7 COVID-19 vaccines knowledge

by Annette D' Arqom

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RESEARCH ARTICLE

COVID-19 vaccines knowledge and acceptance among Indonesian adults in Java Island [version 1; peer review: awaiting peer review]

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Abstract

Background: To increase vaccination coverage, it is important to understand COVID-19 vaccination programs and respondents' acceptance. Therefore, this study aimed to measure respondents' knowledge of the COVID-19 vaccine and its acceptance among Indonesian adults in Java.

Methods: A web-based survey was distributed through social media on self-claimed knowledge, risk and benefits of the vaccine, as well as respondents' acceptance and experiences of the vaccination. The survey period was from March to July 2021, and 910 responses were included for further analysis. The frequency of each categorical factor, including self-claimed knowledge of the COVID-19 vaccine, their descriptive benefit and side effects of the COVID-19 vaccine, and their experiences receiving or not receiving the vaccine were explored. Predictor factors on vaccine knowledge and acceptance are investigated using multivariate ordinal regression analysis.

Results: This study showed that almost all the respondents in both groups have knowledge about COVID-19 vaccination, or at least ever heard about it. The main source of information is social media. More than two third of respondents from each group had already received a COVID-19 vaccine or were at least on the waiting list. Moreover, a quarter of the respondents still hesitate to receive the vaccination.

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Any reports and responses or comments on the article can be found at the end of the article.

Only less than 10% of respondents reject the vaccination, with the strongest reason being scared of the side effect. Moreover, it found that respondents' knowledge of the vaccination was influenced by age, medical background, a history of relatives who tested positive for COVID-19, source of information, economic status, and education levels. Moreover, the acceptance was influenced by age, knowledge about vaccines, and having medical background.
Conclusions: This study showed high levels of knowledge and acceptance of the COVID-19 vaccine among adults in Java. Increasing understanding or knowledge about COVID-19 vaccine risks and benefits is necessary to reduce vaccination hesitancy.

Keywords
acceptance, COVID-19, hesitancy, knowledge, vaccines

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Introduction

The COVID-19 situation has improved due to high vaccination coverage (Dye, 2022). Unfortunately, virus mutagenicity produces new variants known to reduce vaccine effectiveness. Boosters have been provided to maintain the protective effect of the vaccine. Even though many researchers continue to develop new vaccines with high efficacy, doubts regarding their effectiveness and safety remain an issue (Shukla *et al.*, 2022).

Several studies have shown a relationship between sociodemographic and physiological factors and vaccine acceptance. The sociodemographic factors include age, type of occupation, marital status and monthly income (Faturohman *et al.*, 2021). Moreover, psychological factors might affect vaccination acceptance, adherence and completion (Pandolfo *et al.*, 2022; Yanto *et al.*, 2021). Moreover, misinformation about the COVID-19 pandemic, including the therapy and vaccination, constitutes a huge challenge to overcome (d' Arqom *et al.*, 2021; Pristiyono *et al.*, 2021).

In Indonesia itself, the current president, Joko Widodo, became the first Indonesian to become vaccinated on January 13, 2021. Since then, the Indonesian government has implemented vaccination programs for certain Indonesian population groups such as Indonesia's medical personnel and the elderly. When this study was conducted, the vaccination for the general Indonesian adult population had just started, following the vaccination for healthcare professionals, the elderly, and individuals with comorbidity (Jiao & Aditya, 2021).

However, various concerns have risen from the general population regarding the vaccine. Among these are views towards the vaccine's effectiveness, its lack of research, misinformation about its side effects, religious beliefs, fear of injection etc. (Fakhriani et al., 2022; Hidayana *et al.*, 2022; Simanjorang *et al.*, 2022; Theodorea *et al.*, 2021). The Indonesian government ordered the vaccine from China and approved the emergency use for mass vaccinations; unfortunately, due to the concern above, vaccine acceptance was only about 64.8% as reported by UNICEF, WHO, and ministry of health (UNICEF *et al.*, 2020). In the end, to increase vaccine coverage, the Indonesian government made COVID-19 vaccination a requirement for all social aspects such as transportation, direct cash assistance programs (bantuan langsung tunai), obtaining passports, and other public services (Gunawan J *et al.*, 2022). This strategy remains in effect. With this mandate, vaccine acceptance increased from 60 to 86.81% (Kemenkes, 2022). However, the debate on mandatory vaccines involves human rights issues (King *et al.*, 2022).

As Java is the most developed island in Indonesia and the most populated, most government facilities and programs are concentrated in this area, including the COVID-19 vaccination programs during the early implementation. Therefore, this study focused on an adult population in Java (Arifin & Anas, 2021). Moreover, knowledge and awareness are part of individual factors affecting vaccine acceptance (Erchick *et al.*, 2022). Thus, this study aimed to measure the effect of COVID-19 vaccine knowledge and COVID-19 acceptance among Indonesian adults in Java during the first implementation of the COVID-19 vaccination mandatory programs.

Methods

Study design and data collection

This cross-sectional study on COVID-19 vaccination among Indonesian adults in Java during the second wave of the pandemic was part of the Dietary Supplement, COVID-19 Vaccine Acceptance, and Mental Health among Indonesian Adults project. This study followed the Helsinki Declaration and was approved by the Health Research Ethics Committee, Faculty of Medicine, Universitas Airlangga (No. 86/EC/KEPK/FKUA/2021). The data were collected from March to June 2021 using a web-based survey generator (www.surveyplanet.com). The survey was distributed online on social media and via email. Before entering the survey, respondents were provided with a landing page consisting of the objective of the study, brief explanation of the survey, the responsible person, and an informed consent page containing permission to use the data anonymously. The respondents provided their consent by choosing the YES button. Multiple submission was prevented by the web-based generator. The inclusion criteria of the respondents were Indonesian citizen, older than 18 years old, and residing in Java when the study was conducted. The minimum sample size was 383, calculated with 5% margin of error, 95% confidence level, and unknown population number which filled with 100,000. This study followed the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) guidelines, and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Eysenbach, 2004; Vandenbroucke *et al.*, 2007).

Survey instrument

Three sections of the questionnaire were developed and distributed online to measure respondents' COVID-19 knowledge and acceptance. The sections covered sociodemographic information of the respondents, their knowledge of COVID-19 vaccine effects and their acceptance of COVID-19 vaccination. The sections of vaccine knowledge were modified from a questionnaire from UNICEF (UNICEF *et al.*, 2020) and the COVID-19 vaccine acceptance behaviours

were developed by a medical doctor and evaluated by three experts, two pharmacologists and a social science expert. Face validity was performed concerning 20 respondents to ensure their understanding of the questions, including the wording and format. A copy of the questionnaire can be found in Extended data.

Analytical procedure

Respondents were divided into two groups based on their sex: male and female. COVID-19 vaccine general knowledge and vaccine acceptance behaviours were measured using nominal scales. Data were processed and analysed using Microsoft Excel and SPSS 24.0 (IBM, Chicago, IL, USA), and visualized using GraphPad Prism 5.0. Descriptive analysis for each categorical variable was measured, followed by the chi-square test to observe differences between groups. For analysis, we converted the occupation into unemployed and employed, and religion into majority and non-majority. Multivariate ordinal regression analysis was performed to determine determinant factors of self-claimed vaccine knowledge and acceptance. All models were mutually adjusted for all potential confounders, such as sex, age, marital status, employment status, economic status, education, religion, insurance, history of testing positive for COVID-19, as well as the history of family members or relatives testing positive for COVID-19. The dummy variables included sex, marital status, religion, medical background and employment status. Vaccine acceptance points were contracted into reject, hesitate, and accept (respondents who received at least one vaccine or on the waiting list). Significance was defined as a p-value <0.05.

Results

Characteristics of respondents

The questionnaires recorded 1,006 responses from March to June 2021. Only 910 responses were valid after the exclusion criteria. The 96 responses were excluded due to domicile outside Java. From these 910 responses, the majority were female, most numerous in the 18 to 25-year-old age group, with marital status single or unmarried, and average economic status. The majority of female respondents were unemployed and had graduated from high school, while the majority of male respondents were employed and held a bachelor's degree (p=0.000 and p=0.005, respectively). Table 1 summarizes respondent characteristics.

Experiences of COVID-19 and its vaccination

Most respondents reported never experiencing COVID-19 symptoms such as fever, sore throat, coughing, aches and pain, loss of taste and smell, etc. More female respondents reported these conditions compared with male respondents. Only 175 (19.2%) respondents reported that they ever experienced COVID-19 symptoms, with more male respondents confirmed to have symptoms compared with female respondents, both with or without lab confirmation (Figure 1A, p= 0.002). However, the proportion of the respondents did not differ regarding knowing relatives who contracted COVID-19 (Figure 1B).

All respondents have some knowledge regarding the vaccination programs being initiated by the government, with more male respondents reporting having good knowledge levels, and more female respondents reporting having sufficient knowledge about the vaccine (p= 0.040). Less than 1% of males and females confessed never hearing about the vaccination programs (Figure 2A). No difference was found concerning respondents' knowledge on benefits of obtaining the COVID-19 vaccine, including preventing infection and spreading infection, preventing fatality from COVID-19, and even though they contract the disease, they will only exhibit mild symptoms (Figure 2B). Similar knowledge was also observed concerning the side effects of vaccination. The respondents knew that side effects ranged from mild to severe, from soreness at the injection site to anaphylactic shock (Figure 2C). They confessed that the main source of their information was social media, friends/family members, news and others (Figure 2D).

When this study was conducted, COVID-19 vaccination remained limited for healthcare providers, the elderly, people with comorbidity and just reaching general adulthood. However, data of general adults were recorded and placed on a waiting list. Therefore, vaccine acceptance in this questionnaire was divided in six categories: received two shots, received one shot, received more than three shots, on a waiting list, hesitating, and rejecting the COVID-19 vaccine.

The majority of respondents were willing to accept COVID-19 vaccines, with more female respondents receiving two doses of the COVID-19 vaccine, and more male respondents on the waiting list. One-third of male respondents hesitated whether to receive a shoot or not during this study period, which was more than female respondents (25%). The rejection number was less than 10%, with a higher proportion comprising male respondents (Figure 3A). Among respondents who received the vaccination, the strongest reason to receive was its safety, followed by its possibility to reduce COVID-19 fatality (Figure 3B). The three major side effects experienced by respondents receiving vaccination were soreness at the injection site, drowsiness, and myalgia or body aches. Only one male respondent experienced an anaphylactic reaction, even though more than 1% of male and female respondents reported allergic reactions such as itchiness and swelling

Table 1. Characteristics of respondents.

Sociodemographic Factors	Male (n=250)	Female (n=660)	X^2	p-value
Age			6.672	0.246
18-25	102 (40.8)	260 (39.4)		
>25-35	43 (17.2)	93 (14.1)		
>35-45	40 (16)	102 (15.5)		
>45-55	32 (12.8)	72 (10.9)		
>55-60	8 (3.2)	33 (5.0)		
>60	25 (10)	100 (15.1)		
Marital Status			2.847	0.092
Single/Un-married	128 (51.2)	379 (57.4)		
Married	122 (48.8)	281 (42.6)		
Occupation			23.531	**0.000**
Unemployed	118 (47.2)	428 (64.8)		
Employed	132 (52.8)	232 (35.2)		
Economic Status			3.936	0.140
Below Average	27 (10.8)	75 (11.4)		
Average	185 (74)	516 (78.2)		
Above Average	38 (15.2)	69 (10.4)		
Education			12.875	**0.005**
Below high school graduate	10 (4.0)	60 (9.1)		
High school Graduate	84 (33.6)	265 (40.2)		
Undergraduate	118 (47.2)	259 (39.2)		
Post-Graduate	38 (15.2)	76 (11.5)		
Religion			2.402	0.121
Muslim	216 (86.4)	594 (90)		
Non-Muslim	34 (13.6)	66 (10)		
Insurance			1.121	0.780
National coverage	191 (76.4)	501 (75.9)		
Private insurance	8 (3.2)	14 (2.1)		
Both	27 (10.8)	79 (12.0)		
Does not have insurance	24 (9.6)	66 (10.0)		
Medical background			10.975	**0.001**
Yes	106 (42.4)	361 (54.7)		
No	144 (57.6)	299 (45.3)		
Family with medical background			0.641	0.423
Yes	143 (57.2)	358 (54.2)		
No	107 (42.8)	302 (45.8)		

Note: Bold face indicate significant p-value calculated using Chi-square test or Fischer Exact test

(Figure 3C). For those still hesitant to receive the COVID-19 vaccine, almost two-thirds would consult healthcare professionals and their family members or friends. Different patterns concerning to whom respondents would consult were observed in this study. In all, 5.3% of the female respondents considered consulting health cadres, which was higher than that of male respondents (3.77%). Moreover, a smaller portion of female respondents considered consulting a government officer or their teacher, while none of the male respondents considered it. Less than 2% of males and females would not consult anyone, except themselves (Figure 3D). Furthermore, the strongest reasons for not receiving the

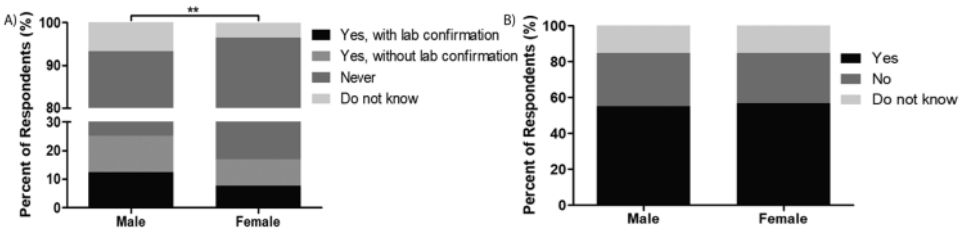

Figure 1. History of COVID-19. (A) History of contracting COVID-19, and (B) History of family/relatives testing positive for COVID-19.

Figure 2. Self-claimed knowledge and understanding about the COVID-19 vaccine. (A) Self-claimed knowledge of the respondents, (B) benefits of COVID-19 vaccination, (C) side effect of the COVID-19 vaccine and (D) source of information about COVID-19 vaccination programs.

COVID-19 vaccine were fear of side effects, insufficient information about this program, and doubt concerning its effectiveness and safety (Figure 3E).

Determinants of COVID-19 knowledge and acceptance

Ordinal regression was performed to predict sociodemographic factors associated with respondents' COVID-19 knowledge and acceptance. Table 2 shows the results from modelling the outcome as a function of several independent variables including age, sex, marital status, work, economic status, education, religion, insurance, having a relative contract COVID-19, and testing positive for COVID-19. The model in Table 2 shows that young adults were 2.654 times and 2.071 times more likely to have a good knowledge on COVID-19 vaccinations than older subjects (18-25 year olds 95% CI 1.534 to 4.592, p=0.000; >25-35 year olds 95% CI 1.130 to 3.796, p= 0.018, respectively). Respondents with a medical background were 2.176 times more likely to possess knowledge of COVID-19 shots (95% CI 1.586 to 2.984, p=0.000). Another positive predictor factor was their knowledge about relatives that had or never had contracted respondents that did not know about this matter. Respondents that could defined that they had relatives who contracted with COVID-19, either yes or no, have higher knowledge about COVID-19 vaccine compared with respondents that did not know about this matter. Respondents that had relatives with COVID-19 were 1.902 more likely to have a good knowledge about COVID-19 vaccination programs (95% CI 1.239 to 2.920, p= 0.003), in contrast, respondents with no COVID-19 positive relatives were 1.583 time more likely to have knowledge about the vaccination (95% CI 1.014 to 2.471, p= 0.043). In addition, respondents following related information, through social media and webinars were more likely to have a higher knowledge level concerning COVID-19 compared with respondents receiving information from other sources (social media: AOR 2.456, 95% CI 1.180 to 5.112, p= 0.016; webinars: AOR 3.563, 95% CI 1.524 to 8.331, p= 0.003, respectively).

The negative predictors to knowledge COVID-19 vaccination programs were economic and education status. Respondents with lower economic status, below average and average, were less likely to have a good knowledge on COVID-19

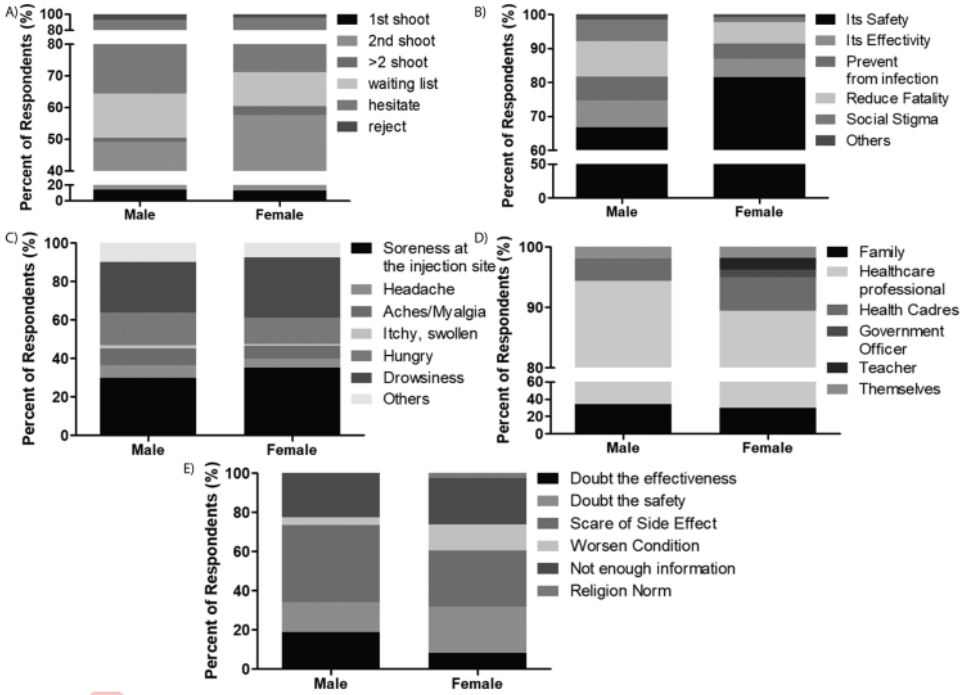

Figure 3. The acceptance and experiences concerning COVID-19 vaccination. (A) Vaccine acceptance, (B) strongest reason to receive COVID-19 jabs, (C) side effects experienced after receiving the vaccine, (D) who hesitating respondents will consult about the programs and (E) reason for vaccine rejection.

vaccinations (below average: AOR 0.439, 95% CI 0.244 to 0.790, p= 0.006; average: AOR 0.438, 95% CI 0.278 to 0.689, p= 0.000). Similarly, respondents with lower education were also less likely to have a good knowledge on vaccinations as respondents below high school level education were 0.120 more likely to have a good knowledge about this program (95% CI 0.057 to 0.254, p=0.000) and high school graduates were 0.490 more likely to have a good knowledge about this program (95% CI 0.286 to 0.838, p=0.009).

Moreover, for COVID-19 vaccination acceptance, at this study period, young adults (18-35 years old) have higher odds to receive and to accept the vaccination (18-25 years old: AOR 0.071, 95% CI 0.031 to 0.159, p= 0.000; >25-35 years old: AOR 0.287, 95% CI 0.114 to 0.724, p= 0.008), as well as middle age adults (>45-55 years old: AOR 0.222, 95% CI 0.087 to 0.567, p= 0.002). Respondents with no or less knowledge about COVID-19 vaccination programs also less likely to receive the jab. Respondents that never heard about these programs were 0.035 times more likely to obtain a vaccination (95% CI 0.005 to 0.239, p=0.001), In contrast, respondents that only heard about government programs were 0.071 times more likely to receive the COVID-19 shot (95% CI 0.035 to 0.145, p=0.000). Respondents with little knowledge about vaccination programs were 0.455 times more likely to receive a jab (0.208 to 0.994, p= 0.048). The only significant positive predictor was whether the respondents had a medical background (AOR 1.488, 95% CI 1.019 to 2.175, p=0.040). The result of ordinal regression for COVID-19 vaccine acceptance was showed in Table 3.

Discussion

Java island is the densest and the most developed island in Indonesia. The capital city of Indonesia is located in the west part of this island. The infrastructure, including transportation and health-related structure, is most complete and advanced compared to other islands in this country (Handayani & Kumalasari, 2015). As the densest island, Java also contributes 68% of the COVID-19 cases in Indonesia. Therefore, the vaccination program was started on this island with the fastest spreading of the vaccination (Arifin & Anas, 2021).

This study found that most of the respondents have a knowledge about the program, or at least have ever heard about the COVID-19 vaccination program. Only small portion of the respondents had never heard about it. Most of the respondents

Table 2. **Ordinal regression on self-claimed knowledge of COVID-19 vaccine.**

	Univariate			Multivariate		
Sociodemographic Factors	**p-value**	**COR**	**95% CI**	**p-value**	**AOR**	**95% CI**
Age						
18-25	**0.000**	6.304	4.165-9.543	**0.000**	2.654	1.534-4.592
>25-35	**0.000**	8.133	4.967-13.314	**0.018**	2.071	1.130-3.796
>35-45	**0.000**	6.220	3.838-10.079	0.155	1.563	0.844-2.896
>45-55	**0.000**	5.036	3.006-8.438	0.167	1.578	0.826-3.013
>55-60	**0.001**	3.185	1.601-6.338	0.860	0.933	0.430-2.024
>60		1.000			1.000	
Sex						
Male	0.239	1.182	0.895-1.562	0.963	0.993	0.727-1.355
Female		1.000			1.000	
Marital Status						
Married	**0.046**	0.775	0.603-0.996	0.230	0.768	0.499-1.182
Single/Un-Married		1.000			1.000	
Occupation						
Unemployed	**0.000**	0.545	0.421-0.705	0.928	0.982	0.666-1.450
Employed		1.000			1.000	
Economic Status						
Below Average	**0.000**	0.271	0.157-0.466	**0.006**	0.439	0.244-0.790
Average	**0.000**	0.348	0.229-0.529	**0.000**	0.438	0.278-0.689
Above Average		1.000			1.000	
Education						
Below high school graduate	**0.000**	0.032	0.017-0.059	**0.000**	0.120	0.057-0.254
High school Graduate	**0.000**	0.425	0.279-0.648	**0.009**	0.490	0.286-0.838
Undergraduate	0.113	0.715	0.472-1.083	0.206	0.742	0.468-1.178
Post-Graduate		1.000			1.000	
Religion						
Muslim	0.407	1.183	0.796-1.758			
Non-Muslim		1.000				
Medical background						
Yes	**0.000**	3.833	2.939-5.000	**0.000**	2.176	1.586-2.984
No		1.000			1.000	
Relative with Medical background						
Yes	**0.000**	1.982	1.538-2.554	0.927	0.987	0.741-1.314
No		1.000			1.000	
Insurance						
National coverage	0.248	1.280	0.842-1.946	0.834	1.049	0.670-1.643
Private insurance	0.069	2.334	0.936-5.815	0.611	1.283	0.491-3.352
Both	0.069	1.648	0.962-2.824	0.730	1.108	0.619-1.986
Does not have insurance		1.000			1.000	
History relatives with COVID-19						
Yes	**0.000**	4.942	3.382-7.222	**0.003**	1.902	1.239-2.920
No	**0.000**	3.374	2.244-5.073	**0.043**	1.583	1.014-2.471
Do not Know		1.000			1.000	

Table 2. *Continued*

	Univariate			Multivariate		
Sociodemographic Factors	**p-value**	**COR**	**95% CI**	**p-value**	**AOR**	**95% CI**
Infected with COVID-19						
Yes, with lab confirmation	**0.000**	4.195	2.017-8.727	0.246	1.604	0.723-3.560
Yes, without lab conformation	**0.006**	2.711	1.331-5.520	0.582	1.237	0.581-2.635
Never	**0.004**	2.465	1.337-4.542	0.369	1.353	0.699-2.617
Do not know		1.000			1.000	
Source of Information						
Social Media	0.317	1.423	0.713-1.512	**0.016**	2.456	1.180-5.112
Family/Friend	0.350	0.686	0.312-1.512	0.381	1.453	0.629-3.353
Webinar	**0.043**	2.283	1.024-5.088	**0.003**	3.563	1.524-8.331
Literature/Journal	0.873	0.912	0.295-2.822	0.694	1.270	0.386-4.184
News	0.422	1.355	0.646-2.842	0.076	2.031	0.928-4.447
Others			1.000			1.000

Notes: The multivariate analysis data in ordinal regression (using a cut-off of P < 0.25) following univariate analysis. AOR: adjusted odds ratio; COR: crude odds ratio; 95% CI: 95% confidence interval.

understand about the benefit and side effects of vaccination, from mild to severe cases. The positive determinant factors of COVID-19 vaccine understanding were respondents with young age and had medical background. Respondents that can be defined as having or did not have relatives with COVID-19, rather than did not know, had higher odds of having good self-claimed knowledge about this vaccine. Moreover, respondents received information from social media, webinars, and literature or journal. Meanwhile respondents with a lower level of education and lower self-reported economic status were less likely to have a good self-claimed knowledge about this government mass program. A similar finding was reported from 449 university students in Bangladesh that concluded medical students had higher odd of having positive knowledge about vaccines, as well as students majoring in economic and business, and science and technology (Rahman *et al.*, 2022). However, our study did not break down the medical-related field background, such as clinical doctors, medical lecturers, pharmacist, nurses, etc. as a study in Vietnam reported that the last two professions had lower knowledge about the COVID-19 vaccine (Duong *et al.*, 2022). Our findings also support that low income and education were related to low levels of knowledge, as reported in 1708 adults in Vietnam. However, in term of young age, this current study showed better self-claimed knowledge than a study in Vietnam (Duong *et al.*, 2022). A study in 1009 Turkey adults also found that respondents with bachelor degrees were more likely to have good knowledge regarding COVID-19 vaccination (Sonmezer *et al.*, 2022).

Even though during COVID-19 pandemic, social media was criticized due to its circulation about the misinformation, including on vaccine, in our study, respondents who got information form social media had higher odd to have good knowledge on COVID-19 vaccination, as well as for them who received information from webinar and literature/journal, compared to news, information from friend/family, etc. We cannot find the study that showed the source of information as a positive predictor factor on COVID-19 vaccine knowledge, but half of the respondents in Turkey, that concluded 62.7% have positive perceptions, used social media as their source of information regarding the COVID-19 vaccine (Sonmezer *et al.*, 2022). However, a study in 233 university students in Nigeria reported only 20.6% had a good knowledge on COVID-19 vaccination, and 60% of the respondent received information from social media (Orok *et al.*, 2022). This discrepancy might be caused by our study using self-claimed knowledge, instead of measuring it.

It has been reported that a good knowledge or understanding of vaccination is important for a successful vaccination program, such as in the influenza vaccine (Yaqub *et al.*, 2014), including in the COVID-19 vaccine (Al-kafarna *et al.*, 2022; Yupari-Azabache *et al.*, 2022). As this study was conducted at the beginning of the vaccination program for general adults; therefore, the experience of COVID-19 vaccination was divided into six categories, including waiting list and hesitated. Our study showed that 60-70% of respondents had already received at least one vaccine and registered on a waiting list. Due to the limited stock of vaccine numbers, cold chain storage, vaccinator, etc., the vaccination program was faster in urban areas than in rural areas, even in Java (Arifin & Anas, 2021). The public sentiment about the vaccine used in Indonesian COVID-19 vaccination program on its early implementation has become a challenge for the government (Xu *et al.*, 2022). Data from Twitter mining showed that 56% of Indonesian had negative tweet in January 2021 (Pristiyono *et al.*, 2021). Lack of confidence about vaccine efficacy, safety, and various personal reason was major

Table 3. **Univariate and Multivariate ordinal regression on COVID-19 vaccine acceptance.**

	Univariate			Multivariate		
Sociodemographic Factors	**p-value**	**COR**	**95% CI**	**p-value**	**AOR**	**95% CI**
Age						
18-25	**0.000**	0.313	0.197-0.498	**0.000**	0.071	0.031-0.159
>25-35	0.148	1.581	0.850-2.943	**0.008**	0.287	0.114-0.724
>35-45	**0.033**	2.018	1.059-3.847	0.190	0.530	0.205-1.369
>45-55	0.936	0.975	0.527-1.804	**0.002**	0.222	0.087-0.567
>55-60	0.322	1.609	0.628-4.127	0.176	0.442	0.136-1.440
>60		1.000			1.000	
Sex						
Male	**0.031**	0.715	0.527-0.969	0.093	0.727	0.501-1.055
Female		1.000			1.000	
Marital Status						
Married	**0.000**	0.300	0.220-0.410	0.536	1.209	0.664-2.201
Single/Un-Married		1.000			1.000	
Occupation						
Unemployed	**0.000**	0.294	0.212-0.407	0.137	0.691	0.424-1.125
Employed		1.000			1.000	
Economic Status						
Below Average	**0.000**	0.273	0.143-0.521	0.056	0.481	0.227-1.017
Average	**0.001**	0.410	0.239-0.705	0.052	0.540	0.290-1.005
Above Average		1.000			1.000	
Education						
Below high school graduate	**0.000**	0.116	0.051-0.265	0.076	0.381	0.131-1.107
High school Graduate	**0.000**	0.109	0.054-0.223	0.184	0.565	0.243-1.313
Undergraduate	**0.001**	0.292	0.142-0.601	0.434	0.729	0.330-1.609
Post-Graduate		1.000			1.000	
Religion						
Muslim	0.283	0.774	0.485-1.236			
Non-Muslim		1.000				
Medical background						
Yes	**0.002**	1.544	1.166-2.044	**0.040**	1.488	1.019-2.175
No					1.000	
Relative with Medical background						
Yes	**0.001**	1.589	1.200-2.104	0.084	1.349	0.961-1.893
No		1.000			1.000	
Insurance						
National coverage	0.178	0.709	0.429-1.170	0.462	0.809	0.459-1.424
Private insurance	0.812	0.881	0.310-2.505	0.831	0.882	0.277-2.806
Both	0.611	0.848	0.450-1.599	0.632	0.837	0.403-1.736
Does not have insurance		1.000			1.000	
History relatives with COVID-19						
Yes	**0.000**	2.170	1.481-3.182	0.134	1.450	0.891-2.359
No	**0.027**	1.603	1.056-2.431	0.368	1.264	0.759-2.105
Do not Know		1.000			1.000	

Table 3. *Continued*

	Univariate			Multivariate		
Sociodemographic Factors	**p-value**	**COR**	**95% CI**	**p-value**	**AOR**	**95% CI**
Infected with COVID-19						
Yes, with lab confirmation	**0.007**	2.839	1.328-6.073	0.586	0.779	0.316-1.916
Yes, without lab conformation	0.568	1.230	0.604-2.504	0.159	0.555	0.245-1.259
Never	**0.000**	3.019	1.631-5.589	0.312	1.448	0.706-2.968
Do not know		1.000			1.000	
Source of Information						
Social Media	0.167	1.663	0.808-3.421	0.812	1.112	0.462-2.674
Family/Friend	0.413	1.416	0.616-3.255	0.726	1.196	0.439-3.261
Webinar	0.354	1.489	0.642-3.454	0.959	0.974	0.357-2.659
Literature/Journal	0.191	2.427	0.643-9.158	0.359	2.065	0.438-9.738
News	0.157	1.762	0.804-3.862	0.588	1.296	0.507-3.317
Others		1.000			1.000	
Knowledge on COVID-19 Vaccine						
Never heard of it	**0.008**	0.104	0.019-0.561	**0.001**	0.035	0.005-0.239
Ever heard of it	**0.000**	0.110	0.061-0.199	**0.000**	0.071	0.035-0.145
Little knowledge	0.066	0.557	0.299-1.039	**0.048**	0.455	0.208-0.994
Enough knowledge	0.089	0.763	0.560-1.042	0.238	0.806	0.562-1.154
Good knowledge		1.000			1.000	

Notes: The multivariate analysis data in ordinal regression (using a cut-off of P < 0.25) following univariate analysis. AOR: adjusted odds ratio; COR: crude odds ratio; 95% CI: 95% confidence interval.

concern found in this study. The acceptance options were further minimized in the multivariate analysis as reject, hesitate, and accept (consisted of respondents had received at least one jab and on the waiting list). Our study found a young adult and middle age adult respondents were less likely to accept the vaccination, as well as respondents that never heard, ever heard, and had a little knowledge about this vaccination. Almost half of younger respondents (18-25 years old) were still hesitant to receive COVID-19 vaccination, even though they claimed to have a good or enough knowledge about the vaccine. A similar finding was also reported in a study of 6,226 Palestinian adults, with 37.8% of them did not believe in the efficacy of COVID-19 as protection toward SARS-CoV-2 infection, even though younger Palestinians showed higher knowledge (Al-kafarna *et al.*, 2022). Our study also found that middle age respondents also have lower odd accept the vaccination. Their rejection and hesitancy was more likely due to their possibility to develop comorbidity diseases (Fan *et al.*, 2021) and higher risk to develop adverse event (Almufty *et al.*, 2021; Orebi *et al.*, 2022). Our study also supports that less knowledge about COVID-19 vaccine also significantly associated with lower COVID-19 acceptance. A similar finding was also reported in Vietnam, where individual with less knowledge is more likely to reject COVID-19 vaccination (Duong *et al.*, 2022). The only significant positive predictor factor was having medical background, which might be related that the healthcare professionals were among the priority to receive the vaccination, and more likely due to higher level of knowledge as reported in Bangladesh and Vietnam (Duong *et al.*, 2022; Rahman *et al.*, 2022).

As this study only covers one most developed and densest islands in Indonesia, a study with wider coverage is necessary. Moreover, as this study was conducted in the beginning of the vaccination program, a follow-up about the reason behind high vaccination coverage in Indonesia should be investigated and analysed as a lesson for future recommendations. Measurement of knowledge, instead of self-claimed, might show more complete picture, even though the results in this study mostly have similar finding with other studies.

Taken together, this study showed high COVID-19 vaccine knowledge and acceptance among adults on Java Island. Increasing understanding or knowledge about COVID-19 vaccine risks and benefits is necessary to reduce vaccination hesitancy. Vigorous campaigns and dissemination of information are needed to increase knowledge of young adults, people at high risk, low economic background, low education level and individuals with the nonmedical-related background. Moreover, because social media constitutes the highest source of information, it could be used for stakeholders to share the correct information about the pandemic and its vaccination programs, including booster programs.

Data availability

Underlying data

Mendeley data: COVID-19 Vaccine Understanding and Acceptance in Java. https://doi.org/10.17632/7y7mg4r9b4.2 (d'Arqom, 2022).

This project contains the following underlying data:

- 910 Vaccine Java Data.xlsx
- Erratum 910 Vaccine Java Data.xlsx (correction of the labelled on the column O on the 910 Vaccine Java Data. xlsx)

Extended data

Mendeley data: COVID-19 Vaccine Understanding and Acceptance in Java. https://doi.org/10.17632/7y7mg4r9b4.2 (d'Arqom, 2022).

This project contains the following extended data:

- Supplement Vaccine.docx (questionnaire)

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PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14