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RESEARCH ARTICLE **OPEN ACCESS**

Acceptance, Promoting Factors, and Barriers of COVID-19 Vaccination in Pregnant Women: A Multicenter Survey in Thailand

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Abstract:

Objectives: This study aimed to survey the acceptance of COVID-19 vaccination in pregnant women and to identify the promoting factors and barriers to vaccination.

Methods: A cross-sectional study was conducted. Self-administered questionnaires were given to pregnant women aged 18 and above who attended antenatal care at 6 hospitals in Thailand between August 2021 and March 2022. Four hundred and eighty women were recruited. The acceptance and factors associated with COVID-19 vaccination were analyzed.

Results: The mean age of participants was 31.1±5.9 years; 92.5% were Buddhists, 56.7% had a bachelor's degree or higher education, and the median gestational age was 26 weeks. Forty-five percent of them never had COVID-19 vaccination. The vaccination acceptance rate was 72.9%. About 87% of women made a decision by themselves. The reasons for acceptance were social responsibility (94%), doctor and health personnel recommendation (93.4%), and free of charge (92.3%). Barriers were fear of side effects (92.4%) and fetal effects (81.7%). Most of the participants got vaccine information from social media (96.6%), television and radio broadcast (90.4%), and health personnel (88.7%). Factors associated with vaccination acceptance were age, gestational age, and attitudes.

Conclusion: The acceptance rate was high, but barriers included fear of side effects and fetal effects.

Keywords: Acceptance, Promoting, Barrier, COVID-19 vaccine, Pregnant women, Thailand.

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1. INTRODUCTION

COVID-19 infection was first reported in Wuhan, People's Republic of China, in December 2019 [1]. It was later declared a pandemic by the World Health Organization (WHO) on March 11, 2020 [2]. The outbreak had a severe impact not only on human health but also on

economics, education, travelling, and politics. As of July 30, 2023, more than 692 million people were infected, and over 6.9 million had died worldwide [3]. COVID-19 infection in Thailand began on January 8, 2020 [4]. Since then, it has spread across the country, with two high peaks: the Delta infection in July-October 2021 and the Omicron wave from February to May 2022 [3]. On July 28, 2023, total deaths were reported to be 34,418 (0.7%) [3].

Pregnant women are one of the high-risk groups for COVID-19 infection due to the increased severity of symptoms, including pneumonia, a higher rate of Intensive Care Unit (ICU) admission, use of respirators, and death, along with a higher rate of premature birth. Allotey *et al*. [5] reported that ICU admissions (odds ratio 2.13, 95% CI 1.53- 2.95), invasive ventilation (OR 2.59, 95% CI 2.28-2.94), and the need for extracorporeal membrane oxygenation (OR 2.02, 95% CI 1.22-3.34) were higher in pregnant and recently pregnant women compared to non-pregnant women of reproductive age. Factors associated with severity include increased maternal age, high body mass index, pre-existing maternal comorbidities, chronic hypertension, pre-existing diabetes, and pre-eclampsia. In Thailand, from April 1, 2021 to July 15, 2022, there were 14,601 infected pregnant women and 123 deaths (0.8%) [6].

From November to December 2020, the pandemic in the USA worsened, with more than 4,000 deaths per day reported [3]. In December 2020, the Food and Drug Administration (FDA) approved the Pfizer mRNA-based vaccine under emergency use, with a reported phase 3 clinical trial efficacy of 95% [7]. The Moderna mRNA-based vaccine was approved later in April 2021 with 94.1% efficacy [8].

Recommendations for vaccination were then issued by the CDC, WHO, and other health organizations. However, in the early period, pregnant women were hesitant to get vaccinated due to safety concerns. The initial COVID-19 vaccine studies did not include pregnant women. The first report on the safety of mRNA vaccine (Pfizer and Moderna) in pregnancy was published by Shimabukuro and colleagues [9, 10]. Out of 827 completed pregnancies, 86.1% resulted in live births, 12.6% in spontaneous abortion, 0.1% in stillbirths, 9.4% in preterm birth, 3.2% in small for gestational age, and 2.2% in congenital anomalies. These outcomes were comparable to published incidences. Following this, the WHO [11] and other health organizations [12-15] recommended vaccination during pregnancy and breastfeeding after appropriate counselling about the benefits and limited safety data.

In Thailand, the COVID-19 vaccine became available on February 28, 2021 [16]. The first two imported vaccines were Corona Vac by Sinovac company and Covishield by Oxford-AstraZeneca. The government has since provided free vaccination for everyone. On May 21, 2021, the Royal Thai College of Obstetricians and Gynaecologists and the Department of Health recommended vaccination for pregnant women after 12 weeks of gestation and for those who are breastfeeding. However, the vaccination rate remained low despite government efforts to promote it through healthcare networks and social media. Our group became interested in this issue and the related obstacles. Hence, we aimed to survey the acceptance of COVID-19 vaccination among Thai pregnant women and identify any promoting factors or barriers to vaccination.

2. MATERIALS AND METHODS

This was a cross-sectional, multicenter study conducted at antenatal clinics of six hospitals in different regions of Thailand. Siriraj Hospital and Rajavithi Hospital are large medical schools in Bangkok, while the other four hospitals are large medical schools located in northern (Maharaj Nakorn Chiang Mai Hospital), north-eastern (Srinagarind Hospital), eastern (Prapokklao Hospital, Chantaburi) and southern (Songklanagarind Hospital) region. After obtaining approval from the Institutional Review Boards of each hospital (REC.64-373-12-1), pregnant women aged 18 and older, literate in Thai, without emergency conditions, and who had never got COVID-19 infection were recruited between August 23, 2021, and March 24, 2022. A self-administered questionnaire addressing knowledge, attitudes, and acceptance of vaccination was distributed after informed consent was obtained. The questionnaire was validated by two experienced obstetricians, and reliability was tested on 30 pregnant women with characteristics similar to the inclusion criteria of study participants before starting recruitment. The Cronbach's alpha coefficient was 0.867. Vaccination acceptance was assessed under the condition that it was offered free of charge by the government, with three response options (accept, refuse, or undecided). Factors associated with acceptance or refusal of vaccination were evaluated.

The sample size was calculated based on the 52% COVID-19 vaccination acceptance rate among pregnant women, as reported by Skjefte *et al*. [17]. A type 1 error ($\alpha = 0.05$) and a margin of acceptance at 0.05 were used. At least 384 cases were required. Allowing for a 10% loss to follow-up, a total of 422 cases were recruited. We planned to survey 480 pregnant women (80 cases from each hospital).

The R program version 3.6.2 was used for statistical analysis. Descriptive statistics and multivariate logistic regression were used to identify factors associated with vaccination acceptance. A p-value of < 0.05 was considered statistically significant.

3. RESULTS

A total of 480 pregnant women participated in the study. The mean age was 31.1 ± 5.9 years, and 92.5% were Buddhists. Most of them (83.3%) were married, 39.8% were in their first pregnancy, 56.7% had completed a bachelor's degree or higher, 27.5% worked in the private sector, and 55.6% had family incomes of 10,001-30,000 Baht per month. The median gestational age was 26 weeks. Regarding the risk of COVID-19 infection, only 2.2% had a history of contact with an infected person, while 54.4% reported no risk of infection. However, 45.2% had not been vaccinated. Details are shown in Table **1**.

Table 1. Demographic data of pregnant woman (N=480).

Variable	N (%)
Age (year, mean ± SD, n = 472)	31.1 ± 5.9
Religion	-
Buddhism	444 (92.5)
Christ	8 (1.7)
Islam	26 (5.4)
Others	2 (0.4)
Marital status	-
Single	74 (15.4)
Married	400 (83.3)
Widowed/ divorced	6 (1.2)
Nulliparous	191 (39.8)
Parity (median, IQR)	1 (0-4)
Abortion (median, IQR)	0 (0-4)
Educational level	-
Primary school or lower	21 (4.4)
Secondary school	115 (24.0)
Vocational school	72 (15.0)
Bachelor's degree	239 (49.8)
Master's degree	33 (6.9)
Occupation	-
Housewife	83 (17.3)
Government officer/ university staff	114 (23.8)
Private employees	132 (27.5)
Trader/ business	87 (18.1)
Labor	33 (6.9)
Agriculture	16 (3.3)
Others	15 (3.1)
Household incomes (Baht)	-
< 5,000	24 (5.0)
5,001-10,000	62 (12.9)
10,001-30,000	267 (55.6)
30,001-50,000	92 (19.2)
50,001-80,000	21 (4.4)
> 80,000	14 (3.0)
Household members include yourself (median, IQR)	4 (1-13)
Gestational age (week, median, IQR)	26.0 (16, 34)
Obstetrics complication (n = 476)	69 (14.4)
Underlying diseases (n = 476)	88 (18.3)
History of COVID-19 contact (n = 476)	11 (2.3)
Risk of COVID-19 infection (n = 476)	-
No	261 (54.4)
Low	141 (29.4)
Moderate	64 (13.3)
High	10 (2.1)
COVID-19 vaccination (n = 476)	-
No	217 (45.2)
1 dose	97 (20.2)
2 doses	148 (30.8)
3 doses or more	14 (2.9)

The vaccination acceptance rate was high, at 72.9%. Participants from Siriraj Hospital and Rajavithi Hospital had the highest acceptance rate, at 88.8%. Conversely, only 30% of pregnant women from Maharaj Nakorn Chiang Mai Hospital accepted vaccination. The decision to vaccinate was primarily based on personal choice (86.7%). The factors most strongly influencing vaccination acceptance, with participants agreeing or strongly agreeing, included vaccination as a social responsibility (94%), the recommendation from doctors, nurses, or

healthcare personnel (93.4%), the government offering free vaccination (92.3%), and the belief that the benefits of the vaccine outweighed the risks (84%), as shown in Table 2. Additionally, the main barriers to vaccination, with participants agreeing or mostly agreeing, were fear of side effects (92.4%) and concern about adverse effects on the unborn child (81.7%). Details are shown in Table 3. Most pregnant women received vaccine information from various sources, including Line, Facebook, and Twitter (96.6 percent), followed by television and radio (90.4%), and from doctors, nurses, or medical personnel (88.7%). The most trusted source of information was doctors (86.7%). According to multiple logistic regression analysis, factors influencing vaccination acceptance included age, gestational age, and attitudes toward vaccines, as shown in Table 4. Older women, those in their second trimester, and those with positive attitudes toward vaccination were more likely to accept the vaccine.

Table 2. Factors promoting COVID-19 vaccination acceptance (N=350).

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Vaccine is more benefits than harms	5 (1.4)	7 (2.0)	44 (12.6)	**164 (46.9)**	130 (37.1)
2. Vaccine can prevent infection	18 (5.1)	35 (10.0)	94 (26.9)	**132 (37.7)**	71 (20.3)
3. The government grants free injections	2 (0.6)	3 (0.9)	22 (6.3)	143 (40.9)	**180 (51.4)**
4. Vaccination is recommended by a doctor, nurse or medical professionals	2 (0.6)	5 (1.4)	16 (4.6)	**174 (49.7)**	153 (43.7)
5. It is a government policy	1 (0.3)	7 (2.0)	53 (15.1)	**183 (52.3)**	106 (30.3)
6. Vaccination is a social responsibility.	0	4 (1.1)	17 (4.9)	142 (40.6)	**187 (53.4)**
7. Injection followed by famous people, celebrities, singers or politicians	129 (36.9)	**150 (42.9)**	46 (13.1)	17 (4.9)	8 (2.3)
8. Most of the people I know have already been vaccinated	8 (2.3)	20 (5.7)	36 (10.3)	**176 (50.3)**	110 (31.4)

4. DISCUSSION

COVID-19 vaccination is an important strategy for preventing infection and reducing disease severity, especially in high-risk groups, such as the elderly, people with chronic illness or low immunity, and pregnant women. Thailand launched a campaign offering free vaccination to pregnant women, officially announcing the policy on May 21, 2021 [18]. Since then, the campaign has been continuously promoted through various media. Initially, only two vaccines (Sinovac and AstraZeneca) were available, but safety concerns were raised regarding their use in pregnant women because early vaccine trials lacked data for this group.

Table 3. Barriers to COVID-19 vaccination (N=131).

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Cannot find the place to get vaccination	17 (13.0)	35 (26.7)	**51 (38.9)**	20 (15.3)	8 (6.1)
2. Fear of side effects after vaccination	2 (1.5)	2 (1.5)	6 (4.6)	**66 (50.4)**	55 (42.0)
3. Fear of side effects to unborn child	1 (0.8)	5 (3.8)	18 (13.7)	52 (39.7)	**55 (42.0)**
4. The vaccine has just been produced and approved for use very quickly	3 (2.3)	7 (5.3)	**60 (45.8)**	36 (27.5)	25 (19.1)
5. Vaccine may have consequences in the future	2 (1.5)	8 (6.1)	**68 (51.9)**	32 (24.4)	21 (16.0)
6. Vaccines are propagated for commercial gains	4 (3.1)	17 (13.0)	**74 (56.5)**	21 (16.0)	15 (11.5)
7. Vaccine does not protect against infection	6 (4.5)	28 (21.2)	**47 (35.6)**	35 (26.5)	16 (12.1)
8. Already have other methods for protection of infection	5 (3.8)	10 (7.6)	**59 (45.0)**	37 (28.2)	20 (15.3)

Table 4. Factors associated with COVID-19 vaccine acceptance (multivariate analysis).

Factors	OR (95% CI)	P-value
Age (yr) 1. < 35 2. > 35	 0.56 (0.35-0.90) 1	 0.017
Gestational age 1. First trimester 2. Second trimester 3. Third trimester	 1.60 (0.90-2.84) 2.61 (1.61-4.22) 1	 0.113 .000
Attitudes towards vaccine 1. Average 2. Good	 0.35 (0.22-0.57) 1	 0.000

In our study, the vaccination acceptance rate varied depending on the survey location and the study period. Most data were collected between August and September 2021, except for Rajavithi Hospital, where data collection occurred from February to March 2022. Overall, the vaccination acceptance was quite high at 72.9%, though it was only 30% at Maharaj Nakorn Chiang Mai Hospital. This disparity may be explained by the survey timing at Chiang Mai, which was conducted in August 2021. During that period, a large outbreak of the Delta variant occurred in Bangkok and its surrounding areas, while Chiang Mai had few cases.

Another report from Thailand by Pairat *et al.* [19],

which surveyed pregnant women and their husbands at the antenatal clinic of Vajira Hospital in Bangkok between July 1 and September 30, 2021, found that the vaccine acceptance rate among 171 pregnant women was 60.8%. This was lower than the rate at our two Bangkok sites: Siriraj Hospital (88.8%) and Rajavithi Hospital (88.8%). When compared with other countries, vaccination acceptance rates were quite varied and largely depended on the study period. For instance, the acceptance rate was similarly high at 77.4% in a study by Tao *et al*. [20], which surveyed 1,392 pregnant women in five provinces of the People's Republic of China in November 2020. Another study by Mose *et al*. [21] found an acceptance rate of 70.7% among pregnant women surveyed at a government hospital in the Gurage Zone, South-Western Ethiopia, between January 1-30, 2021. Moreover, Skjefte *et al*. [17] studied 16 countries around the world (14 countries with a high incidence of infection and 2 countries with a low incidence: Australia and New Zealand) from October 28 to November 18, 2020. The overall acceptance rate was 52% (range, 28.8%-84.4%). Mexican and Indian women had an acceptance rate of over 80%, while Australian and Russian women had acceptance rates below 45%. Two other reports showed low acceptance rates. Goncu Ayhan *et al*. [22] surveyed 300 pregnant women in Ankara City Hospital, Turkey, from January to February, 2021, and found that only 37% accepted vaccination. Another study by Gunawardhana *et al*. [23] found that only 9.3% of pregnant women in Cameroon would accept vaccination, a rate similar to that of non-pregnant individuals. A recent systematic review by Sarantaki *et al*. [24] summarized data from 18 studies, finding that the acceptance rate was between 17.6%-84.5%.

The top five factors affecting vaccine acceptance in our study were vaccination as a social responsibility, recommendation from doctors, nurses, or healthcare personnel, the availability of free vaccination from the government, the belief that vaccine has more benefits than harms, and the fact that vaccination was a government policy. The two main obstacles were fear of side effects (92.4%) and concern about adverse effects on the unborn child (81.7%). Multivariate analysis showed that the factors associated with increased vaccine acceptance included being aged 35 or older, being in the second trimester of pregnancy, and having positive attitudes toward vaccines. Moreover, Pairat *et al*. [19] reported that one factor affecting vaccine acceptance was whether husbands wanted their wives to be vaccinated. The primary reasons for vaccine refusal were similar to our findings: fear of harm to the unborn child (58.2%), fear of side effects (17.9%), and lack of confidence in vaccine efficacy (11.9%).

Studies in other countries identified different factors influencing vaccine acceptance. For example, Tao *et al*. [20] found that increased vaccine acceptance was associated with younger age, living in the Western region, low education, late pregnancy, high COVID-19 knowledge score, high risk of contracting the disease, low level of perceived barriers, high level of perceived vaccine benefit, and high level of perceived cues to action. Mose *et al*. [21] reported that factors, such as being aged 34-41, having completed primary school, and having good knowledge and good practices for disease prevention, were associated with higher acceptance. The reasons for rejection were fear of side effects, the vaccine may be ineffective, using other methods to prevent the disease, the vaccine may cause COVID-19 infection, and vaccines may affect the fetus. In Skjefte's study [17], the strongest predictors of vaccine acceptance were confidence in its efficacy and safety, belief in the importance of vaccines to one's country, confidence in routine childhood vaccines, concern about COVID-19 infection, and trust in science.

The top three reasons for refusing vaccination were concerns about exposing the unborn baby to harmful side effects, fear that the vaccine would be rushed through for political reasons, and a desire for more safety and efficacy data in pregnant women. A systematic review by Sarantaki *et al*. [24] found that predictors of vaccine acceptance included older age, white race, occupation, higher education, having underlying disease, being in the third trimester, prior influenza vaccination, knowledge of COVID-19, and confidence in vaccine efficacy and its safety. Goncu Ayhan, *et al* [22] also reported that the most common reasons for refusing the vaccine were lack of data on vaccine safety in pregnant women and concern about potential harm to the unborn child. Interestingly, in their study, women in their first trimester were more likely to accept vaccination than those in their second or third trimesters, whereas, in our study, women in their second trimester were 2.6 times more likely to accept vaccination than those in their third trimester. Similar to the study by Pairat in Bangkok [19], 55.8% of pregnant women chose to be vaccinated during the second trimester, in accordance with recommendations from the Department of Health and the Royal Thai College of Obstetricians and Gynaecologists [18] to avoid potential risks to the fetus in the first trimester. Following more reports on vaccine safety in pregnant women [25, 26], the CDC has since recommended that vaccination can be given at any gestational age [27].

Understanding the factors affecting vaccine acceptance or rejection in each country is crucial for planning strategies to increase vaccination rates. The most important priorities are building confidence in the efficacy and benefits of vaccines and ensuring safety for both the fetus and pregnant women. Nowadays, there are more reports of real-life data, including in Thailand, where more than 100,000 pregnant women have been vaccinated and given birth.

Disseminating accurate information about COVID-19 vaccines is another key factor in promoting vaccine acceptance. Our study found that most pregnant women received vaccine information from social media platforms such as Line, Facebook, and Twitter (96.6%), followed by television and radio (90.4%) and healthcare personnel (88.7%). The most trusted source of information was doctors (86.7%). Similarly, Gunawardhana *et al*. [23] reported that 82% of pregnant women considered healthcare professionals the most trusted source of information. Furthermore, the study by Naqvi [28] found

that family members and healthcare professionals were the most reliable data sources. Kumari *et al*. [29] surveyed the general population in India and found that 86.6% of respondents received information from healthcare personnel, 84.6% from government agencies, 83.8% from family members or friends, 81.8% from television or radio, and 74.5% from social media. Age was related to receiving information from reliable media, such as television, radio, or government agencies, with older individuals and those of higher socioeconomic status being more influenced by trusted media sources.

Conversely, the study by Mose [21] in Ethiopia found that only 34.1% of pregnant women received information from television or radio and 30.8% from medical personnel. Choosing the right methods or media to educate pregnant women about vaccines depends on accessibility and the context of each country. However, healthcare professionals should always be involved, as they are the most trusted group.

The strengths of this research are: 1) the number of participants was sufficient, 2) it was a multicenter study in Bangkok and other regions of Thailand, 3) the survey was conducted at large medical school hospitals, 4) self-administered questionnaires were used, allowing pregnant women to feel more comfortable than interviewed by staff, and 5) the data collection was nearly 100% complete. However, there were some limitations: 1) this was a cross-sectional study, so interpreting factors associated with outcomes requires caution; 2) there was a possibility of selection bias because nurses or research assistants invited the pregnant women to participate; 3) the study periods differed among hospitals, with different disease outbreaks occurring during each period, and 4) the results may not be representative of the entire Thai population.

Suggestions for further research include: 1) conducting in-depth interviews with pregnant women who refused or were undecided about vaccination to gain more insights into their opinions, attitudes, and perspectives, 2) surveying healthcare personnel to assess their knowledge, attitudes, and vaccine acceptance, as they may influence pregnant women's decisions, and 3) studying the efficacy, side effects and safety of COVID-19 vaccination in Thai pregnant women who received the vaccines and gave births. Real-world data will help increase confidence in the efficacy and safety of the vaccine.

CONCLUSION

A survey of 480 pregnant women attending antenatal care at six hospitals revealed a high acceptance rate of vaccination, with 73% of participants expressing willingness to vaccinate. The factors affecting the acceptance of vaccination included a sense of social responsibility, recommendations from doctors, nurses, or other medical personnel, free availability through government programs, the perception that the benefits of the vaccine outweighed the risks, and the fact that vaccination was a government policy. Despite the high acceptance, barriers were identified, primarily involving fear about side effects and concern that the vaccine might harm the unborn child. Moreover, most participants received vaccine information from various sources, including social media platforms, such as Line, Facebook, Twitter, television, radio, and healthcare professionals. Among these sources, information provided by doctors was the most reliable.

AUTHORS' CONTRIBUTIONS

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to its submission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

LIST OF ABBREVIATIONS

ICU	=	Intensive Care Unit
WHO	=	World Health Organization
FDA	=	Food and Drug Administration

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Institutional Review Boards of each hospital (REC.64-373-12-1).

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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