



# Willingness to Vaccinate against Coronavirus Disease 2019 and Related Predictors among Non-Healthcare Personnel in Indonesia

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## Abstract

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**BACKGROUND:** Willingness to vaccinate against coronavirus disease 2019 (COVID-19) among non-healthcare personnel must be increased, considering that breaking the chain of transmission requires 84–90% herd immunity, with at least 62% of the vulnerable population vaccinated. However, achieving uptake of recommended vaccination in the targeted population ultimately lies with the community's willingness. This decreasing trend may also be an outcome of a high level of concern over vaccine safety.

**AIM:** This research was intended to determine the willingness to vaccinate against COVID-19 and its associated factors.

**METHODS:** It employed a cross-sectional study, and the collected data were analyzed using descriptive analytics and categorical comparison analysis. Two online surveys on Google Forms with non-healthcare personnel as the research subjects were conducted at different times (the first and second stage of vaccination). Screening with inclusion and exclusion criteria yielded 862 respondents spread over 32 provinces in Indonesia.

**RESULTS:** The results actually showed an increase in willingness to receive the vaccine, from 42.4% of the respondents in survey 1–55.6% in survey 2, and a relationship ( $p = 0.00$ ) between the surveys and this variable. About 36.8–45.3% were feeling hesitant; the main reason for vaccine hesitancy (42.2%) and unwillingness (43.2%) was mistrust in the effects or benefits of the vaccine. Although demographic characteristics were not related to the willingness ( $p > 0.05$ ), the opposite was true for the COVID-19 knowledge level (Odds ratio: 1.66; 95% confidence interval: 1.26–2.18).

**CONCLUSION:** There is an increasing number of people willing to vaccinate against COVID-19 (42.4% in survey 1 and 55.6% in survey 2). The time of the survey and COVID-19 knowledge are two predictors ( $p = 0.00$ ) of this willingness.

## Introduction

The coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has rapidly developed into a pandemic, posing a threat to public health worldwide [1]. Common symptoms at the onset of illness are fever, cough, and fatigue [2], [3]; some have even reported shortness of breath, headache, sore throat, chest pain, nausea, vomiting, diarrhea [4], [5], and abdominal pain [6]. People infected with SARS-CoV-2 can contribute to the spread of infection [7], and those who do not have the symptoms (asymptomatic) can also transmit the disease [8], [9]. Knowledge directly affects attitudes and practice, and trust in efficacy is the most influential and significant factor of preventive behaviors towards COVID-19 [10].

Herd immunity is indirect protection from infectious disease that occurs when a population

develops immunity either through vaccination or previous infection. In the context of COVID-19, herd immunity should be achieved through vaccination, as opposed to exposing the population to disease-causing pathogens [11]. Breaking the chain of transmission requires 84–90% herd immunity [12], with at least 62% of the vulnerable population vaccinated against COVID-19 [13]. The development of a vaccine for SARS-CoV-2 infection is a strategy to overcome the COVID-19 pandemic [14], [15], [16]. An effective vaccine will be beneficial and offer an even greater benefit if used in time to prevent repeated or continuous epidemics [17], [18].

COVID-19 vaccine acceptance in the community in several countries has not reached 70% [19], [20], while in Indonesia, it is in the range of 45.7–74% [21]. Lower willingness to be vaccinated can be attributed to increasing concerns about vaccine safety [22]. The public can easily access news from social media about vaccine safety, especially the effects that occur after getting the vaccine. Believing in the conspiracy theories regarding the vaccine

is positively associated with trusting and relying on social media more than health information providers [23]. Perceptions of vaccine efficacy and willingness to protect others play an essential role in vaccine acceptance [24]. The strategy introduced to achieve vaccination uptake in the targeted population depends on several factors, such as community involvement in health promotion to dispel misconceptions [25]. Furthermore, it is imperative to raise awareness and perception of COVID-19 risk among the community [26], [27]. Vaccine doubts in some countries are upwards of 25%, with the most expressed reason being concerns about the vaccine's safety [28], [29], [30] and efficacy [27]. Some significant predictors of vaccine doubts are sex, education, occupation, income, having children, political affiliation, and perceived threat of COVID-19 infection [31], [32].

When the public can access news about the effects of the COVID-19 vaccine, it is necessary to find out if there is a decrease in the willingness to be vaccinated. The purpose of this study was to determine whether there was a decrease in the willingness to vaccinate against COVID-19 among non-healthcare workers in Indonesia and the factors that are predicted to correlate with it (predictors).

## Methods

This cross-sectional study consisted of two online surveys on Google Forms, with non-healthcare personnel in Indonesia as the research subject. The first survey was conducted from January 28 to 30, 2021, during the first stage of vaccination (January-April 2021, for health workers and public service officers), while the second survey was conducted from May 4 to 10, 2021, during the second stage of vaccination (starting in April 2021, for vulnerable population) [33]. This research has received approval from the Research Ethics Committee of the Faculty of Medicine in Indonesia (No. 1230/C.16/FK/2021).

### **Research sample and data collection**

The research used multi-stage sampling starting with stratified random sampling to determine which samples would be collected in 34 provinces in Indonesia, followed by purposive sampling for the sample collection. The research samples were the Indonesian community or population who met the inclusion criteria, namely were currently living in Indonesia, aged 18 years and over, had not received the COVID-19 vaccine, and were literate in the Indonesian language. Respondents who were engaging in the healthcare sector as health workers were excluded from the survey. The survey targeted 1000 respondents from the entire 34 provinces in the country to produce the most representative result. Data collection in

the first and second surveys was conducted online using Google Form, and the link was sent to the respondents via WhatsApp. This online data collection complies with ethical clearance published by the research ethics committee, and this was to avoid direct face-to-face contact to minimize the risk of exposure to COVID-19.

### **Data measurement**

The research instrument was a questionnaire consisting of a subject information sheet, Informed Consent, demographic profiles, knowledge of COVID-19 and its preventive measures, and willingness to vaccinate against the disease. The questionnaire items concerning COVID-19 knowledge and prevention were developed from the WHO official website [34], while the ones on willingness to receive vaccination referred to similar previous studies [19]. In addition to the subject information sheet and Informed Consent, the questionnaire consists of three aspects: (1) Respondent's demographic profile, that is, gender, age, formal educational attainment, occupation, and family size, (2) knowledge of COVID-19 and preventive measures, comprising ten true or false questions, and (3) willingness to vaccinate against COVID-19 with three response options: willing – hesitant – not willing. It also provides space for respondents to write down the reasons behind their hesitancy and unwillingness.

### **Data analysis**

The research data were analyzed descriptively and analytically. Descriptive analysis was used to describe data in percentage form, namely demographic characteristics, willingness to be vaccinated, reasons for vaccine hesitancy and unwillingness, and the mean score of COVID-19 knowledge. Meanwhile, the analytical data were analyzed using a categorical comparative test, odds ratio (OR), and confidence interval (CI). A categorical comparative test with the Chi-square test was carried out to see if the demographic characteristics (i.e., sex, age, education, occupation, and family size), COVID-19 knowledge, and willingness to vaccinate against COVID-19 were related. OR aimed to measure data relationship in the Chi-square test. In the categorical comparative test, data on COVID-19 knowledge were categorized into two: Good (score equal to or higher than 80) and bad (lower than 80).

## Results

### **Demographic profiles**

Of the 1044 respondents, 862 met the inclusion and exclusion criteria and participating in the survey.

A total of 182 respondents were excluded because 18 respondents were less than 18 years, 28 were health workers, and 136 provided incomplete responses to the questionnaire. The demographic characteristics of the respondents were as follows: 62.9% female, 56.3% within the age range of 18–29 years, 53.1% university graduates, 51.3% employed, and 60.2% living in a family of two to four. A total of 623 respondents were involved in survey 1, and 239 were in survey 2. Respondents spread across 32 provinces of 34 provinces in Indonesia, from Aceh to West Papua, except North Maluku and Papua.

### Willingness to vaccinate against COVID-19 and predictors of willingness to vaccinate against COVID-19

In survey 1, the respondents who were hesitant and not willing to be vaccinated were 45.5% and 12.4%, respectively. Meanwhile, in survey 2, there were 36.8% “hesitant” responses and 7.5% ‘unwilling’ responses. These results indicate an increase in the willingness to be vaccinated. Moreover, the categorical comparative

test confirmed the statistical relationship ( $p = 0.000$ ) between the survey and the willingness.

This study described the willingness to vaccinate against COVID-19 based on respondents’ demographic characteristics and analyzed what factors were related to the willingness. In this case, the predictors were knowledge of the disease and demographic characteristics. Similarly, the previous studies [31], [32] have also predicted the relationship between respondents’ demographic characteristics (i.e., sex, age, education, employment status, and family size) and vaccine doubts. The Chi-square test of independence included “hesitant” and “unwilling” cell merge to obtain an OR. The analysis results are presented in Table 1. Respondents who were hesitant and unwilling to vaccinate against COVID-19 were asked to include several reasons. Table 2 presents each of the submitted reasons.

### COVID-19 knowledge

Based on the analysis results, there was a relationship ( $p = 0.00$ ) between COVID-19 knowledge

**Table 1: Willingness to be vaccinated and factors predicted to correlate with the COVID-19 vaccine**

	Total Respondents (%)	Willingness			p-value	Odds ratio (95% confidence interval)
		Willing n (%)	Hesitant n (%)	Unwilling n (%)		
Survey 1	623 (72.3)	264 (42.4)	282 (45.3)	77 (12.4)	0.000*	0.59 (0.43–0.79)
Survey 2	239 (27.7)	133 (55.6)	88 (36.8)	18 (7.5)		
Knowledge of COVID-19					0.000*	1.66 (1.26–2.18)
Adequate	483 (56.0)	249 (51.6)	196 (40.6)	38 (7.9)		
Poor	379 (44.0)	148 (39.1)	174 (45.9)	57 (15.0)		
Demographic characteristics						
Sex					0.732	1.08 (0.82–1.42)
Male	320 (37.1)	151 (47.2)	137 (42.8)	32 (10.0)		
Female	542 (62.9)	246 (45.4)	233 (43.0)	63 (11.6)		
Age group					0.118	a vs b b vs c a vs c
18–29 (a)	485 (56.3)	211 (43.5)	225 (46.4)	49 (10.1)		
30–49 (b)	313 (36.3)	151 (48.2)	121 (38.7)	41 (13.1)		
≥ 50 (c)	64 (7.4)	35 (54.7)	24 (37.5)	5 (7.8)		
Education					0.982	a vs b b vs c a vs c
Primary school (a)	25 (2.9)	10 (40.0)	12 (48.0)	3 (12.0)		
Senior high school (b)	379 (44.0)	175 (46.2)	163 (43.0)	41 (10.8)		
Higher education (c)	458 (53.1)	212 (46.3)	195 (42.6)	51 (11.1)		
Occupation					0.274	a vs b** (p=0.458)
Employed (a)	442 (51.3)	209 (47.3)	176 (39.8)	57 (12.9)		
Homemakers (b)	103 (11.9)	43 (41.7)	47 (45.6)	13 (12.6)		
Students (b)	267 (31.0)	122 (45.7)	123 (46.1)	22 (8.2)		
Unemployed (b)	50 (5.8)	23 (46.0)	24 (48.0)	3 (6.0)		
Family size					0.319	a vs b b vs c a vs c
Single (a)	39 (4.5)	18 (46.2)	13 (33.3)	8 (20.5)		
2–4 (b)	519 (60.2)	242 (46.6)	225 (43.4)	52 (10.0)		
≥ 5 (c)	304 (35.3)	137 (45.1)	132 (43.4)	35 (11.5)		

\*Significant, \*\*Cell merge.

**Table 2: Reasons underlying hesitancy and unwillingness to vaccinate against COVID-19**

Reasons	Survey 1		Survey 2		Total	
	Hesitant n (%)	Unwilling n (%)	Hesitant n (%)	Unwilling n (%)	Hesitant n (%)	Unwilling n (%)
Mistrust in the effects or benefits of the available COVID-19 vaccine (vaccine efficacy)	131 (38.5)	35 (35.4)	25 (23.4)	6 (28.6)	156 (34.9)	41 (34.2)
New diseases arise after being vaccinated (vaccine side effects)	63 (18.5)	4 (4.0)	30 (28.0)	5 (23.8)	93 (20.8)	9 (7.5)
Fear of needles	44 (12.9)	13 (13.1)	15 (14.0)	4 (19.0)	59 (13.2)	17 (14.2)
I feel healthy and believe that not everyone is susceptible to COVID-19	36 (10.6)	16 (16.2)	12 (11.2)	3 (14.3)	48 (10.7)	19 (15.8)
There is no clear and detailed public dissemination about the effects and side effects of the available COVID-19 vaccine	25 (7.4)	8 (8.1)	7 (6.5)		32 (7.2)	8 (6.7)
I believe some contracted COVID-19 despite having been vaccinated	7 (2.1)	7 (7.1)	8 (7.5)	3 (14.3)	15 (3.4)	10 (8.3)
The COVID-19 vaccine is not halal	7 (2.1)	3 (3.0)	3 (2.8)		10 (2.2)	3 (2.5)
A lot of news on social media is unclear and confusing	7 (2.1)		2 (1.9)		9 (2.0)	
I believe simply boosting my immune system is enough	7 (2.1)	2 (2.0)			7 (1.6)	2 (1.7)
Comorbidities	2 (0.6)	9 (9.1)	3 (2.8)		5 (1.1)	9 (7.5)
Some are paralyzed and even died after receiving the vaccine	4 (1.2)	1 (1.0)	2 (1.9)		6 (1.3)	1 (0.8)
There is more than one type of vaccine	4 (1.2)				4 (0.9)	
I believe drinking herbal beverages is enough to prevent COVID-19	3 (0.9)	1 (1.0)			3 (0.7)	1 (0.8)

Respondents can write more than one reason.

and willingness to vaccinate against the disease. Therefore, the research continued to determine if the predictors correlated with COVID-19 knowledge using categorical correlation analysis, that is, the Chi-square test. In this study, a descriptive analysis was conducted to show the average score of respondent's COVID-19 knowledge for each demographic characteristic (i.e., sex, age, education, occupation, and family size). Then, the respondent's demographic characteristics and knowledge of COVID-19 were inputted to the chi-square test of independence. Table 3 shows the factors predicted to correlate with the COVID-19 knowledge.

## Discussion

More respondents in survey 2 (55.6%) were willing to vaccinate against COVID-19 than survey 1 (42.4%) (Table 1), indicating an increase in the positive attitude toward COVID-19 preventive measures among the non-healthcare personnel from the first to the second stage of vaccination. This is in contrast to a study in Hong Kong [22] where the willingness to receive vaccination decreased from 44.2% (survey 1; a local COVID-19 epidemic broke) to 34.8% (survey 2; the local epidemic was coming to an end). Willingness to vaccinate against COVID-19 among non-healthcare personnel must be increased, considering that breaking the chain of transmission requires 84–90% herd immunity [12], with at least 62% of the vulnerable population vaccinated [13].

There is a significant relationship ( $p = 0.000$ ) between knowledge of COVID-19 and willingness to vaccinate against the disease (Table 1). Respondents with a good comprehension of COVID-19 are 1.66 times more likely to be willing than those with lower knowledge scores (OR: 1.66; 95% CI: 1.26–2.18). This finding corresponds to a study in Vietnam [35] showing that

willingness to receive the vaccine and level of COVID-19 knowledge is significantly related, with a 1.2-fold increase in the likelihood of getting the vaccine for a 1-unit increase in the total knowledge score (AOR:1.2; 95% CI: 1.1–1.3;  $p < 0.0$ ).

Demographic characteristics, that is, sex, age, education level, employment status, and family size, are not predictors of willingness to get the COVID-19 vaccine ( $p > 0.05$ ). Although the willingness in men aged 50 with higher education, employment, and family of two to four is higher than in other groups, there is no relationship between these demographic characteristics and willingness to take the vaccine ( $p > 0.05$ ). This is in line with [36], which found that women's willingness to receive the vaccine is lower than their male counterparts, and that willingness is higher in people aged 65 and over and those with higher education than the other groups. Similarly, [37] found that the willingness to get the vaccine does not necessarily vary across demographic profiles, that is, sex ( $p = 0.429$ ) and education level ( $p = 0.129$ ). Research in Brazil [38] also confirms the absence of a statistical relationship ( $p > 0.05$ ) between the number of household members and vaccine doubts.

Results showed 13 reasons for vaccine hesitancy and unwillingness (Table 2), and the most expressed reason was that respondents did not believe in the efficacy of the available vaccines. The second-highest reason for vaccine hesitancy was the vaccine's side effects, but this is in contrast to the second reason most expressed for unwillingness: respondents feel healthy and think that not everyone is susceptible to COVID-19 infections. Similarly, a previous study in Nepal [39] found that 90 health workers and staff in medical colleges were unwilling to vaccinate against COVID-19; 40 of them have concerns about vaccine safety. Likewise, research in Ethiopia [40] showed that respondents are hesitant to take the vaccine due to concerns about its safety and/or side effects (37%), followed by doubts about its efficacy (20.7%), and lack

**Table 3: Factors predicted to correlate with the COVID-19 knowledge**

Demographic characteristics	Total n (%)	Knowledge of COVID-19			p-value	Odds ratio (95% confidence interval)
		Mean score	Poor (<80)	Adequate ( $\geq 80$ )		
Sex						
Male	320 (37.1)	75.6	144 (45.0)	176 (55.0)	0.639	1.07 (0.81–1.41)
Female	542 (62.9)	76.8	235 (43.4)	307 (56.6)		
Age range						
18–29 (a)	485 (56.3)	75.3	231 (47.6)	254 (52.4)	0.005*	a vs b 1.57 (1.17–2.09)
30–49 (b)	313 (36.3)	78.3	115 (36.7)	198 (63.3)		
$\geq 50$ (c)	64 (7.4)	74.5	33 (51.6)	31 (48.4)		
Education						
Primary school (a)	25 (2.9)	72.0	14 (56.0)	11 (44.0)	0.022*	a vs b 1.36 (0.60–3.08)
Senior high school (b)	379 (44.0)	75.5	183 (48.3)	196 (51.7)		
Higher education (c)	458 (53.1)	77.2	182 (39.7)	276 (60.3)		
Occupation						
Employed (a)	442 (51.3)	76.1	197 (44.6)	245 (55.4)	0.715	a vs b** 1.05 (0.80–1.38)
Homemakers (b)	103 (11.9)	77.2	182 (43.3)	238 (56.7)		
Students (b)	267 (31.0)	76.3				
Unemployed (b)	50 (5.8)	76.8				
Family size						
Single (a)	39 (4.5)	74.9	18 (46.2)	21 (53.8)	0.960	a vs b 1.09 (0.57–2.10)
2–4 (b)	519 (60.2)	76.5	228 (43.9)	291 (56.1)		
$\geq 5$ (c)	304 (35.3)	76.2	133 (43.8)	171 (56.3)		

\*Significant, \*\*Cell merge.

of adequate information (12.7%). Similarly, research in China [41] found that vaccine doubts stem from concerns about the safety of the newly developed vaccine (60.0%) and its efficacy (28.8%); some question the necessity of vaccination (7.5%) and believe that the risk of COVID-19 infections is low (3.7%).

Many respondents of the age 30–49 (78.3%) showed higher average scores of COVID-19 knowledge than the other age groups (Table 3). This finding corresponds with a previous study in Indonesia [42], where 71% of the well-informed respondents are 30–49 years old. There was a significant difference ( $p = 0.001$ ) in knowledge about COVID-19 in the three age groups, similar to a study in Malaysia [43], which also found a significant score difference between age groups. The current research findings indicate that age and COVID-19 knowledge have a significant relationship ( $p = 0.005$ ), as is the case with a study in Africa [44] that found a significant relationship ( $p < 0.05$ ) between age, education, nationality, background, and the COVID-19 knowledge score. Respondents of the 18–29 age group are 1.57 times more likely to gain less knowledge of COVID-19 than those aged 30–49 (OR:1.57; 95% CI: 1.17–2.09). However, in another study [44], respondents of 18–29 years old are 1.4 times more likely to gain better knowledge of COVID-19 than other age groups (95% CI: 0.55–0.89;  $p = 0.004$ ).

Respondents with higher education had a higher COVID-19 knowledge score (77.2) than primary and senior high school education. This is in line with [10], which shows that the level of knowledge is higher in individuals with a higher education level. In addition, there was a significant difference ( $p = 0.009$ ) in the COVID-19 knowledge of the three groups of educational attainment. Results indicate that education level and COVID-19 knowledge are significantly related ( $p = 0.022$ ), where respondents with senior high school education are 1.42 times more likely to have less knowledge than those with higher education (OR:1.42; 95% CI: 1.08–1.86). In other words, individuals with a higher level of education have better COVID-19 knowledge. Likewise, a study in Africa [44] found that respondents with senior high school education are 4.7 times more likely (95% CI: 0.15–144.7;  $p = 0.73$ ) to have better knowledge about COVID-19 than those who never attended formal education. This also applies to education level and age as significant indicators of COVID-19 knowledge [42].

Sex, employment status, and family size are not predictors of COVID-19 knowledge level ( $p > 0.05$ ), as is the case with the research in Saudi Arabia [45] which concludes that employment status is not a predictor ( $p = 0.09$ ) of COVID-19 knowledge. Furthermore, although the knowledge scores were higher among female respondents (76.8) and homemakers (77.2) than in other respondents, there is no statistical difference between the groups ( $p > 0.05$ ). Similarly, a study in Saudi Arabia [46] found no statistical difference in the

knowledge scores of male and female respondents. Furthermore, a previous study in Indonesia [42] supports this finding, that there is no relationship between sex, marital status, and level of COVID-19 knowledge.

## Conclusion

Knowledge about COVID-19 is a predictor of willingness to vaccinate against the disease (OR: 1.66; 95% CI: 1.26–2.18). Based on the knowledge score, many non-healthcare workers have less knowledge of the disease and its preventive measures ( $<80$ ). Therefore, disseminating accurate information and educating the public about this matter becomes necessary. For educational materials to be readily accepted by non-health workers, especially in terms of prevention, such as the use of drugs and the importance of vaccines, authorities, and relevant stakeholders need to factor in predictors of the knowledge level and decide on the appropriate media of information delivery. The research has found that only half of the respondents (42.4–55.6%) are willing to get the vaccine, meaning that education alone cannot improve these figures, but this must be supported by positive news about the efficacy and side effects of the COVID-19 vaccine to address reasons for vaccine hesitancy and unwillingness.

## Research Limitations

The number of respondents is not the same in each province, as well as the number of respondents in survey 1 and survey 2.

## Author Contributions

Conceptualization, F.B.; Methodology, F.B., F.S., In., S.S.; Formal Analysis, F.B., F.S., In., S.S., Is.; Investigation, F.B., F.S., In., S.S., Is., G.I.H., M.R.N.R.; Data Curation, Is., G.I.H., M.R.N.R.; Writing — Original Draft Preparation, F.B., F.S., In., S.S., Is.; Writing — Review and Editing, F.S., In., S.S. All authors have carefully read and approved the published version of the manuscript.

## Data Availability Statement

The data used in this study cannot be published for ethical reasons (respondent privacy).

## Institutional Review Board Statement

The research complies with the research guidelines issued by Universitas Ahmad Dahlan, and the procedure was approved by the Health Research Ethics Committee of the Faculty of Medicine, Duta Wacana Christian University, Indonesia (Ethical Clearance No. 1230/C.16/FK/2021, issued on January 18, 2021).

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