

COVID-19 concerns, influenza vaccination history and pregnant women's COVID-19 vaccine acceptance: a systematic review

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ABSTRACT

Pregnant women have a higher risk of serious illness during the coronavirus disease 2019 (COVID-19) pandemic. This raises concerns about COVID-19 infection in pregnant women. Other than COVID-19, pregnant women are also a high-risk group for influenza infection. Influenza vaccination is used to prevent coinfection with COVID-19. Thus, this study examined the acceptance of the COVID-19 vaccine in pregnant women based on factors of worry about COVID-19 infection and a history of influenza vaccination. This study was a systematic review that assessed cross-sectional articles of the year 2020-2021 from the Pubmed, Science Direct, and Medrxiv databases with narrative analysis. There were three articles that met the criteria. The three articles showed significant relationships between concerns of being infected with COVID-19 and receiving COVID-19 vaccine acceptance in pregnant women, while a significant relationships between a history of influenza vaccination and accepting COVID-19 vaccination in pregnant women were only found in two articles. Compared to the history of influenza vaccination, the concerns of being infected with COVID-19 in pregnant women were significantly more related to accepting COVID-19 vaccination, so it can be the focus of intervention to increase the acceptance of COVID-19 vaccination in pregnant women.

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1. INTRODUCTION

Vaccination plays an important role as an attempt to end a pandemic, without the exception of the coronavirus disease 2019 (COVID-19) pandemic. However, the latest data apprehending COVID-19 vaccination and safety reasons especially towards pregnant women is still very scarce [1]. Vaccine acceptance is defined as an individual or a group choice to either agree or decline when given the opportunity to be vaccinated [2]. COVID-19 vaccine acceptance in pregnant women varies in many countries, that is 37% in Turkey [3], 61% in the European Union [4], and 70.7% in Ethiopia [5]. The implementation in the United States between December 14, 2021, and May 8, 2021, that was recorded on the vaccine safety datalink (VSD) only 5.3% of the pregnant women had accepted the first dose of COVID-19 vaccine, and only 11.1% of pregnant women had accepted the complete dose. Although there was a reported increase from the end of

March-May, 2021 that could be associated with increased eligibility and availability of the COVID-19 vaccine for pregnant women, the cumulative coverage of COVID-19 vaccination in pregnant women is still classified as low, namely below 25% [1]. The acceptance rate of the COVID-19 vaccine in pregnant women still remain to be low, despite the fact that two surveys conducted in New York reports an increased COVID-19 vaccine acceptance from 17.3% in December, 2019 until May, 2021 [6] to 44.3% on January 7-29, 2021 [7].

According to a study conducted by Pascawati and Satoto, the percentage of respondents that perceived pregnant women as a high-risk group was relatively low at 26.45% [8]. Low vaccine acceptance may increase the risk of severe illnesses in COVID-19-infected pregnant women. According to a study by Villar *et al.* [9], morbidity and mortality rates in pregnant women with COVID-19 was recorded to be higher than that of without COVID-19 (31.9%), appertaining higher rates of hypertension due to pregnancy (58%), preeclampsia/eclampsia (59%), infections that required antibiotics (25%), and related to a higher risk of intensive care unit (ICU) admission (59%). It was also reported that the risk of morbidity and mortality in neonates was two times higher in pregnant women with confirmed COVID-19 diagnoses (17%).

Moreover, CDC also stated that the condition of COVID-19-infected pregnant women may increase the risk of preterm birth, stillbirth, and other pregnancy complications [10]. Further impacts of vaccine refusal in pregnant women include the prolongation in forming herd immunity [5], [11]–[13]. On the other hand, COVID-19 vaccination during pregnancy provides benefits for the mother and child. According to a study by Gray *et al.* [14], the immune response induced by the COVID-19 vaccine was significantly higher than natural immune response due to severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) infection during pregnancy. The transfer of antibodies produced by vaccines was also detected in neonates through placental and breastmilk pathways. A preliminary study conducted by Shimabukuro *et al.* [15] also reported that there were no significant warning signs or increased risks among pregnant women that were vaccinated by the mRNA-type vaccine againts COVID-19.

Due to the fatal consequences of COVID-19 vaccine refusal and hesitancy in mind, it is important to identify factors contributing to the low rates of vaccine acceptance in order for it to be understood and intervened comprehensively. Moreover, the large disparities of COVID-19 vaccine coverage between countries have the potential to delay global pandemic control as well as social and economic recovery [16].

Definitive therapy for COVID-19 infection has yet to be discovered, however herd immunity can be formed if COVID-19 vaccine uptake could reach a certain number of the general population [17]. In a systematic review that involved 290,327 participants, it was found that influenza vaccination significantly associated with the decreased risks of SARS-Cov-2 infection [18]. In terms of risk perception and perceived health threat, avian influenza, as well as severe acute respiratory syndrome (SARS) and other previous emerging infectious diseases were considered similar to COVID-19 [19]. A higher perception of COVID-19 risk was also reported in females [20]. Compared to males, females expressed higher levels of concern about the effect of the COVID-19 pandemic that was assumed to be the cause of higher score tests on COVID-19 knowledge in women [8].

As an addition to the concern, data regarding the side effects of the COVID-19 vaccine in pregnant women are very limited because clinical trials are still ongoing. A cross-sectional study reported no statistical difference in the side effects of COVID-19 vaccination among pregnant and non-pregnant women. To be specific, pregnancy-related adverse events reported in the immediate or early post mRNA vaccination period were very uncommon [21]. Political reasons influencing vaccine hesitancy are not covered by the health sector, so it is deemed inappropriate for researchers, both in terms of theoretical and scientific foundations, to be studied more deeply. Studies on associated factors of COVID-19 vaccine acceptance among pregnant women are less studied and there has been no systematic review regarding this matter. Therefore, this systematic review aimed to assess factors associated with pregnant women's COVID-19 vaccine acceptance, particularly the concern of being infected with COVID-19 infection and history of receiving the influenza vaccine, through a comparison of several existing studies. Results of this systematic review can be deemed as a consideration in making evidence-based public health policy by relevant stakeholders.

2. RESEARCH METHOD

2.1. Research type and design

This research was a systematic review conducted using articles with a cross-sectional design without any limitations of countries. The searching process of the data was conducted online based which ended on June 29, 2021.

2.2. Literature searching strategy

The search for literature was conducted online from an electronic databases including Pubmed, Science Direct, and Medrxiv. The PECO format (P=population, E=exposure, C=comparison, O=outcomes) was used to establish our research question. The population involved were pregnant women, with the exposure emphasizing concerns about COVID-19 infection, later compared with the history of influenza vaccine, and the outcome as COVID-19 vaccine acceptance. Studies were included for this systematic review if meeting these criteria: i) population: women who are pregnant during the research, with the minimum age of 18 years old; ii) intervention: concerns about COVID-19 infection; iii) comparison: history of influenza vaccine; iv) outcome: acceptance rate of COVID-19 vaccine; v) original research articles with cross-sectional study design; vi) articles written in English; vii) published or unpublished studies (including grey literature); viii) conducted in 2020 and 2021. Articles that were merely in the form of abstracts or unable to be accessed in full-text and studies with samples less than 500 were excluded from this systematic review.

The search for published articles was conducted using keywords that were combined with a Boolean operators (AND, OR NOT or AND NOT), which were beneficial to broaden the scope of the search. The keywords used in this systematic review were aligned with the medical subject heading (MeSH term) that consisted of keywords consistent with our PECO ("Pregnant" OR "expectant mother" OR "pregnancy") AND ("worry" OR "worried" OR "concern") AND ("history of influenza vaccine" OR "influenza vaccine" OR "flu vaccine") AND ("COVID-19 vaccine" OR "SARS-CoV-2 vaccine") AND ("acceptance" OR "willingness"). However, after attempted search with the keywords mentioned, we were unable to find a result, therefore the keywords were expanded into ("Pregnant" OR "expectant mother" OR "pregnancy") AND ("COVID-19 vaccine" OR "SARS-CoV-2 vaccine") AND ("acceptance" OR "willingness").

2.3. Study selection

From the database search, a total of 234 published articles were obtained and managed using the preferred reporting items for systematic review and meta-analysis (PRISMA) method as shown in Figure 1. The articles obtained were then screened based on inclusion and exclusion criteria, title, and abstract suitability. Then a manual review of the articles was carried out by hand searching to find articles containing the appropriate exposure and comparison, namely examining the influence of concerns about being infected with COVID-19 and history of influenza vaccination on the acceptance of COVID-19 vaccination in pregnant women, thus four articles were obtained. A quality assessment of the studies and the risk of bias was then carried out.

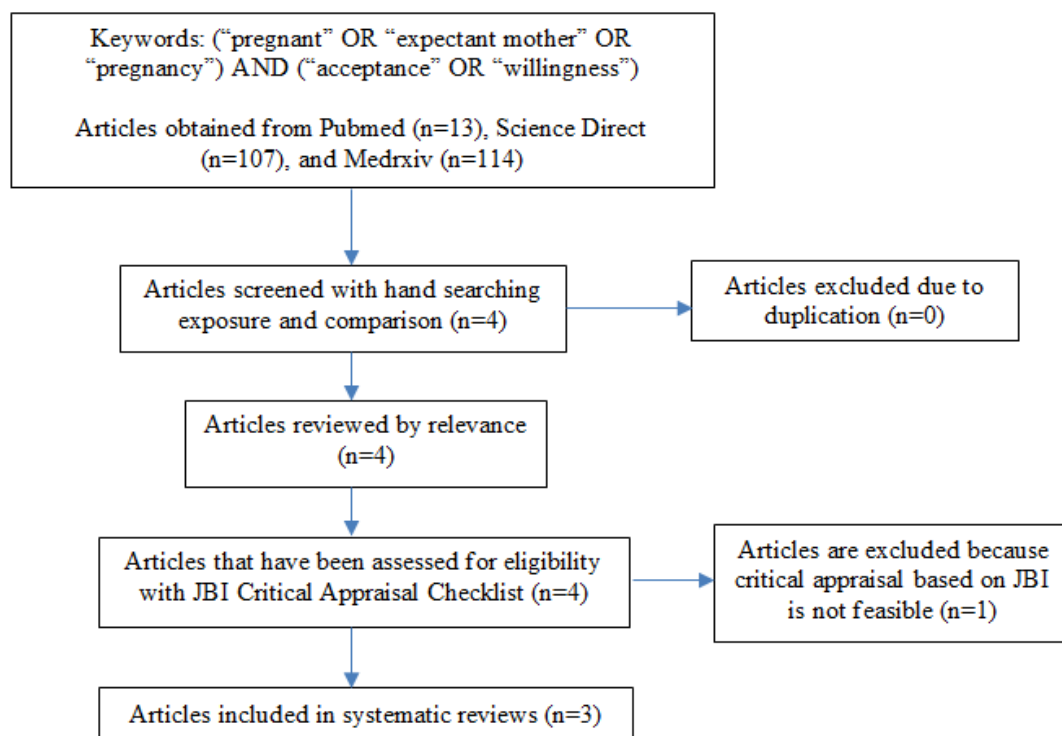


Figure 1. PRISMA method

2.4. Assessment of study quality and risk of bias

The Joanna Briggs Institute (JBI) critical appraisal checklist for cross-sectional studies was used to assess the methodological quality and possible bias (both in design, implementation, and analysis) of each study (n=4) [22]. The checklist for the cross-sectional study consists of eight assessment criteria. Assessment is done by answering 'yes', 'no', 'unclear', or 'not applicable'. Each 'yes' answer is given a score of 1 and the other answers are given a score of 0. The study can be included in this systematic review if it gets a total score of at least 50%. Studies with <50% were excluded to avoid bias in the validity of the results and study recommendations. Of the four studies assessed by The JBI critical appraisal checklist, three studies scored >50%, hence included and used as a source of this systematic review. Meanwhile, one study was excluded because the results of the JBI critical appraisal were not feasible, namely the measurement of exposure and outcomes was not valid and reliable and there was no strategy to overcome confounding factors.

2.5. Data extraction and analysis

The data taken from each article included the characteristics of the study, including data in the form of the author, article publication year, location and time of research, study design, sample size, variables used, statistical data, concerns about being infected with COVID-19, history of influenza vaccination, COVID-19 vaccine acceptance in pregnant women, data analysis, as well as advantages and limitations of research. The data synthesis in this systematic review has been done using a narrative approach to obtain a more comprehensive understanding of the correlation between concerns of COVID-19 infection and history of influenza vaccination with COVID-19 vaccine acceptance in pregnant women. Data analysis of this systematic review was carried out qualitatively.

3. RESULTS AND DISCUSSION

The three included studies were conducted in 2020 during the COVID-19 pandemic before the COVID-19 vaccine was available for pregnant women via Emergency Use Authorization. Thus, COVID-19 vaccine acceptance among pregnant women in these studies only reflects the willingness and positive attitudes towards the idea of receiving the COVID-19 vaccine during pregnancy. The duration of these studies ranged from 15 to 133 days. The summary of these three cross-sectional studies was shown in Table 1 (see Appendix).

The study of Skjefte *et al.* [23] has the advantage of a large sample population covering 16 countries, both developed and developing countries around the world, which can provide a more representative picture of geographic variations in the conditions of acceptance of COVID-19 by the global community. Therefore, the results of this study can be considered in making policies to increase vaccination in vulnerable groups, especially pregnant women. However, selection bias is still possible in this study because respondents in the US and European countries have a higher level of education than the general public and are predominantly white. In addition, this cross-sectional survey was conducted online so that respondents were limited to people who have access to technology. It is possible that the most vulnerable groups who generally show more vaccine hesitancy cannot participate. This causes the possibility of overestimating vaccine acceptance rates. Online surveys also cause responses to vary based on the respondent's attitudes, feelings, and other biases that can only describe the respondent's current opinion.

The research of Tao *et al.* [24] was a hospital-based multicenter cross-sectional study. Concern about getting COVID-19 is one of the factors related to attitudes towards receiving the COVID-19 vaccine in this study, with the question point being "Are you worried about getting COVID-19?" and "Are you worried about your unborn baby getting COVID-19?". High concerns for COVID-19 infection significantly affect the acceptance of COVID-19 vaccination in pregnant women. Regarding history of influenza vaccination, Tao *et al.* reported low acceptance of seasonal influenza vaccine in pregnant women (8.8%) [24]. Interestingly, it did not significantly affect the acceptance of COVID-19 vaccination in pregnant women. Some limitations of this study are the hospitals were selected purposively, which was only conducted in China and did not include pregnant women who never had an antenatal examination [24].

In a study by Battarbee *et al.* [25], there is an advantage that the population represented was quite diverse because it consisted of three urban centers in the United States, namely Salt Lake City, New York, and Birmingham. However, the sample obtained was only pregnant women who had access to antenatal care and gave consent to participate in the study, so they could not represent the entire population at the centers mentioned and could not compare the conditions of pregnant women with non-pregnant women in the same community. There was a social bias in filling out surveys due to social behavior and norms in society. Only 45.9% of pregnant women were more likely to receive their get COVID-19 vaccination if recommended by a health worker. Meanwhile, the three main reasons for refusing COVID-19 vaccination were pregnant women do not want the baby to be exposed to the side effects of the vaccine (65.9%), worrying that the

vaccine approval is too hasty due to political reasons (44.9%) and want to see data on safety and effectiveness in pregnant women (48.8%).

3.1. Characteristics of pregnant women in accepting COVID-19 vaccination

The majority of pregnant women accepting COVID-19 vaccination were in the age group of 40–65 years (54.7%) in the study of Skjefte *et al.* [23], <25 years age group (81.7%) in the study of Tao *et al.* [24] and 35–50-year age group (51%) in Battarbee *et al.* [25]. Of the three studies reviewed, Tao *et al.* [24] study showed a significant association between age and COVID-19 vaccination acceptance. This is possible because pregnant women at a young age tend to be more aware of updated information related to COVID-19, thus showing a higher willingness to receive the COVID-19 vaccine.

Skjefte *et al.* [23] found that the educational level of the respondents who showed higher COVID-19 vaccine acceptance was high school or equivalent (56.1%). Similarly, most respondents were high school graduates and diploma level graduates (81.3%) in the study of Tao *et al.* [24], and bachelor's degree (66 %) in Battarbee *et al.* [25]. The three studies showed that educational level was related to COVID-19 vaccine acceptance. This is understandable as pregnant women with higher knowledge are likely to know more about COVID-19 and the severity of the virus in themselves and in their fetuses, so they can easily accept the COVID-19 vaccine [5].

Skjefte *et al.* [23] showed all of the study population were workers who were categorized into essential and non-essential health sector workers. Battarbee *et al.* [25] showed that many as 60% of respondents had a job. Meanwhile, according to Tao *et al.* [24], the respondents who were likely to accept the COVID-19 vaccine were housewives (80.2%). Socioeconomic conditions in Skjefte *et al.* [23] were divided into the lower class, lower middle class, middle and upper-middle-class, with pregnant women from the lower class (56.1%) were being likely to accept COVID-19 vaccination. The research of Tao *et al.* [24] divides the household income per month with the highest number of incomes <3,000 RMB (80.8%), while in Battarbee *et al.* [25], 80% of respondents indicated that their socioeconomic status was above the poverty line, but they were not presented with the distribution of COVID-19 vaccine acceptance. Low-income groups have been shown to have a high risk of contracting COVID-19 due to denser living conditions, use of public transportation, and a higher likelihood of working outside the home, all of which limit social distancing capabilities [26].

3.2. Concerns about COVID-19 infection among pregnant women

During this COVID-19 pandemic, pregnancy induces concerns among pregnant women about the health of the fetus or the mother's health, worries about going to the hospital, and the spread of COVID-19 to those closest to them. Mortazavi *et al.* [27] found that mothers with their first pregnancy during the COVID-19 pandemic, under the age of 30 years, working, and having a history of previous abortions showed a higher level of concern about being infected with COVID-19. A high level of concern about being infected with COVID-19 in pregnant women was also shown in the three studies used in this systematic review, Tao *et al.* [24] showed the number of pregnant women who were concerned about being infected with COVID-19 was higher (89.4%) than in other studies [23]–[25]. The high level of concern in the study of Tao *et al.* [24] is possibly related to the high number of pregnant women less than 35 years old and using only samples in the Chinese region. A possible explanation is that young pregnant women are more likely to follow social media and updates regarding the impact of the COVID-19 virus on the general population and its risks, thus indicating a higher level of concern about being infected with COVID-19.

Different results were shown in the study of Mose and Yeshaneh [5] in Southwest Ethiopia. Pregnant women in the age group of 34 to 41 years were 1.5 times more likely to accept the COVID-19 vaccine (aOR 1.464 CI: 1.218–5.129) compared with pregnant women in the age group between 18 and 24 years. This may be due to the more fatal complications of the COVID-19 virus in the elderly population and the presence of age-related chronic diseases such as hypertension, kidney disease, and heart disease that can increase the risk of COVID-19-related morbidity and mortality. Therefore, it can cause concerns in the population of the elderly age group. The concerns can affect the well-being of pregnant women. Thus, it is recommended to form a support group for pregnant women during the COVID-19 pandemic to help overcome their concerns and increase awareness of COVID-19, especially for pregnant women with low levels of anxiety which may tend to underestimate the risk during this pandemic.

3.3. The effect of fear of being infected with COVID-19 on acceptance of the COVID-19 vaccine among pregnant women

Studies used in this systematic review showed significant results in the concerns of pregnant women being infected with COVID-19 with the acceptance of the COVID-19 vaccine [23]–[25]. Skjefte *et al.* [23] showed that pregnant women with a level of concern about being infected with COVID-19 were 1.79 times

more likely to accept the COVID-19 vaccine (aOR 1.79 95% CI: 1.48-2.16). Higher results were obtained in the study of Tao *et al.* [24], which showed that the rate of COVID-19 vaccine acceptance among pregnant women with concerns about being infected with the COVID-19 was 2.18 times higher (aOR 2.18, 95% CI: 1.36–3.49). However, a study conducted by Battarbee *et al.* [25] did not show the OR value but showed a significant relationship ($p=0.01$) between COVID-19 vaccine acceptance in pregnant women and fear of being infected with COVID-19. These findings are in alignment with a study by Shmueli [28], which stated that people's perceived susceptibility and perceived benefit of the COVID-19 vaccine influenced their willingness to get vaccinated. This study also mentioned that the respondents are more likely to get vaccinated if they believed that the risk of getting infected by COVID-19, infecting others, and the risk of complications could be decreased by vaccination [28].

Concerns about being infected with COVID-19, especially those directly related to the physical health of oneself, or a loved one can be associated with higher acceptance of vaccinations that causes to reduce the likelihood of adverse outcomes [28], [29]. As supported by the Theory of Reasoned Action, pregnant women who knew the severity of the COVID-19 virus infection, especially for their fetuses, are more likely to accept COVID-19 vaccinations [5]. To be noted, positive association of COVID-19 vaccine acceptance with COVID-19-related anxiety should not be interpreted as increasing the fear in the general population will lead to a further increase in vaccine acceptance. Excessive fear and emotional attitude towards the pandemic will be risk factors for more severe mental health problems and the inability to take appropriate and adaptive preventive measures [29]. Therefore, a better suggestion is the use of communication-risk strategies, by increasing public perception of risk and severity, and promoting prevention as well as therapy in overcoming some fears and concerns about COVID-19, especially among those who consider the disease to be harmless. The increased perception of risk related to the COVID-19 pandemic will lead individuals to engage in risk aversion behavior and emphasize the adaptive role of anxiety in reducing risk. Examples of risk aversion behavior in the COVID-19 pandemic, such as keeping a distance from other people, avoiding crowded places, and staying at home, and higher acceptance of the COVID-19 vaccine was carried out in individuals with high levels of COVID-19-related anxiety as an adaptive anxiety response [30], [31].

One of the steps that can be taken is disseminating credible information by health workers as health promoters or educators in dealing with COVID-19 as well as forging critical health literacy and digital health literacy [32]. Studies conducted in Indonesia state that many residents want more information about the COVID-19 vaccine through researchers, academics, health journals and articles, social media (WhatsApp, Facebook, Instagram, and Twitter), the internet, traditional/alternative medicine, and volunteers who received the COVID vaccine in clinical trials [33].

It is advisable for social media users to always confirm the truth of the information by validating the source of information, reading given information until the end, confirming the author, in-depth investigation of the written data of the information, recognizing if there are fake images, and looking for other sources or asking a professional directly if in doubt information validity. The government's role in eradicating hoaxes can be done by issuing appeals regarding COVID-19, holding press conferences, advertising preventive campaigns, and making regulations and fines regarding distributing wrong and misleading information. [34] In addition, the government's role in creating national consensus on the importance of public health measures, including wearing face masks and mass vaccination to end the COVID-19 pandemic crisis, is needed to build confidence in COVID-19 vaccination overcoming denial and doubt about disease or risk—such as public fear and misunderstanding [23].

3.4. History of influenza vaccination among pregnant women

Low willingness and concern about vaccination from preventable diseases, such as influenza, are generally more expressed by pregnant women than in the general population [35], [36]. This phenomenon is still found even though vaccination during pregnancy has long been researched, studied, and officially recommended [37]. Since the 2009 H1N1 pandemic, public health agencies in many countries have gradually developed national vaccination programs that recommend seasonal influenza vaccination in pregnancy, such as in the United Kingdom [38] and the United States [39]. However, maternal influenza vaccination uptake still has not reached the 80% target as proclaimed by the United States Health and Human Services' Healthy People 2020 Campaign [1], [40]. Even though maternal vaccination plays a crucial role in protecting infants from severe illness and death in early life, low acceptance of influenza vaccination in pregnant women was still observed and ranges between 8.8-62% in various countries in this systematic review [23]–[25].

3.5. Effect of influenza vaccination history on acceptance of COVID-19 vaccination among pregnant women

Two of the three articles reported that a history of receiving influenza vaccine was significantly associated with accepting COVID-19 vaccination [23]–[25] and one article stated that there was no

significant association [24]. The three articles in this systematic review have similar confounding factors, namely age, education, and household socioeconomic condition, so that the adjusted odds ratios of the three can be compared. Tao *et al.* [24] found the results of a multivariate analysis of the association between a history of influenza in pregnant women and accepting the COVID-19 vaccine did not show a significant result (aOR 1.30 (0.74–2.28)). Different results were obtained in the research of Battarbee *et al.* [25] who reported a significant association between pregnant women and a history of influenza vaccination, with the result being 2.6 times more likely to accept COVID-19 vaccination (aOR 2.6 (1.9–3.6)). The research of Skjefte *et al.* [23] also reported that pregnant women who received influenza vaccination the previous year were 1.4 times more likely to receive COVID-19 vaccination (aOR 1.40 (1.18–1.67)). Skjefte *et al.* [23] used the results of the study as a reference because it was carried out in 16 countries consisting of developed and developing countries with high to low COVID-19 cases so that they could better represent a large and diverse population.

A study on 515 pregnant women and 1,036 breastfeeding mothers in Switzerland by Stuckelberger *et al.* [41] also had similar results, respondents with a history of influenza vaccination in the previous year were 2.1 times more likely to accept COVID-19 vaccination (aOR 2.1 (1.5–2.8)). Having a history of influenza vaccination in this study was used to measure one's habits and beliefs about vaccination [41]. The characteristics of the respondents in this study are similar to Skjefte *et al.* [23] in terms of age and education, with the average age of the respondents being 30–34 years and the last education level being higher than high school. Acceptance of COVID-19 vaccination was more reported among older individuals probably because complications of COVID-19 are more severe and often accompanied by chronic diseases that can reduce the immunity of pregnant women such as hypertension, kidney disease, or heart diseases. This condition increases anxiety/fear among older people, so they are more likely to accept COVID-19 vaccinations. Higher education also causes respondents to have the ability to read and sort news, and follow social media related to the COVID-19 virus and the fatal conditions caused, so that the acceptance of the COVID-19 vaccine tends to be higher [5]. The study of Stuckelberger *et al.* [41] was conducted in different locations with the three articles analyzed in this systematic review, namely in Switzerland, so it can add more data to the geographical depiction of influenza vaccination history and its association COVID-19 vaccination acceptance in various countries.

History of receiving previous influenza vaccination can be a positive predictor of COVID-19 vaccine acceptance, and conversely, refusal of influenza vaccination is a negative predictor [41]. This condition was found in pregnant women, and 1,009 general adult respondents in China, most of whom consisted of women (62.1%), and the median age was 30 years. The existence of vaccination experience with previous viral vaccines seems to be sufficient to increase one's confidence in vaccination, as evidenced by respondents who have previously received influenza vaccination more showing a desire/predisposition to accept the COVID-19 vaccine (OR 2.176 (1.474–3.211)) [42]. In addition, a study on health workers in Izmir, Tukey also reported similar result [43].

No significant association was found in the research of Tao *et al.* [24] in China. In line with this results, a recent study by Tao, Wang, and Liu [44] in women of reproductive age in China reported no association between a history of influenza vaccination and acceptance of COVID-19 vaccination. However, no history of previous influenza vaccination was significantly associated with a decrease in influenza vaccination acceptance (aOR=0.34, 95% CI:0.25–0.47) [44]. This can be understood as both studies were conducted in China. The average COVID-19 vaccination acceptance rate exceeds 80% in Asian countries with a firm trust in the central government, such as China (nearly 90%), South Korea, and Singapore [16]. As many as 83.7% of Chinese participants answered that they would accept COVID-19 vaccination if recommended by their superiors at work and if declared safe and effective by the government [16]. Yang *et al.* [45] stated that the Chinese government has made efforts to facilitate COVID-19 vaccination for the community and is one of the main predictors in COVID-19 vaccine development to control the pandemic. Compliance and trust in the central government may also be one of the reasons why most respondents' answers were mostly inclined to COVID-19 vaccine acceptance, thus the answers were less varied and led to insignificant results. Meanwhile, in the setting of influenza vaccination, Chinese people can choose and are not required to accept, unlike the emergency use of COVID-19 vaccination.

In several studies related to factors that influence the acceptance of COVID-19, the history of influenza vaccination was included in the questions to describe the respondents' views/beliefs about vaccination in general [23]–[25]. Two theoretical models can be combined to identify health behaviors that affect the intention to receive COVID-19 vaccination, namely the Health Belief Model (HBM) and Theory of Planned Behaviour (TPB), in which one of the concepts discussed was perceived self-efficacy [28]. Self-efficacy is a person's belief in his/her ability to take action, which is the key to changing health behavior [46]. Self-efficacy was reported to be a significant predictor of intention to receive COVID-19 vaccination

(OR=2.05, 95% CI 1.54–2.72) [28]. Another significant predictor mentioned in this study was history of receiving seasonal influenza vaccine in the previous year (OR=3.31, 95% CI 1.22–9.00) [28]. This may be related to the experience of being vaccinated before, which will make a person more confident and more open to receiving another vaccination in the future.

The discussion topic about influenza vaccination history and its relationship with COVID-19 vaccination acceptance in this systematic review is more applicable to countries that have a national policy to vaccinate pregnant women against influenza, such as Italy, India, Spain [47], the United Kingdom [38], Australia [48], the United States [39], Canada [49], Singapore and Thailand [50]. Although WHO has already recommended prioritizing seasonal influenza vaccination for pregnant women, many countries still do not have a national influenza vaccination policy, especially in low-middle-income countries [51]–[53]. In this case, Indonesia's national influenza vaccination policy only covers people who will go on pilgrimage [50], so the study of influenza vaccination history related to COVID-19 vaccination acceptance in pregnant women is less applicable in this country.

4. CONCLUSION

Based on the three articles that we reviewed, it was found that the relationship between concerns of being infected with COVID-19 with the acceptance of COVID-19 vaccination among pregnant women was more significant compared to influenza vaccination history. Therefore, the concern for being infected with COVID-19 should be the main focus of intervention and handling efforts in increasing the acceptance of COVID-19 vaccinations for pregnant women. Steps that can be taken are to increase the perception of risk and severity and promote prevention and therapy against COVID-19.

The role of health workers and the government is needed to build trust in COVID-19 vaccination with clear and integrated communication using social media, electronic and print media, SMS, telephone, direct communication, and others. In addition, the government needs to pay attention to preventing the spread of wrong and misleading information by holding press conferences, preventive campaign advertisements, making regulations and fines regarding the distribution of wrong information. Although the level of concern affects vaccine acceptance, it is necessary to understand that the role of the government is not to increase public fear but to increase the level of public awareness. Future research should use a more specific and appropriate assessment to measure the level of concern for pregnant women about COVID-19.

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APPENDIX

Table 1. Summary of population, intervention, comparison, outcome of the studies

No	Authors	Title (year)	Location and time	Population	Intervention	Comparison	Outcome	Keypoints
1	[23]	COVID-19 vaccine acceptance among pregnant women and mothers of young children: results of a survey in 16 countries (2021)	14 countries with the highest cumulative incidence of COVID-19: the United States (US), India, Brazil, Russia, Spain, Argentina, Colombia, UK, Mexico, Peru, South Africa, Italy, Chile and the Philippines. Two countries with low COVID-19 incidence: Australia and New Zealand as references. Time: October 28-November 18, 2020	Women aged ≥ 18 years old, currently pregnant, or with at least 1 child <18 years old (n total 17,871 respondents; n pregnant women = 5,294 (29.6%))	The level of concern for pregnant women and mothers of school-age children in 16 countries (n=17,844) varied from very worried, somewhat worried, not very worried to not worried. As much as 30-95% respondents said they were very worried about this matter, 0-50% were somewhat worried, 0-30% were not very worried, and 5-55% were not worried	49.9% of the total respondents (pregnant and non-pregnant women) had received the influenza vaccine last year	On average 52% of pregnant women will receive the COVID-19 vaccine if it has 90% efficacy Acceptance of COVID-19 vaccine in pregnant women was $>80\%$ in India and Mexico, $>60\%$ in the Philippines and Latin America and $<45\%$ in the US, Russia, Australia	Concerns about COVID-19 infection were associated with pregnant women's COVID-19 vaccine acceptance (aOR 1.79 95% CI: 1.48-2.16) History of receiving influenza vaccine last year was associated with pregnant women's COVID-19 vaccine acceptance (aOR 1.40 95% CI: 1.18-1.67)) Sensitivity analysis results: no difference in vaccine acceptance between countries before and after November 9, 2020 (the day Pfizer-BioNTech announced the results of the first COVID-19 vaccine efficacy)
2	[24]	Acceptance of a COVID-19 vaccine and associated factors among pregnant women in China: a multi-center cross-sectional study based on health belief model (2021)	six hospitals in Beijing, Hebei, Hubei, Anhui, and Yunnan Province, Republic of China Time: November 13-27, 2020	Pregnant women aged >18 years and attending antenatal clinics at participating obstetric hospitals from November 13-27, 2020 (n=1392)	Vulnerability or high concern for COVID-19 infection (89.4%)	History of influenza vaccination (8.8%)	77.4% of pregnant women agreed to be vaccinated when a COVID-19 vaccine became available in China.	Susceptibility or high concern for COVID-19 infection was associated with pregnant women's COVID-19 vaccine acceptance (aOR 2.18, 95% CI: 1.36–3.49)

Table 1. Summary of population, intervention, comparison, outcome of the studies (*continue*)

No	Authors	Title (year)	Location and time	Population	Intervention	Comparison	Outcome	Keypoints
								<p>The history of influenza vaccination in pregnant women was not associated with pregnant women's COVID-19 vaccine acceptance (aOR 1.30, 95% CI: 0.74–2.28)</p> <p>Pregnant women in China have higher acceptance rate of the COVID-19 vaccine than in other countries, such as the United States (75.42%), Italy (70.79%), Canada (68.74%), Germany (68.42), Russia (54.85)</p>
3	[25]	Attitudes toward COVID-19 illness and COVID-19 vaccination among pregnant women: a cross-sectional multicenter study during August-December 2020 (2021)	<p>The United States (Salt Lake, New York, and Birmingham)</p> <p>Time: August 9- December 10, 2020</p>	Pregnant women <28 weeks of gestation, 18-50 years who participated in the survey (n=939)	Respondents with concerns about COVID infection (49%)	Respondents with a history of influenza vaccine are 62%	41% of women will receive a COVID 19 vaccine if it is available during their pregnancy	<p>Worried about COVID-19 infection was related to and pregnant women's COVID-19 vaccine acceptance (p= 0.01)</p> <p>The history of Influenza vaccination was associated with pregnant women's COVID-19 vaccine acceptance (aOR 2.6, 95% CI 1.9-3.6); p-value <0.01</p>