Hand Hygiene and Mask-Wearing Practices during COVID-19 among Healthcare Workers: Misinformation as a Predictor

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Abstract. Poor public health information is a hurdle in infectious disease control. The study aims to examine whether healthcare workers adhere to hand hygiene and mask-wearing guidelines during the COVID-19 pandemic and to explore their exposure to misinformation about the pandemic as a predictor. A cross-sectional survey was sent to 518 healthcare workers across Indonesia, the fourth largest nation in the world, in September 2020 during the COVID-19 pandemic. The respondents reported whether they adhered to the guidelines of hand hygiene and mask wearing and whether they believed in four pieces of misinformation about the origin, severity, contagion, and prevention of COVID-19. The association between misinformation and hand hygiene and mask wearing was tested with logistic regression models controlling for demographic and health-related covariates. Approximately 25% of healthcare workers did not always adhere to hand hygiene guidelines and approximately 5% did not adhere to mask-wearing guidelines. There are significant associations between all four pieces of misinformation and hand hygiene and mask wearing. It is important to improve public health information about COVID-19, which may hold key to healthcare workers' hand hygiene and mask wearing and to protect their health and patients' safety.

INTRODUCTION

As COVID-19 has become a global pandemic, and scholars call for the prevention of its spread using social and behavioral sciences.[1–3] The WHO and the CDC have repeatedly emphasize the importance of preventive behaviors such as handwashing and mask wearing in cutting down the spread of the virus.[4,5] However, the public's adherence to these guidelines remain low in many places.[6] Among all professions, healthcare workers have a heightened responsibility to adhere to the hand hygiene and mask wearing guidelines. On one hand, preventive behaviors are necessary to the healthcare workers' mental and physical health.[7–9] Healthcare workers play a vital role in taking care of COVID-19 patients and other patients with scarce hospital resources during the pandemic period. Fulfilling these duties depends on their own infection control and health.[10] On the other hand, given the long incubation period of COVID-19, infection of COVID-19 by healthcare workers puts patients' health and safety at risks.[1] Despite the repeated calls to increase healthcare workers' awareness of, access to, and abidance by hand hygiene and mask wearing guidelines, previous research on this topic relies on literature review or expert opinions.[11,12] There lacks empirical evidence on whether healthcare workers indeed adhere to these guidelines during the ongoing pandemic. Therefore, the first goal of the study is to explore the compliance rates of hand hygiene and mask-wearing guidelines among healthcare workers during the COVID-19 pandemic.

Adherence to handwashing and mask wearing depends on various social and psychological factors, among which

the misinformation about COVID-19 has been identified as a consistent predictor in previous research on the general populations.[13–15] These studies examine misinformation about various facets of COVID-19, including whether it is engineered by human in a laboratory (origin), whether it causes severe health risks (severity), whether it can be spread through 5G network (contagion), and whether it can be prevented by eating garlic (prevention).

Although previous studies offer evidence on the link between the beliefs in misinformation and preventive behaviors,[13–15] we know little about whether the association is also present among healthcare workers. Although healthcare workers have the specialist knowledge to be less susceptive to misinformation, they may also hold misbeliefs about COVID-19 for several reasons. First, the psychological roots of rumors and conspiracy theories are so entrenched that even professionals sometimes fall into the traps. Research shows that when exposed to misinformation, affective responses lead to information avoidance and distorted information processing, and these psychological mechanisms are common in human decision-making under uncertainties.[1] Second, the COVID-19 pandemic evolves rapidly and causes great mental distress.[3,16] There is quick dissemination of critical information and much unverified and conflicting information on social media, which could have led to information overload, especially among healthcare workers who lacked work–family balance and supportive social networks.[17–19] Third, the infrastructure for public health communications could be less developed in the developing countries.[20,21] Information insufficiency, especially paucity of updated information verified by public health authorities, may lead the healthcare workers in less developed countries or regions to believe in misinformation.[22] In other words, even if some healthcare workers are not prone to misinformation, there are delays and geographic disparities in receiving and absorbing accurate health information.[23,24] For these reasons, we hypothesize that the link between misinformation and

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noncompliance with hand hygiene and mask-wearing guidelines is also present among healthcare workers.

The setting of the study is the healthcare sector in Indonesia, which is the fourth largest nation in the world with a population of more than 260 million.[25] The country was heavily hit by the COVID-19 pandemic, with > 1.6 million cases and 44,594 deaths as of April 26, 2021, at the time of submission of this article.[26] Previous research documents high prevalence rates of misinformation among the general public in the country and identifies key operational challenges for its healthcare systems.[2,27] However, to our knowledge, there has not been no study on misinformation and preventive behaviors including handwashing and mask wearing among the healthcare workers in the country, calling for more empirical evidence on this important population. Understanding of healthcare workers' health behaviors holds significant implications for their health and the patients' safety.[28–30]

METHODS

Data and sample. The data for this study were collected by an online survey on September 26, 2020, when there was a total of 271,339 confirmed cases of COVID-19 and 10,308 deaths in Indonesia.[31] The study site is State Polytechnic of Health Malang Indonesia. The study population is healthcare workers in Indonesia. The participants of the survey included healthcare workers from more than 200 Indonesian cities who were attending an online seminar conducted on September 26, 2020. Convenience sampling was used, but the respondents were diverse in socioeconomic characteristics (as described in Table 1) to represent the study population. The online survey reached 786 healthcare workers, and we received 518 valid responses (response rate of 65.9%).

Moreover, none of the participants were involved in any of the planning, execution, and reporting stages of the study.

Measures. *Dependent variables.* In this study, there are two dependent variables to measure preventive health behavior: frequency of washing hands and frequency of wearing a mask. Specifically, the respondents were asked about the frequency of washing hands for 20 seconds or longer after touching objects outside the home, and the frequency of wearing a mask outside the home on a scale ranging from 1 (never) to 7 (anytime). Given that both variables are highly skewed, we combine the categories from 1 to 5, and the categories from 6 to 7 to construct the binary variables to measure whether the healthcare workers carried out frequent preventive health behavior (90% of the time or above). A robustness check analyzing the frequencies of preventive health behavior as metrical variables yields consistent results.

Independent variables. The independent variable is COVID-19 misinformation beliefs, which are measured by four separate statements. Specifically, the respondents reported the extent to which they agree with the following four statements on a scale ranging from 1 (completely disagree) and 5 (completely agree): 1) "Coronavirus was deliberately engineered," 2) "Coronavirus is no worse than a common cold," 3) "The 5G mobile network is spreading coronavirus," 4) "Eating garlic will prevent you from catching the coronavirus." Due to small sample sizes, misinformation beliefs are recoded to have three categories ("completely agree or agree," "neither agree or disagree," "disagree or completely disagree") in multivariate regression models.

Control variables. This study also controlled for several sociodemographic characteristics of the healthcare workers, including their age, ethnicity, education levels, professions, whether they had chronic diseases and whether they had

TABLE 1
Sample characteristics

	M, %	Range
Frequency of washing hands, M (SD)	5.93 (1.34)	1–7
Frequency of wearing a mask outside the home, M (SD)	6.63 (0.81)	1–7
Age, M (SD)	29.24 (7.59)	18–55
Ethnicity, %		
Malay	5.79	
Batak	4.83	
Java	58.69	
Sunda	9.27	
Others	21.43	
Education levels, %		
High school	12.55	
Diploma	42.08	
Bachelor's	20.85	
Honors	11.39	
Master	13.13	
Professions, %		
Healthcare practitioners	56.76	
Healthcare lecturers	10.42	
Healthcare interns and students	23.36	
Other	9.46	
Whether have chronic diseases, %		
Yes	6.76	
No	93.24	
Whether have had flulike symptoms in past 6 months, %		
Yes	19.69	
No	80.31	
Number of respondents	518	

M = Mean; SD = standard deviation.

had flulike symptoms in the past 6 months. These variables are included because they are relevant to misinformation and preventive health behaviors according to previous studies.[13,14] More details about categories of each variable and its distribution are in Table 1.

Analytic strategy. This study first used descriptive analyses to describe the patterns and distributions of hand hygiene and mask-wearing compliance and those of four COVID-19 misinformation beliefs. Next, this study conducted multivariate analyses to examine the associations between healthcare workers' COVID-19 misinformation beliefs and preventive health behaviors. As the main outcome variables were binary, we used binary logistic regression models to examine the association between each of the four misinformation beliefs and frequent preventive health behaviors. To ensure the robustness of the results, we treated both dependent variables as metrical variables and use ordinary least squares (OLS) regression to capture greater variation of preventive health behavior frequencies. All analyses were performed using STATA 15. The data were secured in an encrypted computer of the first author.

Ethics. The survey was approved by the Ethics Committee of State Polytechnic of Health Malang Indonesia (#931/KEPK-POLKESMA/2020). Participation in this survey was voluntary, and participants could opt-out at any time.

RESULTS

Descriptive statistics. Figure 1 shows that ~75% of the healthcare workers indicated they washed their hands after touching objectives outside the home frequently ($\geq$ 90% of the time) as opposed ~25% of the respondents who washed their hands less frequently. In contrast, ~95% of the healthcare workers frequently (at least 90% of the time) wore a mask outside the home, and only 5% of them wore a mask less frequently. Overall, this suggests that although most of the healthcare workers comply with both standard heath practices, mask wearing is a more commonly adopted health practice among the healthcare workers than hand washing.

Figure 2 shows the distributions of four common COVID misinformation beliefs. In terms of whether coronavirus was deliberately engineered, nearly 40% of respondents tended to completely disagree with the statement. This stands in contrast with ~10% of respondent who agreed or completely agreed with it. The pattern is similar to statements claiming that coronavirus is no worse than a common cold. In terms of whether the 5G mobile network can spread coronavirus, respondents showed a clear attitude and more than half of them completely disagreed with the statement. Finally, in terms of whether eating garlic can prevent coronavirus, although most respondents held an opposing attitude, nearly 30% of respondent could not judge this statement. Such findings suggest that even healthcare workers did not have a clear understanding on this aspect.

Logistic regression models. Table 2 shows several logistic regression models and the odds ratios of misinformation beliefs and their confidence intervals. In Panel A, Model 1 shows that in terms of whether coronavirus was deliberately engineered, the respondents who indicated they agreed or neither agreed nor disagreed with this statement were significantly less likely (odds ratios = 0.42 and 0.51) to

wash hands frequently after touching objects outside the home than those who did not agree. Similarly, Model 2 shows that respondents who agreed who or neither agreed nor disagreed with the statement that coronavirus is no worse than a common cold were also significantly less likely (odds ratios = 0.54 and 0.53) to frequently wash their hands than their counterparts who did not agree. In terms of whether 5G network is spreading the coronavirus and whether eating garlic can prevent the coronavirus, Models 3 and 4 show that respondents who agreed with these statements were significantly less likely (odds ratios = 0.29 and 0.49) to wash their hands frequently than their counterparts who did not agree.

In Table 3 shows that in terms of whether coronavirus was deliberately engineered (odds ratios = 0.24 and 0.18) and whether coronavirus is no worse than a common cold (odds ratios = 0.26 and 0.20), the healthcare workers who agreed or who neither agreed nor disagreed with these statements were significantly less likely to wear a mask frequently outside the home than those who do not agree. Similarly, in terms of whether 5G network is spreading the coronavirus (odds ratios = 0.10) and whether eating garlic can prevent the coronavirus (odds ratios = 0.14), Models 3 and 4 show that respondents who agreed with these statements were significantly less likely to wear a mask frequently outside the home than their counterparts who did not agree. Further a robustness check (see Table A1 in Supplemental Appendix) analyzing the frequencies of preventive health behavior as metric variables yielded consistent results.

DISCUSSION

In a sample of 518 Indonesian healthcare workers, we found that 1) the noncompliance rate of hand hygiene guidelines was approximately 25%; 2) the noncompliance rate of mask-wearing guidelines was approximately 5%; 3) noncompliance with both hand hygiene and mask wearing were significantly associated with misinformation about COVID-19.

Previous studies have generally found higher noncompliance rates of handwashing and mask-wearing guidelines during the same period in other populations. One study found the "poor behaviors" of hand hygiene and mask wearing to be 57.95% and 48.40%, respectively, among primary school students in Wuhan, China, in February 2020.[6] Another study found lower noncompliance rates of hand hygiene (38.1%) and mask wearing (44.3%) among Iranian adults (age 16 years or older) from March to April 2020.[31] A study based in Indonesia found a 43.1% noncompliance rate with hand hygiene guidelines (not always washing hands) among Muslims in May 2020.[32] In contrast to past studies,[6,12] the much lower noncompliance rates of handwashing (25%) and mask wearing (5%) among Indonesian healthcare workers in September 2020 in our study may be explained by their better professional training or higher occupational risks of contagion.[13] However, approximately one-fourth (25%) of Indonesian healthcare workers in our sample did not fully comply with the hand hygiene guidelines, compared with lower noncompliance rate of mask-wearing guidelines (5%), which is concerning given the vital role of
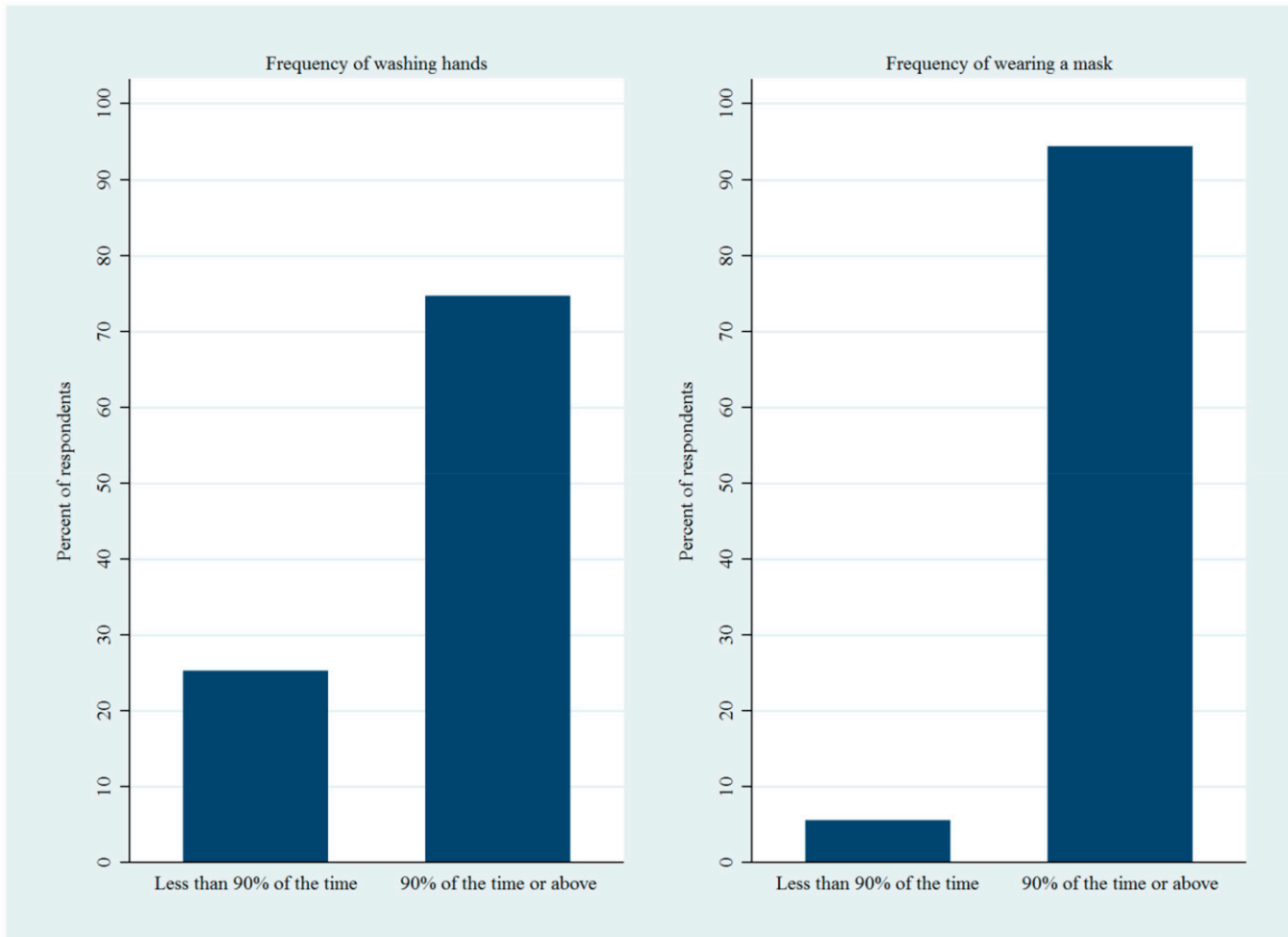
FIGURE 1. Descriptive statistics for frequencies of handwashing and mask wearing. This figure appears in color at www.ajtmh.org.

healthcare workers' hand hygiene in ensuring patient safety while fighting the COVID-19 pandemic.[10]

Moreover, we found that noncompliance with hand hygiene and mask wearing were both associated with misinformation about COVID-19 among Indonesian healthcare workers. These results are in line with previous research on the general populations, which consistently found associations between misinformation and COVID-19 preventive behaviors.[6,13,14,33] Our results suggested that misinformation may similarly affect medical professionals during a public health emergency, which challenged the lay assumption that healthcare workers are not prone to the misbeliefs due to their medical knowledge or professional trainings.[13] Furthermore, our study extended past studies[27,34] by examining four types of misinformation, including misinformation about the origin, severity, contagion, and prevention of COVID-19. We found that all four types of misinformation were each significantly associated with noncompliance with hand hygiene and mask-wearing guidelines. Drawing from these new findings, public health policies need to address all four types of misinformation in designing targeted interventions.

There are several limitations of this study. First, the cross-sectional design limits our ability to make causal inference. For example, the associations between misinformation and preventive behaviors may be confounded by unobserved respondent characteristics such as personality or suffer common-variance bias due to our reliance on self-reported measures. Future research could use a longitudinal or experimental design to better identify the causal effects of misinformation. Second, although our sample is diverse in terms of sociodemographic characteristics, like most studies on healthcare workers during a pandemic,[1,10] we did not use probability sampling to draw a representative sample of Indonesian healthcare workers. Future studies can replicate our exploratory findings using a probability sample of Indonesian healthcare workers or generalize our findings to other countries. Finally, healthcare workers are a heterogenous group consisting of people with different demographic and socioeconomic characteristics. Future research could explore how the effects of misinformation among healthcare workers vary with ethnicity, migration status, residential areas, socioeconomic status social networks, and health condition, for example.[35]

Interventions to reduce COVID-19–related misinformation in the general population can be applied to healthcare workers to increase their preventive behaviors. Information campaigns sponsored by public health authorities and their media partners are a common strategy to curtail health-related misinformation.[36] In addition, scalable psychological
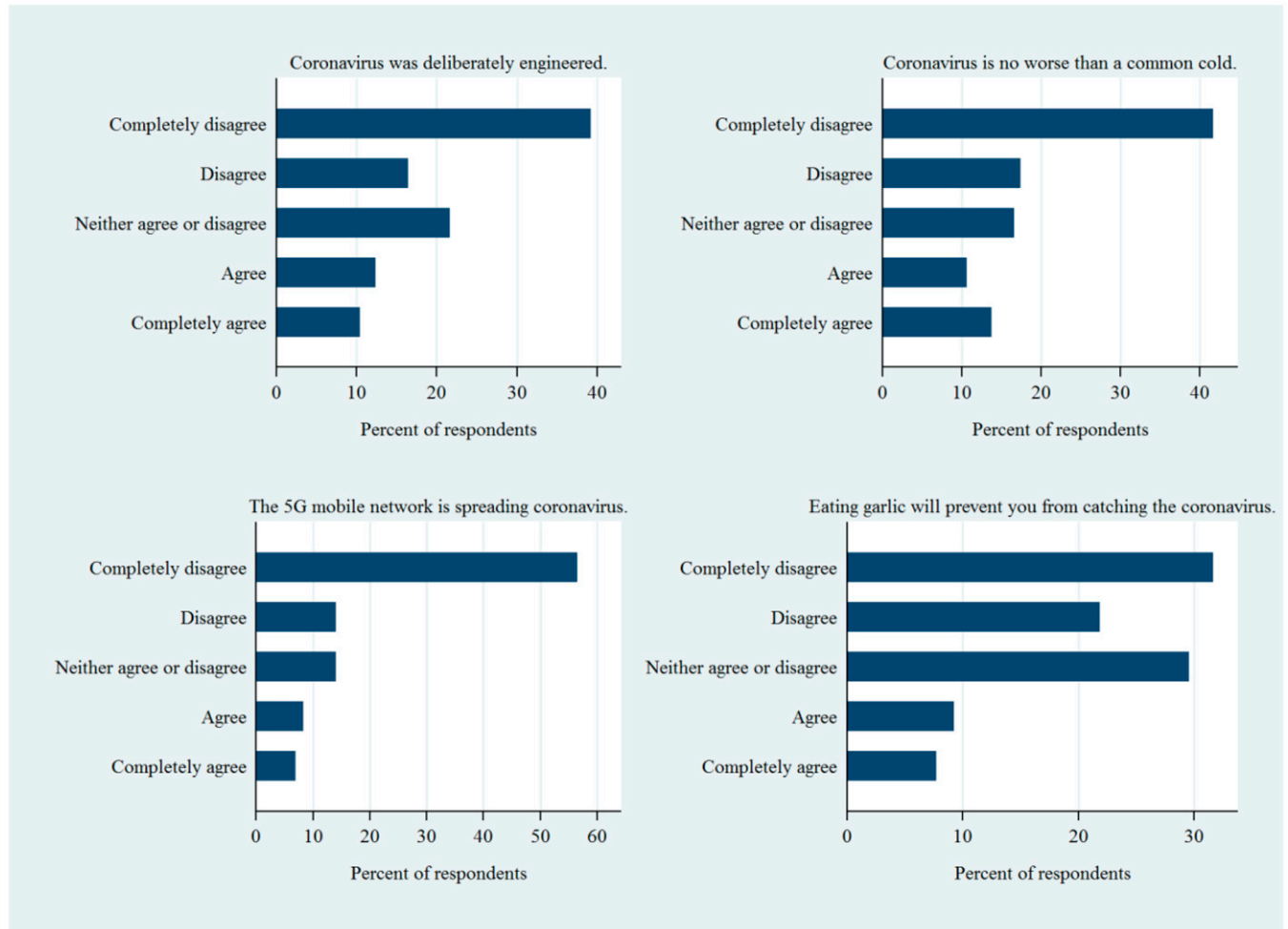
FIGURE 2.   Descriptive statistics for COVID misinformation beliefs. This figure appears in color at www.ajtmh.org.

nudging has been shown to decrease misinformation. For example, an experiment found that a simple reminder for judging the accuracy of a non-COVID-19–related headline decreased the sharing of misinformation about COVID-19.[34] Moreover, given the central role of social networks in spreading misinformation,[37] it is important for hospital administrators to offer regular trainings and resources to ward-level clinical leaders,[1] so that they can share the accurate and updated information to other healthcare workers, patients, and the community. Finally, public health infrastructures such as handwashing facilities and personal protective equipment supply must be accessible to increase preventive behaviors even after misinformation is reduced.[1]

TABLE 2
Logistic regression models examining the effects of COVID-19 misinformation beliefs on frequent handwashing and frequent mask wearing outside the home.

	Model 1	Model 2	Model 3	Model 4
Misinformation beliefs (Ref. = completely agree or agree)	COVID engineered	COVID is like a common cold	The 5G network spreads COVID	Eating garlic prevents COVID
Neither agree nor disagree	0.42**	0.54*	0.73	0.80
	(0.25–0.71)	(0.31–0.95)	(0.40–1.34)	(0.49–1.31)
Disagree or completely disagree	0.51*	0.53*	0.29***	0.49*
	(0.31–0.86)	(0.33–0.87)	(0.17–0.50)	(0.28–0.86)
Observations	518	518	518	518
Pseudo R^2	0.09	0.09	0.12	0.09

All models control for age, ethnicity, educational level, profession, whether participants had chronic diseases, and whether they had flulike symptoms in the past 6 months. Odds ratios are reported. Confidence intervals are in parentheses.
*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$ (two-tailed tests).

TABLE 3
Logistic regression models examining the effects of COVID-19 misinformation beliefs on frequent mask wearing outside the home

	Model 1	Model 2	Model 3	Model 4
Misinformation beliefs (Ref. = completely agree or agree)	COVID engineered	COVID is like a common cold	The 5G network spreads COVID	Eating garlic prevents COVID
Neither agree or disagree	0.24**	0.26*	0.56	0.67
	(0.08–0.70)	(0.09–0.78)	(0.16–1.97)	(0.21–2.09)
Disagree or completely disagree	0.18**	0.20**	0.10***	0.14***
	(0.06–0.53)	(0.08–0.55)	(0.04–0.26)	(0.05–0.38)
Observations	518	518	518	518
Pseudo R^2	0.09	0.08	0.12	0.11

All models control for age, ethnicity, educational level, profession, whether participants had chronic diseases, and whether they had flulike symptoms in the past 6 months. Odds ratios are reported. Confidence intervals are in parentheses.
*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$ (two-tailed tests).

CONCLUSIONS

During the COVID-19 pandemic, most Indonesian healthcare workers adhered to the mask wearing guidelines but approximately one-fourth of them did not fully comply with the handwashing guidelines. Noncompliance with preventive behaviors were associated with their misinformation about the origin, severity, contagion, and prevention of COVID-19. Interventions to reduce misinformation during a pandemic are necessary to improve healthcare workers' health and well-being and to protect patients' safety, especially in low- and middle-income countries.

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