

Knowledge, Attitudes, and COVID-19 Prevention Practices of Healthcare Workers in Indonesia: A Mobile-based Cross-sectional Survey

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Abstract

Knowledge of disease can affect attitudes and prevention practices, and wrong attitudes and practices can directly increase the risk of disease infection. This study aimed to describe the knowledge, attitudes, and COVID-19 prevention practice of healthcare workers in Indonesia and factors associated with prevention practices. A mobile-based cross-sectional survey was conducted in August 2020 with 254 healthcare workers in Indonesia. The self-administered questionnaire consisted of four parts: 1) sociodemographic information, 2) knowledge of COVID-19, 3) attitudes and anxiety toward COVID-19, and 4) COVID-19 prevention practices. The results indicated that healthcare workers in Indonesia had excellent knowledge and positive attitudes about COVID-19, but their prevention practices were lacking. The multiple logistic regression analysis results revealed that the factors associated with the COVID-19 prevention practices of healthcare workers in Indonesia were knowledge, attitudes, anxiety, domicile island, age, income, and education. Healthcare workers who had excellent knowledge, positive attitudes, and high anxiety exhibited better COVID-19 prevention practices than others. Healthcare workers in Sumatra Island, aged 41–50 years, and an undergraduate education showed better COVID-19 prevention practices than others.

Keywords: attitudes, COVID-19, healthcare workers, knowledge, practices

Introduction

Coronavirus disease 2019 (COVID-19), a disease caused by SARS-CoV-2, was first identified in the city of Wuhan in China's Hubei Province in December 2019.¹ On January 30, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a public health emergency of international concern.² On March 11, 2020, WHO declared the COVID-19 outbreak a pandemic.³ This ongoing pandemic has spread extremely quickly, with more than 162.7 million confirmed cases of infection and more than 3.37 million deaths (2.1%) worldwide as of May 18, 2021.⁴ In Indonesia, the first case of COVID-19—a mother and child—was reported on March 2, 2020.⁵ To date (May 18, 2021), there have been 1,748,230 confirmed cases of infection in Indonesia and more than 48,477 deaths (2.8%).⁶

Countries worldwide have implemented various methods to prevent wider transmission, such as social distancing, washing hands, limiting means of transportation, closing public places, testing, and contact tracing.⁷ Healthcare workers are at high risk of contracting COVID-19 because they are directly involved in provid-

ing services to help control the ongoing outbreak. Therefore, all precautions should be taken to control the spread of infection to health workers. Prevention efforts can be initiated by identifying risk factors for infection and taking appropriate action to reduce these risks.

Previous study had shown that the occurrence of disease transmission among healthcare workers was associated with overcrowding, the absence of isolation room facilities, and environmental contamination. The risk of transmission is exacerbated by the fact that some healthcare workers do not have sufficient awareness of infection prevention practices.⁸ Knowledge of disease can affect the attitudes and practices of healthcare workers, and wrong attitudes and practices can directly increase the risk of infection.⁹ A good understanding of health workers' knowledge, attitudes, practices, and possible risk factors can help predict expected positive behaviors.

Currently, the use of mobile-based surveys is growing and is an opportunity that can be utilized for research. The existence of technology support and adequate mobile-based infrastructure is something positive that must be utilized. The use of mobile survey vases has great po-

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tential to support data collection in the health sector, including surveys on COVID-19. There has been no study on the knowledge, attitudes, and prevention practice of healthcare workers in Indonesia related to COVID-19. Therefore, this study aimed to analyze the knowledge, attitudes, and COVID-19 prevention practices of healthcare workers in Indonesia and factors associated with prevention practices using a mobile-based cross-sectional survey.

Method

A cross-sectional survey was conducted throughout Indonesia in August 2020. The survey was conducted online (mobile-based data collection) because it was impossible to conduct face-to-face interviews during the large-scale social distancing (LSRR)/*Pembatasan Sosial Berskala Besar* (PSBB) that had been in place since the beginning of the COVID-19 pandemic. The study population consisted of health personnel, including doctors, nurses, midwives, nutritionists, laboratory assistants, and public health experts who provided health services during the COVID-19 pandemic as eligibility criteria. The sample size was calculated using the proportion estimation formula at a 95% confidence interval. An estimated proportion of healthcare workers with prevention practices regarding COVID-19 was at 60%, and a precision of 6%, the minimum sample required was 257 respondents. Of the 311 responses, 35 respondents filled in incomplete, and 22 filled in double. The final sample comprised 254 respondents who completed the entire survey.

A self-administered questionnaire collected data on health workers' knowledge, attitudes toward, and prevention practices regarding COVID-19. Surveys were hosted on the KoBoToolbox platform. The KoBoToolbox platform allowed for questionnaire design, data collection, descriptive analysis, and data download via Excel spreadsheets for further analysis. The questionnaire link contained the invitation to participate in the online survey, and eligibility criteria were sent randomly via a WhatsApp group of healthcare workers. The WhatsApp groups of healthcare workers included medicine, nursing, midwifery, public health, nutrition, and laboratory assistants. WhatsApp message delivery contained an explanation of the survey and informed consent, as well as the respondent's eligibility criteria. If potential respondents agree, they could click on the questionnaire link available on the KoboToolbox platform. In the questionnaire on the KoboToolbox platform, informed consent and eligibility criteria were asked again. If the respondent agrees, a list of questions would appear, and the respondents fill that in.

The completed questionnaires were taken from the KoBoToolbox form and exported to Microsoft Excel 2010 for data cleaning and coding. The clean data was

exported to IBM SPSS Statistics in the Computer Laboratory of Faculty of Public Health, Universitas Indonesia (IBM SPSS Version 17). The respondents' knowledge of COVID-19 consisted of 18 questions (true or false) about symptoms, transmission, prevention, and control of COVID-19. Correct answers were given a score of 1, and incorrect answers were given 0. The total knowledge score ranged from 6 to 18. A score of 13 or less was considered quiet, 14–15 was considered good, and 16–18 was considered very good.

The respondents' attitudes toward COVID-19 consisted of ten questions (agree or disagree) about prevention, use of masks, beliefs, worship in mosques, and physical distancing. Positive attitude answers were given a score of 1, and negative attitude answers were given 0. The attitude score ranged from 1 to 10. Scores less than 8 were categorized as negative, scores 8–9 were classified as positive, and a score of 10 was categorized as very positive.

The respondents' anxiety about COVID-19 consisted of four questions about the pressure of family members and respondents' health. The answers were ranged from 1 (not at all anxious) to 100 (very anxious). An anxiety score of 80 or less was categorized as low anxiety, and a score of 81 or more was classified as high anxiety. The respondents' practices related to COVID-19 consisted of 12 questions about COVID-19 prevention and control methods, including wearing masks, keeping distance, washing hands, avoiding crowds, and avoiding mobility. Answers ranged from 1 (never practicing) to 100 (always practicing). A prevention practice score of 80 or less was categorized as less, and a score above 80 was classified as good.

The survey questionnaire was adopted from previous studies on COVID-19 and other materials about the COVID-19 pandemic.¹⁰⁻¹⁴ Several questions were added according to Indonesian conditions, including knowledge and prevention practice of COVID-19 referring to the COVID-19 Prevention and Control Guidelines published by the Ministry of Health of the Republic of Indonesia.¹⁵ This survey questionnaire has the advantage of being valid and reliable and adopting the Indonesian context. The knowledge questionnaire of COVID-19 was valid and reliable with good internal validity and reliability testing (Cronbach's alpha = 0.661, item-total correlation more than 0.3). The attitudes questionnaire toward COVID-19 was valid and reliable with good internal validity and reliability testing (Cronbach's alpha = 0.674, item-total correlation more than 0.3). The anxiety questionnaire about COVID-19 was valid and reliable with good internal validity and reliability (Cronbach's alpha = 0.844, item-total correlation more than 0.4). The prevention practices questionnaire related to COVID-19 was valid and reliable with good internal validity and reliabil-

ity testing (Cronbach’s alpha = 0.885, item-total correlation more than 0.5).

The data analysis consisted of descriptive statistics, and the frequency, percentage, mean, and standard deviation distribution were included. The bivariate analysis using a Chi-square test was also utilized to assess the relationship between healthcare workers’ knowledge, attitudes, and sociodemographic characteristics of COVID-19 prevention practices. Multiple logistic regression with a significance level of 0.05 was carried out to identify the odds ratio and factors associated with COVID-19 prevention practices.

Results

The results will be presented in the form of tables and narratives. The description of the respondent’s characteristics, knowledge, attitudes, anxiety, and COVID-19 prevention practices will be followed by factors associated with COVID-19 prevention practices.

A total of 254 healthcare workers participated in the survey. Respondents were scattered throughout

Indonesia, from Java Island (40.6%), Sulawesi Island (30.7%), Sumatra Island (19.7%), and Kalimantan Island (9.1%). Mainly, the respondents were 21–30 years old (44.9%) and had an IDR 2.5–5.0 million per month income (42.1%). There were more female respondents (83%) than male respondents. Respondents with a diploma education level constituted the largest proportion (47.6%). Most of the respondents worked as midwives (52.4%).

Knowledge of COVID-19 symptoms was measured through questions about symptoms and transmission. The level of the respondents’ knowledge is presented in Table 1. In general, healthcare workers’ knowledge about the symptoms and transmission of COVID-19 was good. Fever, cough, and asphyxiate were the three main symptoms recognized by more than 97% of healthcare workers. In comparison, only 68% of respondents knew that headaches were a symptom of COVID-19 and that all infected people show symptoms. Interestingly, only 34% of respondents knew that loss of the sense of taste or smell was a symptom of COVID-19.

Table 1. Knowledge of COVID-19 (n = 254)

Knowledge of COVID-19		*Correct Answer (%)
Symptoms	Fever	98.4
	Cough	97.2
	Asphyxiate	97.2
	Sore throat	96.9
	Cold	87.4
	Headache	68.5
	Everyone infected with the COVID-19 will show symptoms of illness	68.9
	Loss of taste/smell	34.3
Transmission	COVID-19 is transmitted through physical contact (touching/shaking hands)	92.9
	Washing hands with a hand sanitizer is effective in preventing transmission of the COVID-19	94.5
	Touching the mouth/nose/eyes with hands is at risk of being infected with the COVID-19	98.0
	Washing hands with soap and running water is effective in preventing transmission of the COVID-19	99.2
	COVID-19 is transmitted through droplets when sneezing/coughing	98.4
	Infected people who experience no symptoms can still transmit the virus to others	98.8
	The use of masks is effective in preventing transmission of the COVID-19	99.2
	Staying at home is effective in preventing the spread of the COVID-19	99.2
	Avoiding handshakes is effective in preventing transmission of the COVID-19	99.2
Physical distancing is effective in preventing transmission of the COVID-19	100.0	

Note: *Percentage of the respondents that answered correctly

Table 2. Attitudes about COVID-19 Prevention (n = 254)

Attitudes about COVID-19 Prevention	*Agrees (%)
Apply physical distancing during the COVID-19 pandemic	99.6
Wear a mask when meeting relatives/friends/neighbors	98.8
Avoid handshakes/physical contact when meeting relatives/friends/neighbors	98.4
Avoid going to malls, markets, or other crowds	96.9
Implement large-scale social restrictions (lockdown) during the COVID-19 pandemic	95.7
Not attending religious recitation in mosques	87.0
Large-scale social restrictions violators must be subject to sanctions/fines	80.3
Avoid congregational prayer in mosques/public places during LSRR	75.6
Leaving Friday prayers for Muslims during the lockdown and replacing them with midday prayers at home	71.3
Keep praying in congregation at the mosque during lockdown because you believe that illness is a provision of Allah	62.2

Note: *Percentage of the respondents that agrees with the statement

Table 3. Anxiety about COVID-19 (n = 254)

Anxiety about COVID-19	*Mean Score±SD
The news about COVID-19 worries me	82.8±19.2
I am worried about my health	84.6±21.7
I am worried about the health of my family members	87.6±20.3
I worry when I have to leave the house	87.8±18.2

Notes: SD: Standard Deviation, *Not at all anxious (Score 1), very anxious (Score 100)

Table 4. COVID-19 Transmission Prevention Practices (n = 254)

COVID-19 Transmission Prevention Practices	*Mean Score±SD
Use hand sanitizer	35.0±47.8
Wear a mask	39.4±49.0
Avoid using public transportation	65.4±47.7
Avoid congregational prayer in mosques/other public places	66.9±47.1
Avoid handshakes	68.1±46.7
Avoid touching objects in public areas	75.2±43.3
Avoid crowds at malls, markets, or others	75.6±43.0
Wash hands with soap	78.7±41.0
Avoid gatherings, crowds, or long queues	78.7±41.0
Keep a distance of two meters when interacting with other people	79.5±40.4
Avoid touching the face, eyes, nose, or mouth	85.4±35.3
Wear gloves	86.6±34.1

Notes: SD: Standard Deviation, *Never (score 1), Always (score 100)

Regarding the transmission of COVID-19, all (100%) healthcare workers knew that physical distancing was an effective way to prevent transmission of the COVID-19. More than 99% of healthcare workers knew that washing their hands with soap, wearing masks, avoiding handshakes, and staying at home were effective ways to prevent transmission. A total of 92.9% of healthcare workers knew that COVID-19 could be transmitted through handshakes, and 94.5% knew that hand sanitizer effectively prevented transmission.

Respondents' attitudes and anxiety are presented in Tables 2 and 3. In general, healthcare workers in Indonesia had positive attitudes about the prevention of COVID-19 (mean score 86.4%). Three positive attitudes (highest ranking) that were answered agreeably by more than 98% of respondents related to 1) physical distancing, 2) wearing a mask, and 3) avoiding handshakes or physical contact. The less positive attitudes shown by respondents (answered agree 62%–75%), related to 1) continuing congregational prayer at the mosque during the lockdown period (because they believe that illness is a provision of Allah) and 2) not leading Friday prayers for Muslims in lockdown areas. Scores related to respondents' anxiety are presented in Table 3. In general, healthcare workers in Indonesia had a very high anxiety score related to COVID-19. Anxiety about the health of family members (mean 87.6) was higher than anxiety about res-

pondents' own health (mean 84.6). Respondents were also very anxious when they needed to leave the house (mean 87.8) and worried about news about COVID-19 (mean 82.8).

The COVID-19 prevention practices of healthcare workers are presented in Table 4. In general, healthcare workers in Indonesia had poor practices related to the prevention of COVID-19. These poor practices were reflected in the low level of use of masks and hand sanitizer (mean scores of 35.0 and 39.4, respectively). Many healthcare workers indicated that they did not avoid using public transportation, praying in congregations in mosques, or shaking hands (mean scores 65.4, 66.9, and 68.1, respectively). However, the healthcare workers had also implemented many good COVID-19 prevention practices, including wearing gloves (mean score 86.6); avoiding touching their face, eyes, nose, and mouth (85.4); washing hands with soap (78.7); avoiding crowds (78.7); keeping a distance of two meters when interacting with others (79.5).

Table 5 shows an overview of the health workers' COVID-19 prevention practices and their distribution according to knowledge, attitudes, anxiety, and demographic characteristics. The practice scores were categorized as either poor practice or good practice. Less than half (46.5%) of the healthcare workers properly practiced COVID-19 prevention. COVID-19 prevention practices varied according to respondents' characteristics relating to respondents' knowledge, attitudes, and anxiety.

A relationship between knowledge, attitudes, and anxiety and COVID-19 prevention practices was identified. The higher the worker's knowledge, the better COVID-19 prevention practices. As much as 53.9% of the well-informed healthcare workers had good COVID-19 prevention practices. Only 41–45% of less well-informed healthcare workers had good COVID-19 prevention practices.

The more positive the worker's attitude, the better they will handle COVID-19 prevention practices. The 48–49% of healthcare workers with positive or very positive attitudes had good COVID-19 prevention practices. Only 41% of healthcare workers with negative attitudes had good COVID-19 prevention practices. Anxiety was found to enhance good COVID-19 prevention practices. A total of 56.4% of anxious healthcare workers had good COVID-19 prevention practices. In contrast, only 28.6% of healthcare workers who were not anxious had good COVID-19 prevention practices.

Prevention practices were lacking among healthcare workers in Sumatra and Java Island (32.0% and 38.8%, respectively). In comparison, healthcare workers on Kalimantan and Sulawesi Islands had good practices (56.5% and 62.8%, respectively). COVID-19 prevention

Table 5. The Relationship between Knowledge, Attitudes, Anxiety, and Demographic Characteristics with COVID-19 Prevention Practices (n = 254)

Independent Variable	Category	COVID-19 Prevention Practices					
		Less		Good		Total	
		n = 136	%	n = 118	%	n = 254	%
Knowledge	Quite	46	54.8	38	45.2	84	33.1
	Good	55	58.5	39	41.5	94	37.0
	Very good	35	46.1	41	53.9	76	29.9
Attitudes	Negative	46	59.0	32	41.0	78	30.7
	Positive	44	50.6	43	49.4	87	34.3
	Very positive	46	51.7	43	48.3	89	35.0
Anxiety	Low	65	71.4	26	28.6	91	35.8
	High	71	43.6	92	56.4	163	64.2
Domicile Island	Sumatra	34	68.0	16	32.0	50	19.7
	Java	63	61.2	40	38.8	103	40.6
	Kalimantan	10	43.5	13	56.5	23	9.1
	Sulawesi	29	37.2	49	62.8	78	30.7
Age	21–30 years	65	57.0	49	43.0	114	44.9
	31–40 years	52	54.7	43	45.3	95	37.4
	41–50 years	19	42.2	26	57.8	45	17.7
Sex	Male	17	39.5	26	60.5	43	16.9
	Female	119	56.4	92	43.6	211	83.1
Income	<IDR 2.5 million	36	36.4	63	63.6	99	39.0
	IDR 2.5–5.0 million	69	64.5	38	35.5	107	42.1
	>IDR 5.0 million	31	64.6	17	35.4	48	18.9
Education	3-year diploma	62	51.2	59	48.8	121	47.6
	4-year diploma	25	69.4	11	30.6	36	14.2
	Bachelor	14	32.6	29	67.4	43	16.9
	Professional education	19	65.5	10	34.5	29	11.4
Profession	Master	16	64.0	9	36.0	25	9.8
	Doctor	4	80.0	1	20.0	5	2.0
	Nurse	15	48.4	16	51.6	31	12.2
	Professional nurse	7	58.3	5	41.7	12	4.7
	Midwife	78	58.6	55	41.4	133	52.4
	Public health expert, nutritionist, or laboratory assistant	32	43.8	41	56.2	73	28.7

practices differed according to age group and sex. Healthcare workers aged 41–51 years had better practices (57.8%) than healthcare workers aged 21–40 years (43.0–45.3%). Male healthcare workers had better practices (60.5%) than female healthcare workers (43.6%). COVID-19 prevention practices also differed according to income. Healthcare workers with low incomes (less than IDR 2.5 million per month) had better practices (63.6%) than healthcare workers with incomes above IDR 2.5 million per month (35%).

COVID-19 prevention practices also differed by education level and type of profession. Workers who had completed an undergraduate degree (67.4%) exhibited better knowledge of prevention practices than workers who had completed a diploma, professional education, or master’s degree (30.6–48.8%). Public health experts, nutritionists, and laboratory assistants exhibited better practices (56.2%) than other professions (20.0–51.6%).

The multiple logistic regression analysis results (Table 6) show the factors associated with COVID-19 prevention practices among healthcare workers in Indonesia.

Healthcare workers with very good knowledge of COVID-19 were twice as likely to practice good COVID-19 prevention behavior than healthcare workers with less knowledge (ORa = 2.03, p-value = 0.090). Healthcare workers with positive or very positive attitudes were twice as likely to practice good COVID-19 prevention behavior than healthcare workers with negative attitudes (ORa = 2.02 and 2.03; p-value = 0.071 and 0.095, respectively). Healthcare workers with high anxiety were three times more likely to practice good COVID-19 prevention behavior than healthcare workers with low anxiety (ORa = 3.14, p-value<0.001).

Healthcare workers from Sumatra Island had the worst COVID-19 prevention practices compared to healthcare workers from other islands. Healthcare workers from Java, Sulawesi, and Kalimantan Island were 2.58–3.36 times more likely to practice good COVID-19 prevention behavior than those from Sumatra Island (ORa = 2.58–3.36, p-value = 0.039–0.067). Healthcare workers aged 41–50 years were 2.6 times more likely to practice good COVID-19 prevention behavior than

Table 6. Multiple Logistic Regression Results for Factors Associated with COVID-19 Prevention Practices (n = 254)

Independent Variable	Category	Sig (2-tailed)	Coeff B	ORa	95% CI ORa	
					LL	UL
Knowledge (Ref. quite)	Good	0.277	0.431	1.54	0.71	3.34
	Very good	0.090	0.710	2.03	0.89	4.63
Attitudes (Ref. negative)	Positive	0.095	0.704	2.02	0.88	4.62
	Very positive	0.071	0.708	2.03	0.94	4.38
Anxiety (Ref. high)		0.001	1.144	3.14	1.65	5.97
Domicile island (Ref. Sumatera)	Java	0.039	0.959	2.61	1.05	6.49
	Kalimantan	0.053	1.212	3.36	0.98	11.49
	Sulawesi	0.067	0.948	2.58	0.94	7.12
Age (Ref. 21–30 years)	31–40 years	0.540	0.214	1.24	0.63	2.45
	41–50 years	0.041	0.967	2.63	1.04	6.66
Income (<IDR 2.5 million)	IDR 2.5–5.0 million	0.011	-0.949	0.39	0.19	0.81
	>IDR 5.0 million	0.031	-1.141	0.32	0.11	0.90
Education (Ref. 3-year diploma)	4-year diploma	0.289	-0.493	0.61	0.25	1.52
	Bachelor	0.088	0.777	2.17	0.89	5.31
	Professional education	0.787	-0.141	0.87	0.31	2.41
Constant	Master	0.994	0.004	1.00	0.35	2.86
		0.048	-1.342			

Notes: Sig = Significant, Ref = Reference group, ORa = adjusted Odds Ratio, LL = Lower Limit, UL = Upper Limit

healthcare workers aged 21–30 years (ORa = 2.63, p-value = 0.041). Healthcare workers with an undergraduate level of education were twice as likely to practice good COVID-19 prevention compared to healthcare workers with a 3-year diploma (ORa = 2.17, p-value = 0.088).

Discussion

This research was carried out in the early and middle stages of the COVID-19 outbreak in Indonesia (August 2020), still in a critical transmission period after the Muslim religious festivals of Ramadan and Eid al-Fitr. An understanding and analysis of the knowledge, attitudes, and practices of healthcare workers and the factors that influence them can help prevent the wider spread of COVID-19 among healthcare workers and from healthcare workers to the general public. The results of this study were in line with those of previous studies on healthcare workers in China, Pakistan, Nigeria, and Sierra Leone.¹¹⁻¹⁴ This could explain that many healthcare workers have contracted COVID-19 because of their poor COVID-19 prevention practices. This study showed that most healthcare workers in Indonesia had a good knowledge of and positive attitudes toward fighting COVID-19, but the practices of preventing COVID-19 were still not good. So that more strenuous efforts are needed to improve COVID-19 prevention practices among healthcare workers. It is not enough to increase knowledge and attitudes only, but more importantly, discipline healthcare workers who do not comply with COVID-19 prevention practices.^{11,16}

The finding of this study showed that proper preventive practices among Indonesian healthcare workers were

still lacking, the use of hand sanitizers and masks was still very low (mean score 35.0 and 39.4). They had a high potential for contracting and transmitting COVID-19 because many used public vehicles, came to the area crowds at malls and markets, did handshakes, and congregational prayer in mosques or other public places. The use of hand sanitizer and masks needs to be improved. At the beginning of the COVID-19 pandemic, masks and hands were scarcely sanitized due to high demand and limited production capacity. A measure to manage the scarcity of masks for use by healthcare workers by WHO was the recommendation that only COVID-19 patients with respiratory symptoms or COVID-19 caregivers should use masks.¹⁷

The logistic regression analysis results indicated that knowledge affected disease prevention practices. The better the health workers’ knowledge, the better their prevention practices (ORa = 2.03; 95% CI = 0.89–4.63). This finding aligned with studies on healthcare workers in Pakistan and Nigeria, which found a positive correlation between knowledge and practice (r = 0.142, p-value = 0.016).^{12,13} Knowledge is a prerequisite for building beliefs, forming positive attitudes, and promoting good behavior or practice. Individuals’ knowledge and attitudes toward disease influence their effectiveness in disease prevention strategies and practices.⁹

This study also revealed that 86.4% of healthcare workers in Indonesia had positive attitudes toward COVID-19. This study shared the same result with a study on healthcare workers in Nigeria in which 88.5% of healthcare workers expressed positive attitudes toward COVID-19.¹³ The results of the multiple logistic regres-

sion analysis showed that healthcare workers who had positive attitudes were twice as likely as healthcare workers with negative attitudes to practice good preventative practices (ORa = 2.02; 95% CI = 0.88–4.62). These findings were consistent with studies of healthcare workers in Pakistan and Nigeria, which found a positive correlation between knowledge, attitudes, and COVID-19 prevention practices ($r = 0.174$, $p\text{-value} = 0.004$).^{12,13} This correlation can be explained by reasoned action theory. This theory states that a person's intention to carry out a particular behavior is a function of his knowledge and attitude toward that behavior.¹⁸ In the highly dynamic COVID-19 pandemic situation, it is essential to update the knowledge and attitudes of healthcare workers so that they can carry out better prevention practices.

This study indicated that healthcare workers in Indonesia had good knowledge (67%) and positive attitudes (69.3%) about COVID-19. However, their prevention practices were lacking (46.5%). There were gaps in specific aspects of knowledge and practice that warrant attention. It is important to carry out information dissemination, training, and workshops on a regular basis to maintain the knowledge and good attitude of healthcare workers and to oblige them to practice COVID-19 prevention. Involving professional organizations of health workers and government support is very important to make this happen. It is necessary to develop a pocketbook and educational videos containing practical guidelines for COVID-19 prevention practices that are easily accessible. In addition, it is also important to provide rewards and punishments for healthcare workers who are obedient and disobedient to COVID-19 prevention practices.^{16,19} Besides, the factors associated with COVID-19 prevention practices of healthcare workers in Indonesia were knowledge, attitudes, anxiety, the island of domicile, age, income, and education. Healthcare workers who had very good knowledge, positive attitudes, and high anxiety exhibited better COVID-19 prevention practices than others. Healthcare workers in Sumatra Island showed bad COVID-19 prevention practices compared to other regions. Healthcare workers aged 41–50 years and undergraduate education exhibited better COVID-19 prevention practices than others.

The important finding of this study was that healthcare workers who have good knowledge and positive attitudes regarding COVID-19 tend to implement good COVID-19 prevention practices in health services and their daily life. It recommends that it is essential to regularly monitor the implementation of preventive practices during the pandemic to provide continuous improvement responses.¹⁶ The government needs to issue health service practice guidelines modified following the COVID-19 pandemic and disseminated in online forums involving all professional organizations. This is expected to help

the readiness of healthcare workers to provide safer services, both for themselves and for others, to prevent the transmission of COVID-19.²⁰

Strength and Limitations

The use of a mobile-based survey becomes the strength of this study. It will be an opportunity to be utilized for research, including data collection in the health sector and surveys on COVID-19. The existence of technology that supports and adequate mobile-based infrastructure is something positive that had been utilized in this survey. The research questionnaire was adopted from previous research, and the results of the Cronbach's alpha test and item-total correlation found that the questionnaire was valid and reliable. The results of this study can be initial information about knowledge, attitudes, and practices for healthcare workers during the COVID-19 pandemic. These results can be utilized in effective risk communication and education on COVID-19 epidemic control.

This study has several limitations and biases that need to be considered when interpreting the findings. First, the design of the study—the cross-sectional study, cannot conclude direct causality between independent and dependent variables. Secondly, sample coverage—this online survey and a convenient sample were employed to target healthcare workers. With that in mind, the findings may not represent all types of healthcare workers in Indonesia, for instance, the lack of sample size for the subgroup of doctors and uneven distribution of healthcare workers (dominated by midwives and public health experts). Therefore, the generalization of the results of this study must be carried out with caution because it could not describe the whole healthcare workers in Indonesia, especially the subgroup of doctors. It is recommended that future studies should focus on each healthcare worker, for example, the doctor's population only or the nurse's population only, to provide better and more representative results.

Thirdly, internet access selection bias—to participate in this online survey, respondents relied heavily on the availability of internet access. Respondents were also limited to healthcare workers who used a specific WhatsApp group. It is recommended that future studies not only use WhatsApp groups but also combine with other social media such as Telegram, Facebook, Twitter, Instagram, and e-mail. Although internet access in Indonesia covers 73.7% of the entire population,²¹ limitations in sample selection still exist in this study, especially for health workers who do not have internet access.

Conclusion and Recommendations

This study reveals that most healthcare workers in

Indonesia have a good knowledge of and positive attitudes toward COVID-19 and high anxiety about personal and family health. However, their COVID-19 prevention practices are still not good. There is a positive correlation between knowledge and attitudes and COVID-19 prevention practices. The healthcare workers who have good knowledge and positive attitudes regarding COVID-19 tend to implement good COVID-19 prevention practices in health services and daily life.

It recommends that public health education be continuously improved, focusing on groups of healthcare workers with a lack of knowledge, attitudes, and practices. It is necessary to involve professional organizations of health workers to oblige all healthcare workers to practice covid-19 prevention, carry out information dissemination, conduct online workshops on a regular basis, provide websites related to COVID-19 prevention practices, and distribute regular messages and educational videos on COVID-19 prevention practices through social media to maintain the good knowledge, attitude, and practices of healthcare workers.

Abbreviations

COVID-19: coronavirus disease 2019; WHO: World Health Organization; OR: Odds Ratio; ORc: crude Odds Ratio; ORa: adjusted Odds Ratio; CI: Confidence Interval; Sig: Significant; Ref: Reference group; LL: Lower limit; UL: Upper limit.

Ethics Approval and Consent to Participate

Informed consent was obtained individually from all respondents. The study was approved by the Research and Community Engagement Ethical Committee, Faculty of Public Health Universitas Indonesia, with a letter-number: 30/UN2.F10.D11/PPM.00.02/2020.

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 datasets generated and analyzed during the current study are not publicly available due to participant confidentiality but are available from the corresponding author on reasonable request.

Authors' Contribution

B conceived the idea, data collection, data analysis, interpreted the study results, and drafted the manuscript. DZN, MH, RS, and MR performed data collection, critically analyzing and interpreting the study results. ZW gave his expert opinion in sampling design and data collection. PY gave her input in the manuscript drafting. All authors read and approved the final manuscript.

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