaysia and China showed that the actions taken by the government in mitigating the virus and controlling people's movements had an impact on a good attitude and public confidence that this pandemic could

be well controlled.<sup>7,37</sup> This suggests that there is a need for good communication between the government and the community to build public confidence in the government's ability to overcome the COVID-19 situation so that people can have positive attitudes and adjust their daily activities in response to a pandemic situation. This good communication can be established by involving the community in the implemented COVID-19 pandemic-mitigation policy.

Having poor preventive behavior increased the risk of contracting COVID-19 by 1.67 to 5 times. This result indicated that people who were still not practicing preventive behavior tended to engage in some public activities that involved more risk of contracting COVID-19. People must practice preventive behavior when engaging in public activities. It has been recommended to use certain items when going out if possible, such as a face mask and hand sanitizer with 60% alcohol content. This condition suggested that it is crucial for people's behavior adherence in practicing preventive action while the government has to monitor and evaluate public activities as well to reduce the transmission of COVID-19.<sup>38</sup>

The limitations of this study were as follows. The data could not be analyzed regionally and compared because samples were not equally obtained across regions. However, the respondents had similar characteristics because they all lived in a big city. Besides that, the study was performed using an online questionnaire; therefore, it was difficult to capture the profile of all socioeconomic backgrounds of the respondents, but the study findings focused on the daily activities of respondents concerning their risk of contracting COVID-19. Another limitation is that a few independent variables are to be analyzed because the study focused on factors related to the risk of getting COVID-19 based on daily activity, which could be determined by respondents' social demographics, knowledge, attitude, and behavior. Further, more variables and respondents may be some factors to consider for future study.

## Conclusion

The risk assessment of getting COVID-19 could be derived from daily activities carried out during the pandemic. Based on respondents' daily activities, the risk percentages of being infected with COVID-19 were 15.56% at low risk, 63.81% at moderate-low risk, 17.14% at moderate risk, and 3.9% at moderate-high risk. Factors that were significantly related to the risk of COVID-19 transmission in terms of daily activities are sex, attitude, and COVID-19 preventive behavior. The related factors could be prioritized. If new knowledge is threatening communities with higher rates of transmission of COVID-19, then the government or the right

stakeholder should pay more attention to it. The implementation of LSRR should be exercised concurrently with clear and strict rules in the field, including supervision of the performance of health protocols. Health education on health and safety protocols and practices should always be given and reiterated to the community.

#### Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; LSRR: Large-Scale Social Restrictions; OR: Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

#### Ethics Approval and Consent to Participate

This research was approved by the Ethical Committee of the Faculty of Health Sciences, The State Islamic University of Syarif Hidayatullah No. Un.01/F.10/KP.01.1/KE.SP/009.08.006/2020. The authors explained the study to the respondents and obtained consent.

#### Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

#### Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### Authors' Contribution

FA and M contributed to conception or design, preparing the initial and framework. All authors contributed to sample preparation and collecting the data. MTAA contributed to the analysis tools and interpretation of the results. FA took the lead in writing the manuscript and approved it. All authors provided critical feedback and helped shape the research, analysis, and manuscript.

#### Acknowledgment

This work was supported by the research team that has concerned about the issues. The authors are grateful to the Faculty of Health Sciences, The State Islamic University of Syarif Hidayatullah for the administrative support.

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## **Reviewer Acknowledgment**

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