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Analysis of factors influencing pregnant women's perceptions of Covid-19 vaccination based on the health belief model theory

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ABSTRACT

The number of pregnant women receiving COVID-19 vaccination in Semarang City has not yet met the government's target. Acceptance of this vaccination is influenced by individual beliefs and perceptions, which can be analyzed using the Health Belief Model theory. This model involves components such as perceptions of vulnerability, severity, benefits, barriers, and triggers for action, including support from health workers and family. This study aims to identify factors that influence pregnant women's perceptions of COVID-19 vaccination. The research design used was a descriptive survey with data collection through a questionnaire that measured various factors related to acceptance of complete COVID-19 vaccination. Samples were taken using a total sampling technique with a total of 159 pregnant women. Data were analyzed using multivariate analysis. The results showed that of the six characteristics of pregnant women, education level had the greatest influence on perceptions of vulnerability, barriers to vaccination, and support from health workers and family. Parity had the most significant influence on perceptions of COVID-19 disease severity, while age had a significant effect on perceptions of vaccination benefits. This study is expected to provide benefits for pregnant women and health workers, especially in improving health education and helping individuals make informed decisions regarding their well-being.

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INTRODUCTION

The COVID-19 pandemic has had a major impact on pregnant women worldwide(Mccain et al., 2022). This is because pregnant women are a high-risk group for contracting the disease caused by this virus(Auriti et al., 2021). In the United States, as of January 10, 2022, there were 158,107 cases of pregnant women with COVID-19 infection with 259 deaths (Nishigaki et al., 2008). In Indonesia, from January to June 2021, there were 479 cases (20.1%) of maternal deaths due to COVID-19

infection(Wiweko et al., 2023). Research in 12 countries has shown that pregnant women infected with Covid 19 face a significantly increased risk of various serious conditions, including maternal death, admission to the intensive care unit (ICU), requiring mechanical ventilation, receiving critical care, and being diagnosed with pneumonia and thromboembolic disease (Muhsina et al., 2023)(Smith et al., 2023).

COVID-19 vaccination has been shown to be safe and effective for pregnant women(Badell et al., 2022). This vaccine forms antibodies that protect the baby and does not increase the risk of complications such as miscarriage, premature birth, stillbirth, or birth defects (CDC, 2024; Gray et al., 2021). COVID-19 vaccination for pregnant women, especially the COVID-19 mRNA vaccine, is useful for producing antibodies that are similar to antibodies from non-pregnant mothers(Ai-ris et al., 2021). And the antibodies produced by pregnant women due to COVID-19 vaccination are stronger than the natural antibodies produced after COVID-19 infection(Shook et al., 2022).

COVID-19 vaccination for pregnant women in Indonesia began on August 2, 2021 (Directorate General of Disease Prevention and Control, 2021). In December 2021, in Semarang City, 2,582 pregnant women had received the first dose and 1,892 had received the second dose. However, this number has not met the target of 3,600 pregnant women set by the Semarang City Health Office (Semarang City Government, 2021b, 2021a).

Research in 16 countries shows that 52% of pregnant women are willing to receive the COVID-19 vaccine if its effectiveness reaches 90%, while 48% are not willing(Carbone et al., 2022). This unwillingness is due to concerns about side effects for babies (65.9%), vaccine approval that is considered rushed due to political factors (44.9%), and the need for further data on the safety of vaccination for pregnant women (48.8%) (Skjefte et al., 2021). Other factors include comorbidities, prohibitions from husbands or families, anxiety, and fear (Levenson, 2018).

Acceptance of COVID-19 vaccination by pregnant women is influenced by individual beliefs and perceptions(Tao et al., 2021). The Health Belief Model theory can be used to understand health attitudes and behaviors related to vaccination, with components such as perceptions of susceptibility, severity, benefits, barriers, and triggers for action such as recommendations from doctors and family (Ardiningsih & Kardiwinata, 2021; Tao et al., 2021).

Data from the Mijen Health Center, Semarang City in December 2021 showed that 27 pregnant women were infected with COVID-19, with two of them dying(Sumantri & Handayani, 2023). COVID-19 vaccination for pregnant women has been started since August 2021 with a target of 374 people(Luxi et al., 2021). However, until November 2021, only 303 pregnant women have been vaccinated. This data shows that the coverage of COVID-19 vaccination for pregnant women in the Mijen Health Center work area has not reached the set target(Wulan et al., 2024). Exploring the factors that influence pregnant women's perceptions of COVID-19 vaccination is an important area of research, as this understanding can help design public health strategies and increase vaccine acceptance among this vulnerable population (Cox et al., 2023; Sznajder et al., 2022).

Previous studies have been conducted on the relationship between respondent characteristics and the willingness of pregnant women to receive COVID-19 vaccination (Pertiwi & Ayubi, 2022; Sari Maharany et al., 2023). Another study examined factors related to the acceptance of complete COVID-19 vaccination in pregnant women in the working area of the Lubuk Begalung(Nurjazuli, n.d.). Health Center, Padang City in 2022, one of the main variables of which was the perception of pregnant women based on the Health Belief Model(Mulyana & Rahmatalia, 2022). This study used a quantitative research method with a cross-sectional study design (Wangensteen et al., 2011). However, similar studies on pregnant women in Indonesia are still limited, so further research is needed to determine the factors that most influence pregnant women's perceptions of COVID-19 vaccination in pregnant women based on the Health Belief Model theory at the Mijen Health Center, Semarang City.

RESEARCH METHOD

This study is a quantitative study that analyzes the factors that influence pregnant women's perceptions of Covid-19 vaccination(Marbán-Castro et al., 2022). This study was conducted with a descriptive approach(Seixas et al., 2018). The study population consisted of 188 pregnant women registered at the Mijen Health Center, Semarang City. The sampling technique used was total sampling(Plourde & Congalton, 2003). Of the 188 pregnant women, 159 were willing to be research subjects, while 19 did not respond and 10 refused(Krubiner et al., 2021). Data collection was carried out at the Maternal and Child Health Polyclinic of the Mijen Health Center from February 10 to March 4, 2023.

Data collection was carried out using a respondent characteristics questionnaire and the Health Belief Model(Kamran et al., 2014). This questionnaire has been tested for validity using the Pearson Product Moment formula. The results of the questionnaire validity test of 38 statement items were declared valid (Nguyen et al., 2015). The reliability test used Cronbach Alpha with a value of 0.781 - 0.872. Showing that this questionnaire is reliable (Li et al., 2020). The research instruments included a questionnaire on respondent characteristics (such as age, education, occupation, trimester of pregnancy, parity, and comorbidities) and the Health Belief Model (including perceptions of vulnerability, severity, benefits, barriers, family support, and health worker support).

The variables in this study were the perceptions of pregnant women regarding COVID-19 vaccination in pregnant women based on the Health Belief Model theory and the factors that influence it. The results of the study were analyzed using a computer(Dinçer, 2015). Multivariate analysis was used to test the relationship between variables simultaneously using the logistic regression test. This study has gone through an ethical test at the Health Research Ethics Commission of the Faculty of Medicine, Diponegoro University with No. 17/EC/KEPK/FK-UNDIP/I/2023.

The theoretical framework of this research (Glanz et al., 1990), is as follows:

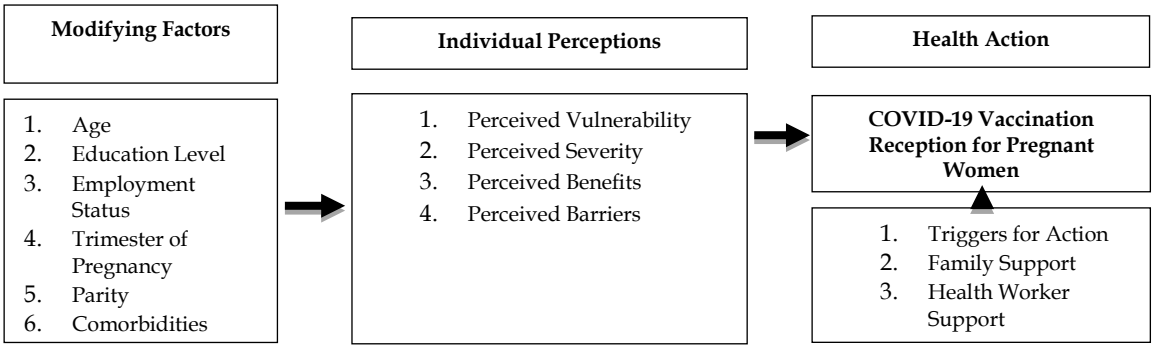

Figure 1. Theoretical framework

RESULTS AND DISCUSSIONS

Table 1. Results of multivariate logistic regression analysis of perception of vulnerability to covid-19 infection in pregnant women at the Mijen Health Center, Semarang City, February 2023

Variables	Wald	p-value (Sig.)	OR (Exp(B))	95% CI for OR
Step 1				
Age	0.502	0.479	0.760	0.355 - 1.626
Education Level	4.662	0.031	0.641	0.429 - 0.960
Step 2				
Level of education	4.420	0.036	0.653	0.439 - 0.972

The results of the analysis showed that Education Level had a significant effect on perceptions of vaccination and susceptibility to COVID-19. In Step 1, the Wald value for Education Level was 4.662 with a p value of 0.031, indicating strong statistical significance ($p < 0.05$). The Odds Ratio (OR) of 0.641 with a 95% CI between 0.429 and 0.960 indicated that an increase in one level of education reduced the odds of perceived susceptibility by 35.9%. In Step 2, similar results were found with a Wald of 4.420, a p value of 0.036, and an OR of 0.653 (95% CI: 0.439 - 0.972).

From the results above, it can be concluded that Education Level is the factor that has the greatest influence on perceptions of susceptibility to COVID-19 in pregnant women. Increasing the level of education significantly reduces the perception of susceptibility to the disease, which emphasizes the importance of education in shaping understanding and attitudes regarding vaccination and disease risk. In contrast, the Age variable does not show a significant influence in this context.

Table 2. Results of multivariate logistic regression analysis of perception of severity of covid-19 disease in pregnant women at Mijen Health Center, Semarang City, February 2023

Variable	Wald	p-value (Sig.)	OR (Exp(B))	95% CI for OR (Lower)	95% CI for OR (Upper)
Step 1					
Age	0.045	0.832	0.917	0.414	2.033
Occupation	1.599	0.206	0.648	0.331	1.269
Trimester of Pregnancy	3.295	0.069	0.643	0.399	1.036
Parity	3.297	0.069	0.511	0.248	1.055
Step 2					
Job	1.572	0.21	0.652	0.333	1.273
Pregnancy Trimester	3.262	0.071	0.645	0.401	1.038
Parity	3.857	0.05	0.499	0.999	0.999
Step 3					
Trimester of Pregnancy	3.861	0.049	0.624	0.39	0.999
Parity	3.918	0.048	0.499	0.251	0.993

Multivariate analysis was conducted in three steps (Step 1, Step 2, and Step 3), with the variables included in the model being age, occupation, trimester of pregnancy, and parity. In Step 3 of the logistic regression analysis, it was found that the Parity variable (the number of live births a mother has had) was the most influential factor on the perception of the severity of COVID-19 disease in pregnant women. The p-value for Parity was 0.048, indicating that this variable was statistically significant at the 5% level. In addition, the Odds Ratio (OR) value of 0.499 with a 95% confidence interval (0.251 – 0.993) indicated that increasing parity was associated with a decrease in the perception of the severity of COVID-19 disease. This means that pregnant women with higher parity tend to have a lower perception of the severity of COVID-19.

Another variable that was also significant in Step 3 was Trimester of Pregnancy with a p-value of 0.049 and OR of 0.624 (95% CI: 0.390 – 0.999). This shows that trimester of pregnancy also affects the perception of severity of COVID-19, although the effect is not as great as parity.

Table 3. Results of multivariate logistic regression analysis of perceived benefits of covid-19 vaccination in pregnant women at the Mijen Health Center, Semarang City, February 2023

Variable	Wald	p-value (Sig.)	OR (Exp(B))	95% CI for OR (Lower)	95% CI for OR (Upper)
Step 1					
Age	4.95	0.026	2.615	1.121	6.099
Education Level	0.614	0.433	1.181	0.778	1.793
Occupation	4.493	0.034	0.474	0.238	0.945
Step 2					
Age	4.682	0.03	2.533	1.092	5.876
Occupation	4.054	0.044	0.5	0.254	0.982

Multivariate analysis was conducted in two steps (Step 1 and Step 2) with the variables entered into the model being age, education level, and occupation.

In Step 2 of the logistic regression analysis, it was found that the Age variable was the most influential factor on the perception of the benefits of COVID-19 vaccination in pregnant women. The p-value for Age was 0.030, indicating that this variable was statistically significant at the 5% level. In addition, the Odds Ratio (OR) value of 2.533 with a 95% confidence interval (1.092 – 5.876) indicated that increasing maternal age was associated with increased perceptions of the benefits of COVID-19 vaccination. In other words, older pregnant women tended to have a more positive perception of the benefits of COVID-19 vaccination compared to younger mothers.

Another variable that was also significant in Step 2 was Occupation with a p-value of 0.044 and OR 0.500 (95% CI: 0.254 – 0.982). This suggests that occupation also influences perceptions of the benefits of COVID-19 vaccination, although the effect is not as large as age.

Table 4. Results of multivariate logistic regression analysis of perceptions of barriers to covid-19 vaccination among pregnant women at Mijen Health Center, Semarang City in February 2023

Variabel	Wald	Nilai-p	OR (Exp(B))	95% CI for OR (Exp(B))
Step 1				
Age	0.012	0.912	0.957	0.442 - 2.075
Education Level	2.095	0.148	0.745	0.500 - 1.110
Pregnancy Trimester	0.144	0.705	0.915	0.578 - 1.448
Comorbidities	0.00	0.999	0.999	0.000 - 0.000
Step 2				
Education Level	2.09	0.148	0.747	0.503 - 1.110
Pregnancy Trimester	0.139	0.709	0.916	0.580 - 1.449
Comorbidities	0.00	0.999	0.999	0.000 - 0.000
Step 3				
Education Level	1.999	0.157	0.753	0.508 - 1.116
Comorbidities	0.00	0.999	0.999	0.000 - 0.000
Step 4				
Comorbidities	0.00	0.999	0.999	0.000 - 0.000

In this analysis, no variables have a p-value less than 0.05, meaning that no variables significantly affect the results. However, if we judge based on the relatively larger Wald value, Education Level has the highest Wald value among the other variables (2.095), although it remains insignificant (p-value = 0.148).

Table 5. Results of multivariate logistic regression analysis of family support for covid-19 vaccination in pregnant women at the Mijen Health Center, Semarang City, February 2023

Variabel	Wald	Nilai-p	OR (Exp(B))	95% CI for OR (Exp(B))
Step 1				
Education Level	2.711	0.1	1.408	0.937 - 2.116
Comorbidity	0.00	0.999	1764174282	0.000 - .
Parity	2.064	0.151	1.418	0.606 - 3.316
Step 2				
Education Level	2.078	0.149	1.341	0.900 - 2.000
Comorbidities	0.00	0.999	2055412381	0.000 - .
Step 3				
Comorbidities	0.00	0.999	1966661667	0.000 - .

A higher Wald value indicates that the variable has a greater contribution to the model. However, since there are no variables with a p-value below 0.05, there are no variables that significantly affect Family Support for COVID-19 Vaccination in Pregnant Women. However, Education Level has the largest influence compared to other variables, although it is not statistically significant in this study.

Table 6. Results of multivariate logistic regression analysis of health worker support for covid-19 vaccination in pregnant women at the Mijen Health Center, Semarang City, February 2023

Variable	Wald	Nilai-p	OR (Exp(B))	95% CI for OR (Exp(B))
Step 1				
Education Level	1.295	0.255	1.282	0.836 - 1.965
Comorbidities	0.00	0.999	3468260112	0.000 - .
Step 2				
Comorbidities	0.00	0.999	3327885264	0.000 - .

From the results of this multivariate analysis, Education Level shows the highest Wald value, indicating that this variable has the potential for a greater influence compared to comorbidity in influencing health workers' support for COVID-19 vaccination in pregnant women. However, this influence is not statistically significant, so it cannot be said definitively that education level is the dominant factor. Thus, Education Level can be considered as a variable that has the potential for the greatest influence on health workers' support for COVID-19 vaccination in pregnant women, although this influence is not significant based on the results of the statistical tests conducted.

Education Level on Perception of Vulnerability to COVID-19 in Pregnant Women, Perception of Barriers to COVID-19 Vaccination in Pregnant Women, Support from Health Workers, and Family Support

Education level plays a significant role in shaping pregnant women's perceptions of their vulnerability to COVID-19. Pregnant women with higher levels of education typically have better access to information and a deeper understanding of health issues. This allows them to seek and understand reliable information about COVID-19, including its risks and preventive measures. In addition, education can improve health literacy, enabling pregnant women to make informed decisions regarding their health and that of their babies (Jahromi et al., 2023).

Critical thinking skills developed through education also provide pregnant women with the ability to evaluate the credibility of information sources and assess the severity of health threats more accurately (Shakerinejad et al., 2023). As a result, educated pregnant women are more likely to take preventive measures, such as wearing masks, maintaining social distancing, and getting vaccinated, which is influenced by their higher perceptions of vulnerability and the importance of protecting themselves and their unborn babies (Jahromi et al., 2023). Additionally, higher education is often correlated with better socioeconomic status, which provides greater access to health resources, including prenatal care, COVID-19 testing, and treatment, further enhancing their ability to manage the risks associated with the pandemic (Shakerinejad et al., 2023).

Educated pregnant women are more likely to understand medical advice and communicate effectively with health care providers. This mutual understanding strengthens the support they receive and increases adherence to health recommendations (Williams et al., 2024). Furthermore, higher education is often associated with better communication skills and awareness of health issues, which may influence family members to provide more informed and supportive care (Badell et al., 2022; Williams et al., 2024). Educated pregnant women are also better able to identify and address barriers to vaccination, such as misinformation or logistical challenges. They are more likely to seek out credible information and resources to facilitate vaccination (Cui et al., 2022). Education also improves health literacy, allowing pregnant women to better understand their risk factors and the importance of preventive measures. This awareness can result in higher perceptions of vulnerability and stronger motivation to take protective measures (Cui et al., 2022).

Parity on Perceived Severity of COVID-19 Disease in Pregnant Women

Parity, or the number of births a mother has had, was the most influential factor on perceived severity of COVID-19 disease in pregnant women (Table 2). Multiparous mothers (those who have given birth more than once) may have more experience with pregnancy-related health

issues and complications. This experience may heighten their awareness of the potential risks and severity of COVID-19 during pregnancy (Marsden KA et al., 2021).

Mothers with higher parity often have more interactions with health care providers due to previous pregnancies, which may heighten their awareness of the severity of COVID-19 and the importance of preventive measures (Marsden KA et al., 2021). Multiparous mothers may also perceive themselves as more vulnerable due to the accumulated stress and health challenges associated with multiple pregnancies, which may heighten their perception of the severity of COVID-19. The social support they have built up from previous pregnancies may also influence their perceptions of the health risks and severity of COVID-19 (Vanstone et al., 2023; Williams et al., 2024).

Age on Perceived Benefits of COVID-19 Vaccination in Pregnant Women

The age of pregnant women can significantly influence their perceptions of the benefits of COVID-19 vaccination (Table 3). Older pregnant women tend to be more aware of the risks that increase with age, both related to pregnancy and COVID-19, and are more likely to view vaccination as a way to reduce those risks (Centers for Disease Control and Prevention, 2024). In addition, they may be more concerned about the health complications that may arise from COVID-19, especially if they have pre-existing health conditions (Johns, 2021).

Greater life experience and maturity may also influence their decision-making process, making them more likely to trust medical advice and understand the importance of vaccination. More frequent interactions with healthcare providers due to age-related pregnancy risks may also reinforce awareness of the importance of vaccination. Additionally, age factors are often related to socioeconomic status, which can affect their access to reliable health information and resources (CDC, 2024; Johns, 2021).

CONCLUSION

This study emphasizes the important role of education level, parity, and age in shaping pregnant women's perceptions of COVID-19 vaccination. The results of the multivariate analysis showed that of all characteristics of pregnant women, education level had the greatest influence on perceptions of vulnerability, barriers to vaccination, and support from health workers and family. Parity had the most significant influence on perceptions of COVID-19 disease severity, while age had a significant effect on perceptions of vaccination benefits. Pregnant women with higher levels of education tend to have better health literacy, critical thinking skills, and better access to health resources, all of which contribute to higher perceptions of vulnerability and a stronger tendency to engage in preventive behaviors, such as vaccination. Parity influences risk perception, where multiparous mothers are more aware of pregnancy-related health risks and are more likely to have a support system that influences their perceptions of COVID-19 severity. Age also plays an important role, as older pregnant women, due to increased awareness of health risks, maturity, and more frequent health interactions, are more likely to view the benefits of COVID-19 vaccination positively. Overall, these factors highlight the importance of targeted educational and health interventions to address the diverse needs and perceptions of pregnant women during the COVID-19 pandemic.

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