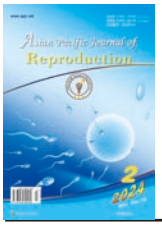

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Knowledge, attitudes, and practices regarding Covid-19 and their relationship with Covid-19 booster vaccination status among women with infertility

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ABSTRACT

Objective: To elucidate the relationship among knowledge, attitudes, and practices regarding Covid-19 and their relationship with booster vaccination status among women with infertility.

Methods: This questionnaire-based cross-sectional study was performed online and offline among women with infertility who visited an infertility clinic in Jakarta, Indonesia. We assessed the patient's knowledge, attitudes, and practices regarding Covid-19 and their relationship with booster vaccination status and sociodemographic profile.

Results: A total of 178 subjects participated in this study, and most participants (92.6%) had received booster Covid-19 vaccines. From the questionnaire, 74.2% had good knowledge, and 99.4% had good attitudes regarding Covid-19; however, only 57.9% of patients had good practices. A weak positive correlation existed between knowledge and attitudes (r=0.11, P=0.13) and a moderate negative correlation between attitudes and practices (r=-0.44, P=0.56). Participants' knowledge about vaccines and infertility was correlated with booster vaccination status (P=0.04). Academic background (P=0.01) and attitudes (P=0.01) were also correlated with booster vaccination status. The significant determinants of hesitance of receiving Covid-19 booster vaccines were high school education or below (OR=0.08, 95% CI 0.02-0.36) and poor practices (OR=0.21, 95% CI 0.05-0.95).

Conclusions: The majority of the participants had received the Covid-19 booster vaccine and had good knowledge and attitudes but poor practices regarding Covid-19. Most participants had poor knowledge about the relationship between infertility and the Covid-19 vaccine. The general population should be more informed and reminded about practices to prevent Covid-19 and the relationship between vaccination and fertility to increase the number of people who receive Covid-19 booster vaccines.

KEYWORDS: Covid-19; Booster vaccine; Infertility; Knowledge; Attitude; Practice; Human reproduction; Pandemic

Significance

There is no scientific proof about the Covid-19 vaccine and the impairment of fertility in women. However, Covid-19 infection could threaten reproductive health. Vaccination is an option to prevent SAR-CoV-2 infection and its adverse outcomes. This study added analysis of knowledge, attitudes and practices of infertile women toward Covid-19 vaccination, specifically booster vaccine. The results of this study demonstrated that knowledge and attitudes of Covid-19 do not determine practices. Knowledge of the relationship between infertility and Covid-19 vaccines is still poor. This study shows the urgency and hopefully creates a follow-up plan of action to increase the number of people who received booster vaccines.

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1. Introduction

Since the World Health Organization declared a pandemic after the discovery of SARS-CoV-2 in 2019, the number of infected people in Indonesia has progressively increased. As many as 56 757 cases were reported in July 2021, and 143 969 deaths were reported as of December 2021[1]. Positive responses were received when the Covid-19 vaccine became available in Indonesia in January 2021. However, there have been some concerns regarding the vaccine's safety in terms of its effects on fertility[2]. Online search engine databases showed a substantial rise in online searches about fertility and the Covid-19 vaccine after the government announced its emergency vaccine authorization[1]. The amount of misinformation about Covid-19 side effects was considerable, especially the assumption that vaccination may cause infertility and worsen the condition of women with infertility[2,3].

One of the reasons for the hesitancy to vaccinate is that the Covid-19 vaccine is recently developed[4,5]. There is a great deal of misinformation circulating on social media about the possibility of vaccines causing temporary or permanent infertility. It was speculated that the Covid-19 vaccine could potentially damage the reproductive system and fertility, especially the vaccine that copies the structure of the virus (mRNA vaccine). A few proteins share a similar amino acid sequence between the SARS-CoV-2 spike protein and syncytin-1, an important protein for the formation of syncytiotrophoblasts. It was feared that the antibody and syncytin-1 would form a cross-reaction, consequently affecting embryo implantation[6–8]. Morris demonstrated no significant differences in biochemical pregnancy between seropositive women with antibodies to the SARS-CoV-2 spike protein and those who were seronegative and underwent *in–vitro* fertilization (IVF)[6].

Misinformation from online sources about the Covid-19 vaccine and infertility without inadequate amounts of evidence could result in women with infertility refusing or delaying vaccination, especially the booster vaccine, which is voluntary in some countries, such as Indonesia[9]. We sought to elucidate the relationship among knowledge, attitudes and practices regarding Covid-19 booster vaccination status among women with infertility.

2. Subjects and methods

2.1. Study design and sampling

A cross-sectional study was conducted at Yasmin Fertility Clinic, Dr. Cipto Mangunkusumo Kencana General Hospital, Jakarta, Indonesia, from January 2022 to December 2022. A convenience sampling technique was used to recruit women with infertility as participants. The inclusion criteria of this study are women with infertility in Jakarta, Indonesia, which have received Covid-19 vaccination screening. This study's exclusion criteria are women currently infected with the Covid-19 virus. Questionnaires were distributed to the subjects either offline at the clinic or online using Google Forms. A sample size of 178 was calculated by comparing two proportions. From the previous data, assuming α 5%, the acquired $Z\alpha$ score is 1.96 (95% confidence interval), and $Z\beta$ is 0.84, with a power of 80%. The proportion of vaccine acceptance is 74% in the sample with good knowledge, and 54% in the sample with low knowledge[10]. A sample size of 178 is needed for minimum subjects for this study; the formula for sample size is shown below.

$$n1 = n2 = \left[\frac{\left(2\alpha\sqrt{2PQ} + 2\beta\sqrt{p1q1+p2q2}\right)}{(p1-p2)}\right]^2$$

2.2. Measurement and data management

The questionnaire for this study was acquired by literature searches of previously validated questionnaires and was adapted to complement the topic of this study. The questionnaire was then translated into Bahasa (Indonesian language). The questionnaire validity test was conducted, and pilot questionnaires were distributed to 40 subjects to grade the questionnaire's validity comprehensively. The questionnaire consisted of 4 different sections: the demographic characteristics of the participants, knowledge of the Covid-19 vaccine and infertility, attitudes towards the pandemic and vaccine acceptance, and practices regarding the Covid-19 pandemic. The patients' demographic data consisted of their initials, age, address, occupation, income[10], academic background, ethnicity, religion, weight, height, medical history, spousal support of vaccination, and duration of infertility.

The knowledge score was obtained by using 12 true or false statements. Every statement had a score of 1 point. There was no point reduction if the subjects answered incorrectly. The maximum score was 12 points. The attitude score was obtained by answering a 4-point Likert scale statement with strongly disagree, disagree, agree, or strongly agree. The attitude questions had a maximum score of 48 points. The practice score was obtained by a yes or no question, in which every "yes" answer was scored 1 point, and every "no" answer was given 0 points. The maximum practice score was 10 points. The knowledge, attitudes, and practices scores were considered high if they were >70% of the maximum score from each component.

2.3. Statistical analysis

Data analyses were performed using SPSS version 25.0. *Chi*-square test, Fisher's exact test, or Kruskal–Wallis test (for ordinal variable) was used for categorical data, while the unpaired *t*-test or Mann–Whitney *U* test was used for numerical data. Knowledge, attitudes, and practices were classified into good (>70%), moderate (60%–70%), and poor (<60%). Correlation analyses were performed to analyse the relationship among knowledge, attitudes, and practices among women with infertility. Spearman test was used for correlation with ordinal variables. Bivariate analyses were performed

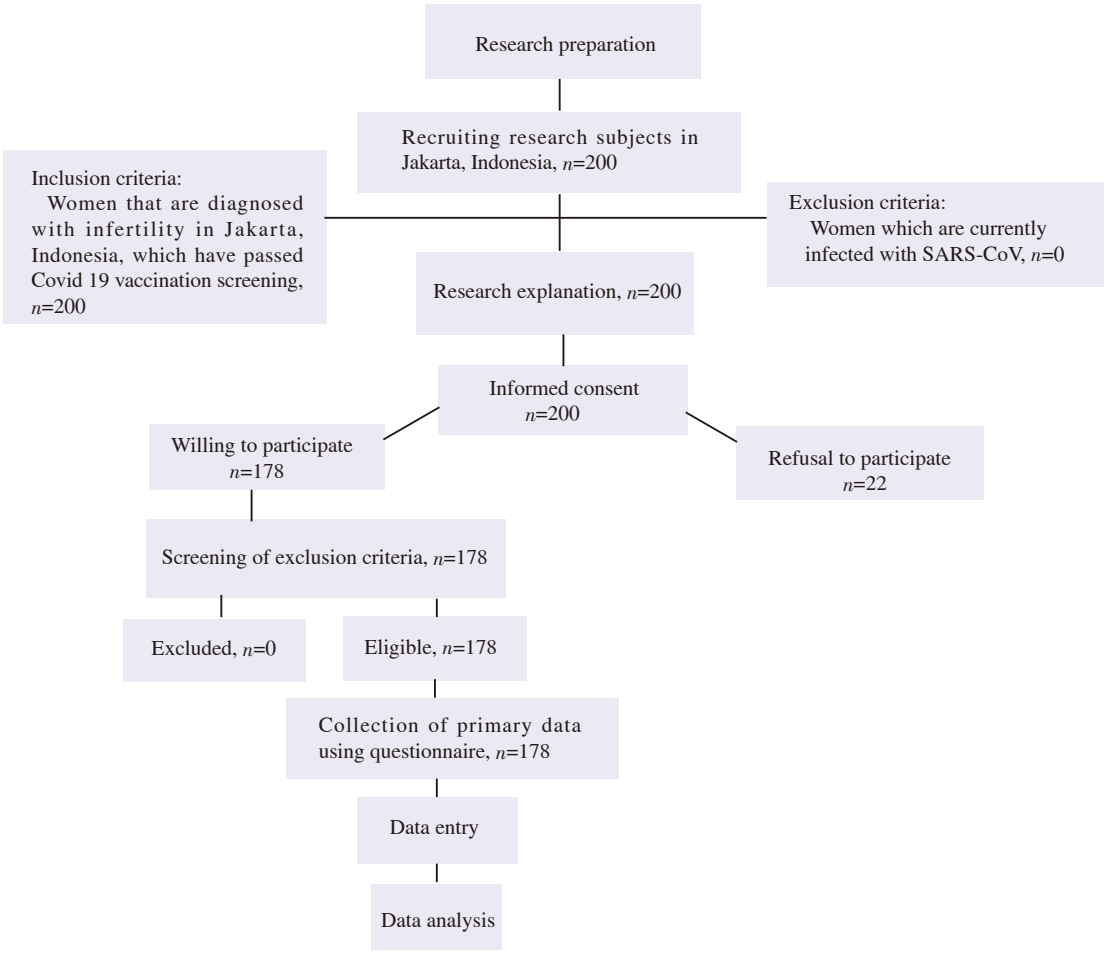

Figure 1. The participant screening process.

to determine the relationship between knowledge, attitudes, and practices and Covid-19 booster vaccine acceptance among women with infertility. Multivariate analyses of sociodemographic data and booster vaccination status, specifically logistic regression, were conducted with regard to the knowledge, attitudes and practices regarding Covid-19 vaccination. The parameter with clinical significance was included in multivariate analyses. The statistical significance level was $P<0.05$.

2.4. Ethics statement

All of the procedures conducted in this study received ethical clearance from the Faculty of Medicine, Universitas Indonesia (Reference number: 309/UN2.FI/ETIK/PPM.00.02/2022). Participants of the study were given thorough informed consent about the research beforehand. The participants voluntarily agreed to complete the questionnaire.

3. Results

3.1. Sociodemographic profiles

The participant screening process is presented in Figure 1. A total of 178 respondents completed the questionnaire. The demographic profiles of the subjects are presented in Table 1. Most of the participants (92.6%) had received booster vaccines. Approximately 58.4% of participants were over 30 years old, and 65.2% were Javanese. Most (78%) of the respondents had an undergraduate degree or above and a higher income than the minimum wage (80.8%).

3.2. Knowledge, attitudes, and practices regarding Covid-19 among women with infertility

Positive responses regarding knowledge of Covid-19 and infertility ranged between 23.6% and 100% (Table 2). There were three questions with results below 50%: questions about the symptoms of Covid-19 (46.6%), transmission of Covid-19 (23.6%) and effect of Covid-19 infection/vaccine on fertility (42%). When comparing groups that did and did not receive a vaccine booster, the effects of the Covid-19 infection/vaccine were significantly different (44.2% *vs.* 15.4%; $P<0.05$).

Most respondents had positive attitudes (agree and strongly agree), with rates ranging from 69.8% to 100%, with the lowest response rate regarding recommendations to stay at home during the pandemic (Table 3).

Most participants wore masks (99.4%) and carried hand sanitizer

Table 1. Respondent characteristics (n=178).

Characteristics	n (%)
Booster vaccination status	
Had not received booster vaccine	13 (7.3)
Had received booster vaccine	165 (92.7)
Age group, years	
20-29	74 (41.5)
30-39	96 (53.9)
40-49	8 (4.5)
Academic background	
High school	21 (11.8)
Diploma	18 (10.2)
Undergraduate degree or above	139 (78.0)
Monthly income	
< Minimum wage (<$ 281.72)	42 (23.6)
> Minimum wage (>$ 281.72)	136 (76.4)
Religion	
Hinduism	2 (1.1)
Islam	144 (80.8)
Catholicism	10 (5.6)
Christianity	22 (12.4)
Ethnicity	
Java	116 (65.2)
Sumatera	35 (20.2)
Eastern Indonesia*	16 (9.1)
Others	10 (5.5)

*Eastern Indonesia includes Ambon, Bali, Kalimantan, Papua, and Sulawesi.

(93.8%) when venturing outside the home. However, several questions were answered with a positive response rate of less than 60%. Only 32.6% of the participants avoided seeing guests at home, 39.35% preferred to engage in activities at home, and 50.6% went outside only when required (Table 4).

In summary, the majority of subjects had good knowledge (74.1%) and good attitudes (99.4%). However, only 57.9% had good practices, while 22.5% had poor attitudes towards Covid-19 among women with infertility (Table 5).

3.3. Correlation among knowledge, attitudes, and practices regarding Covid–19 among women with infertility

Positive weak correlations were found between knowledge and practices (r=0.08, P=0.30) and between attitudes and practices (r=0.11, P=0.13) regarding Covid-19 among women with infertility. Interestingly, a weak negative correlation was found between knowledge and attitudes towards Covid-19 among women with infertility (r=-0.44, P=0.56). However, none of those correlations had significantly differed (Table 6).

In bivariate analysis, there was a significant relationship between

Table 2. Positive responses regarding knowledge of Covid-19 among women with infertility.

No.	Statement	Positive responses			P value
		Total (n=178)	No booster vaccine (n=13)	Booster vaccine (n=165)	
1	The primary clinical manifestations of Covid-19 are fever, fatigue, dry cough, and muscle pain.	169 (94.9)	12 (92.3)	157 (95.2)	0.50
2	Unlike with influenza, nasal congestion, runny nose, and sneezing are rarely found in people infected with Covid-19.	83 (46.6)	4 (30.8)	79 (47.9)	0.23
3	To date, there are no effective drugs for Covid-19; however, symptomatic treatment and early supportive treatment can help the majority of infected people recover from the virus.	153 (86.0)	13 (100.0)	140 (84.9)	0.22
4	Not everyone with Covid-19 will develop severe symptoms. However, those with comorbidities, such as chronic diseases and obesity, and elderly patients have a higher risk of developing the disease.	146 (82.0)	12 (92.3)	134 (81.2)	0.47
5	Direct contact or consuming wild animal meat increases the risk of Covid-19 infection.	42 (23.6)	3 (23.1)	39 (23.6)	>0.99
6	Those infected with Covid-19 will not infect other people if they are currently afebrile.	141 (79.2)	10 (76.9)	131 (79.4)	0.74
7	Covid-19 spreads by airborne droplets (coughing, sneezing, talking) from people who are infected with the virus.	174 (97.8)	13 (100.0)	161 (97.6)	>0.99
8	The general population should wear at least a regular medical mask to prevent Covid-19.	165 (92.7)	12 (92.3)	153 (92.7)	>0.99
9	Covid-19 and/or the Covid-19 vaccine could cause or worsen infertility.	75 (42.0)	2 (15.4)	73 (44.2)	0.04
10	To prevent Covid-19 infection, we should avoid overcrowded places.	166 (93.3)	13 (100.0)	153 (92.7)	0.60
11	Self-isolation and treating sick people are effective ways to stop the spread of the virus.	174 (97.8)	13 (100.0)	161 (97.6)	>0.99
12	Those who have contact with someone who is infected with the virus should self-isolate as soon as possible in an appropriate setting. Generally, the period of isolation is 14 days.	163 (91.6)	12 (92.3)	151 (91.5)	>0.99

Data are expressed as n(%). *Chi* square test is used to analyse the response of each question.

Table 3. Positive responses regarding attitudes towards Covid-19 among women with infertility [*n*(%)].

Statement	Strongly disagree	Disagree	Agree	Strongly agree
1. The Covid-19 pandemic will eventually end.	0 (0.0)	5 (2.8)	109 (61.2)	64 (35.9)
2. Indonesia will overcome the virus.	0 (0.0)	3 (1.6)	99 (55.6)	76 (42.6)
3. During the pandemic, it is recommended to stay at home, including for work and prayer.	2 (1.1)	48 (27.0)	106 (59.6)	22 (12.3)
4. It is recommended to wear a mask every time we go outside.	0 (0.0)	2 (1.1)	88 (49.4)	88 (49.4)
5. Washing our hands with soap is mandatory for every activity.	0 (0.0)	0 (0.0)	85 (47.8)	93 (52.2)
6. Every time we sneeze or cough, we should wash our hands with soap.	0 (0.0)	11 (6.1)	96 (53.9)	71 (39.8)
7. We should wash our hands for at least 40-60 seconds.	0 (0.0)	6 (3.4)	106 (59.6)	66 (37.0)
8. We should wash our hands with soap after visiting public places (the market, mosque, public transportation).	0 (0.0)	1 (0.5)	71 (39.0)	106 (60.5)
9. Washing our hands with soap is mandatory every time we touch an object, including money.	0 (0.0)	4 (2.2)	90 (50.5)	84 (47.1)
10. It is generally not recommended to touch our face, eyes, or nose with unwashed hands.	1 (0.5)	17 (9.6)	101 (56.7)	59 (33.1)
11. Two metres is the minimum distance when social distancing.	0 (0.0)	26 (14.6)	114 (64.0)	38 (21.3)
12. It is recommended to take a shower and refrain from touching our family members every time we return home.	2 (1.1)	5 (2.8)	103 (57.8)	68 (38.2)

Total respondents *n*=178.

Table 4. Positive responses regarding practices in regard to Covid-19 among women with infertility.

No.	Statement	*n* (%)
1	I wash my hands with soap for at least 40-60 seconds with the correct technique every time.	146 (82.0)
2	I always wear a mask whenever I go outside.	177 (99.4)
3	Every time I go home after an activity, I wash my hands and clothes, take a shower, and do not touch anything before doing so.	142 (79.8)
4	I avoid seeing guests in my home during the pandemic.	58 (32.6)
5	I prefer to work, study, and pray at home.	70 (39.3)
6	I only go outside when I have an urgent matter.	90 (50.6)
7	I bring my hand sanitizer every time I go outside.	167 (93.8)
8	I practice social distancing of at least 2 metres.	115 (64.6)
9	I disinfect high-touch areas, such as table surfaces, door handles, money, and phones at least twice a day.	119 (66.9)
10	I avoid touching my face, eyes, or nose.	129 (72.5)

Total respondents *n*=178.

Table 5. Results of all responses for knowledge, attitudes, and practices regarding Covid-19 among women with infertility [*n*(%)].

Items	Level of competency		
	Poor	Moderate	Good
Knowledge	19 (10.7)	27 (15.2)	132 (74.1)
Attitudes	0 (0.0)	1 (0.6)	177 (99.4)
Practices	40 (22.5)	35 (19.6)	103 (57.9)

Table 6. Correlation among knowledge, attitudes, and practices regarding Covid-19 among women with infertility.

Parameters	*r*-value	*P*
Practices and attitudes	0.11	0.13
Practices and knowledge	0.08	0.30
Knowledge and attitudes	-0.44	0.56

Spearman correlation test is used for the analysis and is presented with *r*–value.

academic background and booster vaccination status. A significant relationship was also between attitude scores and booster vaccination status (Table 7).

Multivariate logistic regression of sociodemographic factors knowledge, attitude, practice scores, and booster vaccination status is presented in Table 8. Significant determinants of booster vaccination status were lower education level (high school or below) (*OR* 0.08, 95% *CI* 0.02-0.36) and poor practices (*OR* 0.21, 95% *CI* 0.05–0.95).

4. Discussion

During the period of conducting this study, the government required the public to receive a Covid-19 booster as a condition for being able to carry out activities in public places such as offices and shopping centers in most cities in Indonesia. Most likely due to these reasons, most subjects (92.7%) in this study had received the Covid-19 booster vaccine[11]. Most respondents had good knowledge about Covid-19, and most subjects answered more than 70% of the questions correctly. This result may have been because most of the subjects who came to the clinic had a diploma/undergraduate degree or above (78%). This finding is consistent with those of previous studies conducted in various countries that found a positive association between a higher educational level and knowledge of Covid-19[12,13].

Even though the sample population had good general knowledge,

Table 7. Association between knowledge, attitudes, and practices and booster vaccination status and sociodemographic factors.

Variables	Vaccinated (n=13)	Unvaccinated (n=165)	P value
Age, years			0.468
<35	11 (84.6)	130 (78.8)	
>35	2 (15.4)	35 (21.2)	
Monthly income			0.190
< Minimum wage (<$ 281.72)	5 (38.5)	37 (22.4)	
> Minimum wage (>$ 281.72)	8 (61.5)	128 (77.6)	
Academic background			0.001
High school or below	5 (38.5)	16 (9.7)	
Diploma, undergraduate degree or above	8 (61.5)	149 (90.3)	
Spousal support of vaccination			0.073
Not supportive	1 (7.7)	0 (0.0)	
Supportive	12 (92.3)	165(100.0)	
Knowledge			0.937
Poor	1 (7.7)	18 (10.8)	
Moderate	2(15.4)	25 (15.2)	
Good	10 (77.0)	122 (73.9)	
Attitudes			0.001
Poor	0 (0.0)	0 (0.0)	
Moderate	1 (7.7)	0 (0.0)	
Good	12 (92.3)	165 (100.0)	
Practices			0.089
Poor	6 (46.1)	34 (20.6)	
Moderate	1 (7.7)	34 (20.6)	
Good	6 (46.1)	97 (58.8)	

Data are expressed as n(%). *Chi* square test is used to analyse the data. Fisher's exact test is used for data that does not fulfill the requirement of *Chi* square test. Kruskall Wallis test is used for the analyses of knowledge, attitude, and practice with ordinal variable.

Table 8. Logistic regression of the determinants of getting vaccinated.

Characteristic	Unvaccinated	*OR*	95% *CI*	P value
Age, years				
<35	11	1.15	0.21-6.17	0.87
>35	2	Ref		
Spousal support				
Not supportive	1	N/A		1
Supportive	12	Ref		
Academic background				
High School or below	5	0.08	0.02-0.36	0.01
Diploma, undergraduate degree or above	8	Ref		
Knowledge				
Poor	1	2.31	0.21-24.61	0.49
Moderate	2	0.81	0.14-4.47	0.81
Good	10	Ref		
Attitudes				
Poor	0			
Moderate	1	N/A		1
Good	12	Ref		
Practices				
Poor	6	0.21	0.05-0.95	0.04
Moderate	1	1.24	0.13-12.13	0.85
Good	6	Ref		

Binomial logistic regression test is used to analyse the determinants. Data are expressed by odds ratio (95% confidence interval).

the subject knowledge of infertility and booster vaccines was insufficient. This can be observed from the statement about infertility and the Covid-19 vaccine. This statement had the fewest positive responses compared to the other statements in the questionnaire. Less than 50% of participants answered the statement correctly, especially those who were unvaccinated (P<0.05). The statement that vaccination may worsen infertility has not been scientifically proven and lacks a sufficient amount of evidence. The amount of clarification backing the statement needs to be increased. This may result in women with infertility delaying vaccination because they are trying to conceive. A cross-sectional study in China reported no significant relationship between assisted reproductive technology and Covid-19 vaccination with the inactivated, adenovirus, or recombinant vaccine[14].

This study found that most subjects (99.4%) had a score higher than 70% for the statements on attitudes towards Covid-19. There was also a significant relationship between attitudes and booster vaccination. This shows that most of the population has been following regulations and the prevention program for Covid-19. They have taken preventive action, such as avoiding crowded places and staying at home[12].

Regarding the practice results of this study, only 57.9% of participants had 70% of the maximum score. The majority of the subjects had good practices regarding Covid-19. The rates in this study are noticeably lower than those of a previous similar study[12,13,15]. This may be due to the timing of this study; Covid-19 prevention measures in 2022 were more relaxed than those the year before.

There was a significant relationship between academic background and booster vaccination. We found in our analysis that a low education level had a negative relationship with booster vaccination (*OR* 0.08, 95% *CI* 0.02-0.36). This result is in accordance with the findings from the study by Paul *et al*, in which the respondents who did not believe in the vaccination had a lower educational and knowledge level regarding Covid-19[16]. We also found that poor practices had a negative relationship with booster vaccination status (*OR* 0.21, 95% *CI* 0.05-0.95).

A similar study by Wang *et al* has addressed the problem of Covid-19 vaccination hesitancy in infertile patients. 17.33% of the study population reported hesitancy in taking primary vaccination, 25.63% of couples hesitated in taking booster vaccination, and a total of 32.32 % of couples delayed in taking primary vaccination. The hesitancy of taking the vaccination was associated with a multitude of factors. Unexplained infertility, ongoing IVF treatment, effectiveness, concern for safety, and influence on pregnancy are significant factors in delaying or refusing vaccination. The study reported that subjects with a college or above degree were inversely associated with delay in vaccination. This finding is similar to our study, in which academic background is a significant determinant of taking booster vaccination[17].

A systematic review by Gianfredi *et al* have tackled similar problem in hesitancy of vaccination. The study focused on knowledge, attitude, acceptance, and the hesitancy in pregnant women. In contrast to our study, the review reported that knowledge and attitude were associated with higher acceptance. Multiple factors can cause contrasting results. The study has reported more subjects in the population overall. The different targeted populations could also be a factor in differing results[18].

The study has some limitations. In addition to its relatively small sample, this study only covered people who visited our clinic in Jakarta, Indonesia, an urban city that only represents part of Indonesia. Most of the subjects also had higher education levels. Our study may differ from the knowledge, attitudes, and practices of the population in Indonesia.

In conclusion, this study elucidates that among women with infertility, there is a prevalent attainment of adequate knowledge and favourable attitudes towards Covid-19, alongside a commendable adherence to recommended practices. However, it is imperative to highlight a discernible gap in the understanding concerning the interrelation between Covid-19 vaccination and infertility issues, which needs to be addressed. The investigation revealed a negligible and statistically insignificant correlation between the domains of knowledge, attitudes, and practices. Notably, possessing an educational obtainment of high school or below and demonstrating suboptimal practices emerged as significant predictive factors for the reluctance or refusal to receive the Covid-19 booster vaccination.

This finding underscores the necessity for targeted educational interventions explitcitly tailored towards women with infertility, aimed at discovering the potential impacts of Covid-19 vaccination on fertility outcomes. There is a pressing need to disseminate comprehensive and scientifically robust information regarding Covid-19 preventative measures, alongside the vaccination's safety and efficacy in the context of reproductive health. Such initiatives are crucial in bolstering the uptake of booster vaccinations among this demographic, thereby contributing to the broader efforts to curb the transmission of Covid-19.

Conflict of interest statement

Authors declare no conflicts of interest in this study.

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Authors' contributions

Kevin Ezekia and Gita Pratama conceptualized the manuscript. Gita Pratama, Natasha Talya, Kevin Ezekia, and Irfan Arieqal Hatta Ampri collected the data, analyzed and wrote the manuscript. The review was done by Mila Maidarti, Kanadi Sumapradja, Achmad Kemal Harzif, and Gita Pratama.

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