



Determinants of COVID-19 Vaccine Hesitancy: A Community-Based Study in Dumai City, Riau Province, Indonesia

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Abstract

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BACKGROUND: Indonesia's lowest COVID-19 vaccine coverage of 6.5% is found in Teluk Makmur Village, Dumai City, Riau province. The success of the COVID-19 vaccination program is determined by vaccine hesitancy, which comprises numerous and presumably complex factors that vary over time and between countries or between regions of one given country.

AIM: The aim of the study was to determine COVID-19 vaccine hesitancy prevalence and influencing factors in the community.

MATERIALS AND METHODS: A cross-sectional study was conducted from September to November 2021 at Teluk Makmur Village, Dumai City, Riau Province, Indonesia, involving 149 respondents aged 25–93 years and using a questionnaire on respondents' sociodemographic characteristics and their opinions on possible COVID-19 vaccines. COVID-19 vaccine hesitancy factors were analyzed by multivariable logistic regression ($p < 0.05$).

RESULTS: COVID-19 vaccine hesitancy was present in 51.7% of respondents. Multivariable logistic regression findings: Comorbidities, fear of dying from COVID-19, feelings of shame/stigmatization if known to be infected with COVID-19 were not significantly associated with vaccine hesitancy. Education and distrust of government COVID-19 related policy were significantly associated with vaccine hesitancy.

CONCLUSION: Half of respondents were hesitant about COVID-19 vaccines. COVID-19 vaccine hesitancy factors consisted of education and distrust of government policy.

Introduction

There is currently a global pandemic of the Coronavirus disease 2019 (COVID-19) that has not spared Indonesia and neighboring countries. The number of confirmed COVID-19 cases in Indonesia on July 13, 2021 was reported to be 2,615,529, with 68,219 COVID-19 deaths [1]. The various steps taken to interrupt COVID-19 transmission include personal hygiene, social distancing, using protective devices such as face-masks, and last but not least, instituting a community-wide vaccination program. COVID-19 vaccines have been in production, but the willingness of individuals to receive vaccination is a crucial factor in the successful outcome of the vaccination program [2].

On August 20, 2021, reportedly 32.2% of the world population had received at least one dose of COVID-19 vaccine, and 24.2% was fully vaccinated [3]. However, the percentage of persons vaccinated with at least one dose in Indonesia was still below the world percentage of 20.4% [3]. For vaccine-related protection against infection, the vaccination rate should exceed 80%, since an estimated vaccination rate of at least 60, but probably up to 90%, is required for herd

immunity in the population [4], [5]. Mass vaccination in the community is at present a strategy to accelerate the attainment of herd immunity, thereby lowering COVID-19 morbidity and mortality rates [6].

Vaccine hesitancy is defined as delayed vaccine acceptance or simple refusal to accept vaccination, in spite of the availability of vaccination services [7]. The World Health Organization has determined that vaccine hesitancy is one of the 10 greatest dangers to global health [8], because it impedes an effective vaccination program. COVID-19 vaccine hesitancy rates vary between countries, being 11.3% in Japan [9] and 23% in the US [10]. A systematic review by Robinson *et al.* [11] involving 13 countries and 58,656 respondents showed a reported hesitancy of 20%. Conversely, a COVID-19 vaccination acceptance survey conducted by the Indonesian government found a COVID-19 vaccine hesitancy rate of 35.2%, with 7.6% refusals and 27.6% delays [12].

The vaccine hesitancy determinants are numerous and may be complex and variable over time and between countries or even within one given country [13], while data collection factors may also play a role. Several studies indicate a relationship between sociodemographic factors and COVID-19

vaccine hesitancy, such as female gender, younger age, low education, and lower income [9], [11]. Other studies demonstrate a relationship of factors such as comorbidities (diabetes mellitus and psychiatric illness), fear of death from COVID-19, distrust of the government, and severe psychologic distress, with vaccine hesitancy [7]. A Turkish study demonstrated that age and high perceived personal risk of infection are two positive determinants of public acceptance of potential future vaccines [14]. Vaccine acceptance rates should increase with an increase in subjective personal risk of COVID-19 disease [15].

The Indonesian region with the low COVID-19 vaccination coverage of 6.5% is Teluk Makmur Village, Dumai City, Riau Province [16]. The low coverage rate in Dumai and inter-regional differences in characteristics and habits have resulted in the current need for information on COVID-19 vaccine hesitancy prevalence and influencing factors. This information is needed by policy makers in designing vaccination strategies for increasing vaccination coverage in the community. The objective of this study was to evaluate COVID-19 vaccine hesitancy prevalence and associated factors.

Materials and Methods

Design of the study and study subjects

This observational analytic cross-sectional study was done between September and November 2021 at Teluk Makmur Village, Dumai City, Riau Province, Indonesia. The inclusion criteria were as follows: Local resident (as listed in the household card), male or female aged ≥ 18 years, and agreeing to participate by signing informed consent. The exclusion criterion was being incapable of normal communication. The subjects were randomly chosen among the residents listed in the household cards of the village. The sample size was estimated from the vaccine hesitancy proportion of 93.5% in the community of abovementioned village, $Z_{\alpha} = 1.96$ at $\alpha = 5\%$, and measurement accuracy of 0.05. As the finite population at the data collection site was 4227, the estimated smallest sample in our study was 92.

Before starting the study, we asked all subjects to sign an informed consent sheet, after which we applied for and received ethical clearance from the Committee of Research Ethics, Faculty of Medicine, Trisakti University, under no. 101//KER-FK/IX/2021.

Assessment

The data collection was conducted from household to household using the questionnaire that had been constructed by the investigators. Before its

implementation on the respondents, the questionnaire had been tested for an evaluation of its utility and applicability, and the time spent in filling out. Before data collection, the respondents were asked to provide informed consent. The questionnaire was administered to the respondents who had agreed to participate in the study.

Assessment of Covid-19 vaccine hesitancy

COVID-19 vaccine hesitancy was assessed by the question "If you were offered to receive COVID-19 vaccination at this moment, would you accept or reject/postpone it?". COVID-19 vaccine hesitancy was categorized into hesitancy (if the respondent postpones or rejects vaccination even though vaccination services are available) and no hesitancy (if the respondent wishes to receive COVID-19 vaccination). Both the respondents with no hesitancy to receive vaccination and those with vaccine hesitancy were asked the reason for their decision. The respondents were allowed to give more than one answer, therefore the total of each reason's percentage might differ from hundred percent.

Assessment of possible factors related to Covid-19 vaccine hesitancy

The factors deemed to be possibly associated with COVID-19 vaccine hesitancy were: younger age group ($17 \leq 45$ years) versus middle aged (≥ 45 years), gender, high education basic education (from no education to junior high school) and further education (senior high school to tertiary education). Comorbidities are disorders from which respondents are suffering at present, and include hypertension, diabetes mellitus, pulmonary disease (bronchial asthma, chronic obstructive pulmonary disease, and other respiratory tract diseases), cardiovascular disease (acute coronary syndrome, myocardial infarction, heart failure, and other cardiac disorders), stroke, cancer, and others. Comorbidities are categorized as yes = if the respondent has at least one comorbidity, and no = if the respondent has no comorbidities.

Other COVID-19 vaccine hesitancy-associated factors having dichotomous affirmative versus negative answers include prior infection of respondent or family, fear of death, distrust of government vaccine policy, and feelings of shame if infected with COVID-19 [9].

Statistical analysis

Before data analysis, data cleaning was performed using consistency, range, and logical checks. The distribution of numerical data was checked by means of the Kolmogorov–Smirnov test of normality. The vaccine hesitancy prevalence and the reasons for accepting vaccination or for vaccine

hesitancy were reported as a proportion. Categorical data were presented as the number of respondents (n) and percentage (%). COVID-19 vaccine hesitancy-associated factors were evaluated by means of a logistic regression test, using odds ratio (OR), and 95% confidence interval (95% CI). Test results of $p < 0.25$ were then subjected to multivariable logistic regression at $p < 0.05$.

Results

Characteristics of respondents

In Table 1 may be seen the subject characteristics. The majority of the subjects (101 or 67.8%) were males, while there were 77 younger subjects (51.7%) of both genders. A total of 126 subjects (84.4%) had a high education, 116 subjects (77.9%) had no comorbidities, while those without a history of prior COVID-19 infection totaled 148 subjects (99.3%). In addition, fear of COVID-19 related death was present in 123 subjects (82.6%), and subjects with no distrust of government policy numbered 96 (64.4%). Finally, there were 121 subjects (81.2%) who would be ashamed if infected with COVID-19, whereas COVID-19 vaccine hesitancy was found in 77 subjects (51.7%).

Table 1: Characteristics of respondents (n = 149)

Characteristics	Mean ± SD	n (subjects)	Percentage
Gender			
Male		101	67.8
Female		48	32.2
Age (years)	45.7 ± 11.2		
Younger		77	51.7
Middle-age		72	48.3
Education			
Basic		23	15.5
Further		126	84.4
Comorbidities			
Present		33	22.1
None		116	77.9
Prior history of COVID-19 infection			
Yes		1	0.7
No		148	99.3
Fear of COVID-19 related death			
Yes		123	82.6
No		26	17.4
Distrust of government			
Yes		53	35.6
No		96	64.4
Feelings of shame if infected with COVID-19			
Yes		121	81.2
No		28	18.8
Vaccine hesitancy			
Yes		77	51.7
No		72	48.3

Legend: Age categories: younger (17 ≤ 45 years); middle-age (≥ 45 years); education (basic: No education–junior high school; further: Senior high school–tertiary education); comorbidities: Yes = Having at least one comorbidity; no: Having no comorbidities).

In Table 2 may be seen that the main reason given by the study respondents in the group without vaccine hesitancy is the fear of becoming infected with COVID-19 to a total of 48 (66.7%) subjects. Being recommended by social networks/media was the reason with the lowest total of 3 (3.9%) subjects. In the group with vaccine hesitancy, the three main reasons were fear of adverse reactions to a total of 34 (47.2%) subjects, followed by the feeling that the vaccines are not

Table 2: Reasons for vaccine acceptance or refusal (n = 149)

	COVID-19 vaccine intention	
	Intend n (%)	Hesitant n (%)
Reason for accepting vaccination (n = 77)		
I am afraid to become infected with COVID-19	48 (66.7)	–
I am at high risk of severe disease	13 (16.9)	–
I can obtain free vaccination	13 (16.9)	–
I do not want to infect my household	11 (14.3)	–
It was recommended by friends or family members	10 (13.0)	–
I feel that the community should be vaccinated	5 (6.5)	–
It was recommended in social networks/media	3 (3.9)	–
Reason for vaccine hesitancy (n = 72)		
I am afraid of adverse reactions		34 (47.2)
The vaccines are not effective		19 (26.4)
I want to follow the development of the vaccines		19 (26.4)
I feel that I will not be infected		13 (18.0)
It was recommended by family members not to get vaccinated		7 (9.7)
I feel that I have a low risk of severe disease		4 (5.5)

The number of answers do not equal the total numbers of respondents because the respondents were allowed more than one answer.

effective, and the wish to follow the development of the vaccines, both in equal numbers, namely, 19 (26.4%) subjects.

In the simple logistic regression test for bivariate analysis, there were five variables meeting the requirement for multivariable logistic regression test ($p < 0.25$), namely, education, comorbidities, fear of COVID-19 related death, distrust of COVID-19 related government policy, shame/stigma if infected with COVID-19 (Table 3).

Table 3: Relationship between sociodemographic characteristics and risk factors of COVID-19 vaccine hesitancy (n = 149)

Variables	Hesitancy				p^a	or ^b	95% CI ^c
	Yes		No				
	N	%	n	%			
Gender							
Male	52	51.5	49	48.5	0.946	1.02	0.51–2.03
Female	25	52.1	23	47.9		1	
Age (years)							
Younger	45	58.4	32	41.6	0.089	1	0.29–1.08
Middle-age	32	44.4	40	55.6		0.56	
Education							
Basic	7	30.4	16	69.6	0.031*	1	1.09–7.42
Further	70	55.6	56	44.4		2.85	
Comorbidities							
Present	20	60.6	13	39.4	0.247*	1	0.28–1.38
None	57	49.1	59	50.9		0.62	
History of prior COVID-19 infection							
Yes	0	0.0	1	100	0.999	1751	0.00–0.00
No	77	52.0	71	48		1	
Fear of COVID-19 related death							
Yes	56	45.5	67	54.5	0.002*	5.02	1.78–14.1
No	21	80.8	5	19.2		1	
Perception of possible COVID-19 infection							
Yes	12	37.5	20	62.5	0.073	2.08	0.93–4.65
No	65	55.6	52	44.4		1	
Distrust of COVID-19 related government policy							
Yes	37	69.8	16	30.2	0.001*	1	0.15–0.63
No	40	41.7	56	58.3		0.30	
Feelings of shame/stigmatization if infected with COVID-19							
Yes	57	47.1	64	52.9	0.024*	2.80	1.14–6.86
No	20	71.4	8	28.6		1	

*Statistical analysis with simple logistic regression test; $P < 0.25$ meets requirement for performing multivariable logistic regression test. ^bOR: Odds ratio, ^c95%CI: 95% confidence interval.

Multivariable analysis results of associated factors in relation to COVID-19 vaccine hesitancy.

Education was one of the two factors significantly correlated with vaccine hesitancy, while the other one was distrust of government policy on vaccination. Respondents with high education had a 4.38-fold risk of COVID-19 vaccine hesitancy than did those with low education (aOR = 4.38; 95%CI = 1.53 – 12.56; $p = 0.006$). Respondents with no

distrust of COVID-19 related government policy had a 0.24-fold lower risk of vaccine hesitancy than did those with distrust of COVID-19 related government policy (aOR = 0.24; 95%CI = 0.11 – 0.52; p = 0.001) (Table 4).

Table 4: Results of multivariable logistic regression analysis (n = 149)

Variables	p ^c	aOR ^b	95%CI ^b
Education ^a			
Basic	0.006*	1	1.53–12.56
Further		4.38	
Comorbidities			
Present	0.065	1	0.19–1.05
None		0.44	
Fear of COVID-19 related death			
Yes	0.156	2.74	0.68–11.09
No		1	
Distrust of COVID-19 related government policy			
Yes	0.001*	1	0.11–0.52
No		0.24	
Shame if infected with COVID-19			
Yes	0.641	1.34	0.39–4.67
No		1	

^aCategorization of cofactor data: education (basic: no education-junior high school; high: senior high school-tertiary education), ^bOR = adjusted odds ratio, CI: Confidence interval, ^cStatistical analysis with multiple logistic regression test at P < 0.05.

Discussion

In our research setting, we found a COVID-19 vaccine hesitancy prevalence of 51.7%, which is higher than in a Japanese study in February 2021 that reported a hesitancy prevalence of 11.3% [9], whereas in the US [10] and Turkey [14] prevalence were obtained of 23% and 45.3%, respectively. These differences in prevalence rates may have been caused by differences in the definition of hesitancy, the application of adjustments based of sociodemographic factors [14], the data sources used, and the time period of the studies. Our study's high hesitancy prevalence requires attention because a high degree of hesitancy may also contribute to a low vaccination coverage, where it is known that vaccine efficacy for increasing herd immunity and protecting from infection may be obtained only if 60–90% of the population is vaccinated [4], [5].

The principal vaccine hesitancy reasons to be extracted from among the subjects' responses are anxiety of side effects (47.2%), questions of vaccine effectiveness (26.4%), and wishing to monitor the vaccination results (26.4%). This may be because the COVID-19 vaccines and the clinical trials were still being evaluated when the government decided to vaccinate the whole community. At the time of our study, the Indonesian Ministry of Health had issued decree no. HK.01.07/MENKES/12758/2020 about the types of vaccines for COVID-19 vaccination in Indonesia, namely the Chinese natural virus-based vaccines and the bioengineered RNA vaccines. However, these vaccines either had not passed phase 3 of their clinical trials or their efficacy and safety were still under study [17]. Our study results are consistent with the results of the systematic reviews by Lin *et al.* [18] and Biswas *et al.* [19], in that perceived risk and questions of vaccine safety and effectiveness were

the most frequent of the COVID-19 hesitancy factors, with the result that our subjects preferred to wait until others had received the vaccine.

The attitude toward vaccines is not simply a dichotomous choice between hesitancy and acceptance, but is also affected by such factors as knowledge, information, social norms, emotions, health literacy, risk perceptions, trust, and prior experiences [13], [20], [21]. In another study it was found that individual views of high risk can determine community acceptance of a vaccine [14], as vaccine acceptance rate increases with an increase in the subjective perception of personal risk of infection [15]. Furthermore, the lack of accurate knowledge and the exposure to inaccurate social media COVID-19 vaccine-related information, increase the public anxiety and risk perception that may lead to vaccine hesitancy [22], [23].

There is a positive correlation between knowledge and attitude, in that adequate knowledge can result in a positive attitude, leading to associated good practices in accepting vaccination. The majority of our study subjects (84.4%) had further education with a 4.48-fold significantly higher risk of COVID-19 vaccine hesitancy as compared with subjects with a basic education. Our study results differed from those of Kessels *et al.* [24] reporting that the higher the educational achievement, the more positive the wish for receiving vaccination. Although our study did not measure the respondents' level of COVID-19 vaccine knowledge, the higher risk of vaccine hesitancy in the present study may have been caused by the non-provision of the required information on vaccine efficacy and safety. Our opinion is supported by studies showing that the greatest reason for the respondents' refusal to receive vaccination is their concern about adverse reactions (70%), followed by doubts of vaccine efficacy (20%) [9].

Our study results showed that respondents who had no distrust of COVID-19 related government policy had a 0.24-fold lower risk of having COVID-19 vaccine hesitancy. Our study results are in support of several previously conducted studies that consistently demonstrated that the presence of distrust of the government and COVID-19 related government policies is the factors associated with hesitancy [21]. According to the World Health Organization, there are three primary determinants underlying vaccine hesitancy, namely, complacency, caused by perceived low benefits of vaccination, imagined difficulty of access to vaccination, with the key determinant being lack of confidence in the vaccine [8], [25].

Community-based healthcare workers are still the most trusted advisors and influencers of the decision to accept vaccination. Therefore, to increase the trust of the community in vaccination, these workers should be supported in providing trustworthy and credible information on vaccines [8]. Evidence-based health information and communication is essential for combating vaccine hesitancy [7], [8]. The community

should receive reliable information on COVID-19 and on vaccine availability, efficacy, and side effects [26], by means of context-specific, culturally appropriate, and evidence-based communications and interventions [27].

The World Health Organization's strategic advisory group of experts recommends that governments be proactive in facing vaccine hesitancy "hotspots" based on social and behavioral insights [28]. These strategies should naturally be accompanied by an understanding of the factors affecting vaccine hesitancy in each region, because these are multiple and complex, and vary with the passage of time and between countries or even within a single country. Harada and Watanabe [13] in Japan showed an increase in COVID-19 vaccine acceptance from 40.6% to 85.5% in 5 months.

Implications of the study

Our study's high vaccine hesitancy prevalence should receive the attention of policy makers, such as to result in successful vaccination in the respective regions. Knowledge of the factors affecting vaccine hesitancy is of benefit in providing important information for the government and public health officials for the effective design and delivery of public health messages to induce the majority of the population to voluntarily accept the targeted COVID-19 vaccine.

Limitations of the study

The limitations of this study are the following: First, this study cannot furnish proofs of any cause-and-effect relationship, since it was merely designed for determining the prevalence of vaccine hesitancy and influencing factors. Second, COVID-19 vaccine hesitancy was determined by means of a self-reported questionnaire that had not been validated and was therefore susceptible to bias. Third, the sample size was relatively small and limited to just one Indonesian region and therefore the study results cannot be generalized to other countries or regions, because of the differences in socio-demographics, norms/traditions, and governmental regulations about COVID. Fourth, the present study did not evaluate other factors that are also associated with COVID-19 vaccine hesitancy, such as knowledge or misinformation of COVID-19 news, the side effects of vaccination, and the effectiveness of government policy in the regions involved in the vaccination program, which need to be further investigated. In addition, there is a need for future cohort studies to determine the patterns of changes in vaccine hesitancy during the pandemic.

Conclusions and recommendations

The prevalence of COVID-19 vaccine hesitancy in the present study is 51.7% and the associated

factors are education and distrust of COVID-19 related government policy. There is a need for governmental regulations on the distribution of information that is consistent and accessible to the whole community on the efficacy and safety of COVID-19 vaccines with a view to decreasing vaccine hesitancy.

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