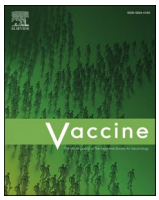
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Pregnant women's experiences of and attitudes toward COVID-19 vaccination: A qualitative descriptive study

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ABSTRACT

Introduction: This study aimed to understand the experiences of and attitudes toward pregnant women regarding COVID-19 vaccination during pregnancy.
Material and methods: A qualitative descriptive study was conducted between April and June 2022 with 25 pregnant women in South Korea through seven focus group interviews via Zoom™. Data were analyzed using a content analysis approach.
Results: Participants ranged in age from 27 to 41 years, with an average of 33.40 (±3.84) years. Gestational ages ranging from 15 to 35 weeks, with 13 women (52.0 %) in their second trimester, and 12 women (48.0 %) in their third trimester. All participants were college graduates. Forty percent completed three doses, while 40 % received two, 12 % one, and 8 % none. Three key themes emerged: (a) COVID-19 vaccine acceptance, (b) COVID-19 vaccine hesitancy, and (c) needs for quality maternal care. Participants who accepted vaccination trusted the vaccines and viewed healthcare providers' recommendations and government policies, such as the "vaccine pass," positively. Hesitant participants cited safety concerns, past medical history, and incomplete vaccination as reasons for reluctance. Additionally, there was a need for enhanced information on the vaccine and supportive, individualized maternal care.
Conclusions: The findings highlight the importance of tailored educational interventions and supportive care that leverages trust in healthcare providers to promote COVID-19 vaccination among pregnant women. There is a need to address information gaps and hesitancy among pregnant women related to their concerns regarding safety or past medical history. Future research should focus on strategies to ensure comprehensive care and information dissemination in this population in order to increase vaccination rates during pandemics.

1. Introduction

In 2019, a novel coronavirus disease (COVID-19) caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) emerged in China, adversely impacting global public health. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic; in response, COVID-19 vaccines were developed and recommended for all individuals, including pregnant women [1]. In South Korea, vaccination of pregnant women began in October 2021.

Pregnant women were considered at high risk of COVID-19, and this risk remains as SARS-CoV-2 continues to mutate into new variants [2]. Studies have shown that pregnant women with COVID-19 are at increased risk for adverse pregnancy outcomes including preterm birth, cesarean delivery, low birth weight, and stillbirth [3,4]. Similarly, related systematic reviews and meta-analyses have reported higher rates of maternal mortality and morbidity, neonatal intensive care unit admissions, and complications in newborns [5,6].

The WHO, along with professional societies such as the American College of Obstetricians and Gynecologists, the Society for Maternal-Fetal Medicine, and the International Society of Infectious Diseases in Obstetrics and Gynecology, advises that pregnant women be vaccinated against COVID-19 [7]. Studies consistently demonstrate that these vaccinations are safe and efficacious for both mother and fetus and have the additional benefit of transferring antibodies to the fetus [8,9].

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Despite proven benefits, many pregnant women have hesitated to receive COVID-19 vaccines. The WHO identifies vaccine hesitancy as a significant barrier to vaccination [10], and studies have reported low vaccination rates among pregnant women [11,12], ranging from 29.7 % to 77.4 % in a systematic review [13]. Studies have highlighted the need for communication between clinicians and pregnant women [14] as well as reliable messaging through mass media regarding vaccine safety [15].

Several studies have explored the experiences of pregnant women amid the pandemic [16–18]; participants reported increased uncertainty, anxiety due to lack of information, fear of the unknown, and disruptions in their routine prenatal care and social life. Regarding COVID-19 vaccination, pregnant women in Turkey expressed mixed feelings of fear and security/insecurity [19]. In the UK and Ireland, vaccine hesitancy was attributed to the rapid development and roll-out, as well as a perceived lack of safety evidence [20]. Furthermore, many pregnant women in the UK viewed vaccination as riskier than contracting COVID-19 [21].

Despite current knowledge about vaccination in pregnancy, more studies are needed to understand pregnant women's evolving experiences of COVID-19 vaccination, particularly multidose regimens. Given differences in variant severity and vaccination policies across regions and countries [22], this study aimed to describe pregnant women's experiences of and attitudes toward COVID-19 vaccination.

2. Methods

2.1. Study design and participants

This qualitative descriptive study involved 25 pregnant women. Following receipt of permission to post recruitment information, the authors recruited participants from a popular online community for pregnant women in South Korea and through snowball sampling. Inclusion criteria were as follows: (1) pregnant, (2) 19 years or older, (3) able to speak Korean, and (4) willing to participate voluntarily.

2.2. Data collection

Data were collected through seven focus group interviews via Zoom™ (a video-conferencing platform) between April 16 and June 2, 2022, and iterative rounds of analysis were conducted to ensure comprehensive topical coverage. Individual focus groups included three to five participants [23]. Two researchers conducted the interviews: a moderator (HK) experienced in focus group interviews led the discussion, and another researcher took notes. Participants were informed of the study's purpose before each interview and freely provided informed consent.

Interviews lasted from 60 to 120 min with no drop-out, were recorded with permission and transcribed verbatim. Participants were compensated with a gift coupon worth 20,000 Korean won (approximately $16 USD). A pilot study was not conducted. As this study occurred during the COVID-19 pandemic, it followed the official recommendations for pregnant women provided by reputable U.S. organizations, including the American College of Obstetricians and Gynecologists, the Society for Maternal-Fetal Medicine, and the Centers for Disease Control. Only participants and researchers were present during interviews. Researchers were female nursing faculty who were PhD-prepared (with the single exception of a female doctoral candidate in nursing) and experienced in conducting qualitative studies. The interviewer had no prior relationship with participants.

Interviews were conducted using a semi-structured interview guide. The interviews began with an opening question, followed by the following questions:

1. What are your thoughts on COVID-19 vaccination during pregnancy?
2. Tell us about your experience with receiving the COVID-19 vaccine.
3. What are the reasons for vaccinating or not vaccinating against COVID-19 in pregnancy?
4. What areas need to be improved in the context of COVID-19 vaccination for pregnant women?

Additionally, participants were asked to elaborate on their responses.

2.3. Trustworthiness

We adhered to Lincoln and Guba's [24] criteria to ensure rigor. Credibility was established through member checking and peer debriefing. To enhance transferability, detailed descriptions of the research methods and participants were provided. Dependability and confirmability were ensured through an audit trail of the research process and by checking for consistency. Participant statements were confirmed during interviews, and reflection was integrated throughout the research process. This study was reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines [25].

2.4. Data analysis

Interviews were transcribed verbatim and checked for accuracy. Data were analyzed using qualitative content analysis [26], utilizing NVivo 12 Plus software. Researchers read each transcript multiple times, identifying meaning units (words, phrases, and sentences) related to the study's aims. Open coding led to grouping of codes into categories, and themes were abstracted from the data. Findings were reported with participants' quotations. One researcher coded each transcript, and the other authors confirmed the coding, resolving discrepancies through discussion until consensus was achieved.

2.5. Ethical approval

This study was approved by the Ethics Committee of Chung-Ang University (2022–026, April 13, 2022), conducted according to the Declaration of Helsinki. All participants voluntarily agreed to participate and provided written informed consent before interviews. They were informed of their right to withdraw at any time without penalty and of the anonymity and confidentiality of discussions. They were also informed that the data would be used only for research purposes.

3. Results

Participants' ages ranged from 27 to 41 years, with an average of 33.40 (±3.84) years. Nineteen women (76.0 %) were experiencing their first pregnancy, and six women (24.0 %) were in their second pregnancy. Gestational ages ranged from 15 to 35 weeks, with 13 women (52.0 %) in their second trimester, and 12 women (48.0 %) in their third trimester. All participants were college graduates. Regarding vaccination status, 10 women (40.0 %) had received a full series of three vaccine doses, 10 women (40.0 %) had received two doses, three women (12.0 %) had received one dose, and two women (8.0 %) were unvaccinated. Three themes emerged from the data: (1) COVID-19 vaccine acceptance, (2) COVID-19 vaccine hesitancy, and (3) needs for quality maternal care. Table 1 illustrates these themes and their categories.

3.1. Theme 1. COVID-19 vaccine acceptance

3.1.1. Trust in vaccination

Some participants considered COVID-19 vaccination to be "safe and harmless to mother and baby" and beneficial for "passing antibodies to the baby." Additionally, they saw its utility for facilitating a "better recovery process" and preventing "high fever" in case of infection. One participant cited that concern for her 3-year-old child had prompted her to be vaccinated. These participants felt confident about their

Table 1
Themes and Categories.

Themes	Categories	Quotes
COVID-19 Vaccine Acceptance	• Trust in vaccination: Participants found vaccination safe and beneficial for passing antibodies to the baby, aiding recovery, and preventing fever.	"Antibodies will be passed on to the baby." "I believe that (the COVID-19) vaccine is safe for pregnant women, and there would be no harm to mothers or babies."
	• Support from healthcare professionals: Some participants had HCPs who recommended vaccination.	"I was vaccinated with three doses (of vaccine) while pregnant (at 5 weeks, 10 weeks, and 31 weeks) because my clinician recommended it."
	• Social pressure and vaccine pass policy: Some participants underwent vaccination due to workplace norms, caregiving roles, or compliance with the "vaccine pass" policy	"The government tells people to get vaccinated, and the company also recommends vaccination and provides time off to get vaccinated. As a person who works in a group, I had to get vaccinated."
COVID-19 Vaccine Hesitancy	• Safety concerns: Some participants feared short- and long-term adverse effects, including birth defects, still-birth or premature birth.	"I heard stories of women having (vaginal) bleeding and miscarriages after getting vaccinated, from the media or people around me."
	• History of high-risk pregnancy and adverse effects: Some participants, especially those who had had past miscarriages or ectopic pregnancies, worried about potential effects of vaccination on embryo implantation.	"In the past, I had a blood clot from birth control pills. By the way, a blood clot is a side effect of COVID-19 vaccination, so I was afraid that I could die from the side effects."
	• COVID-19 infection during pregnancy: Some participants felt anxious about infection or reinfection, doubted the effectiveness of vaccination, and feared birth complications such as miscarriage, bleeding, or premature delivery.	"(Given the Omicron outbreak), I might get COVID-19 regardless of whether I have been vaccinated or not. I am not sure if it is really necessary to get vaccinated".
Needs for Quality Maternal Care	• Strengthening pregnancy-related information: Participants desired more comprehensive information (beyond basic guidance) from the government, media, and experts.	"I got the third dose at a nearby (non-obstetric) clinic. I was a little disappointed. There was no information saying if you had these symptoms, you should go to the emergency room or the obstetrician."
	• Reinforcing comprehensive maternal care systems: Participants saw healthcare facilities for pregnant women as limited, highlighting the need for telehealth services and delivery facilities for infected mothers.	"The mother, who had COVID-19 before delivery, gave birth in an ambulance due to lack of hospital acceptance. It's a serious situation."

vaccination decision, having experienced no issues post vaccination. One participant, vaccinated during infertility treatment, noted, "I became pregnant after vaccination, thus [my] negative attitudes toward COVID-19 vaccination noticeably diminished."

Some participants discovered that they were pregnant after they had received the first or second vaccination dose. These participants reported experiencing confusion about whether early pregnancy symptoms, such as nausea or irregular menstruation, were side effects of vaccination. One participant reported experiencing nausea for several days after the first dose, before having a positive home pregnancy test. Another participant consulted an obstetrician about missed menstruation before accepting the second dose, having heard of "irregular menses" among vaccinated women.

3.1.2. Support from healthcare professionals

A few participants noted that their healthcare professionals (HCPs) had passive attitudes of toward vaccination, with some recommending it only after 20 weeks of pregnancy. Participants whose HCPs advised waiting until after childbirth or failed to mention vaccination during prenatal care perceived vaccination as unnecessary during pregnancy. In contrast, some vaccinated participants had received recommendations from their clinicians that they considered highly reliable.

3.1.3. Social pressure and vaccine pass policy

Some participants underwent vaccination due to social pressure, noting that it was the workplace norm and came with paid vaccine leave benefits. Participants in caregiving roles, such as healthcare workers or educators, were required to receive the COVID-19 vaccine. One elementary school teacher stated, "I feared the criticism I might face if students became infected because of me." Participants also complied with the government's "vaccine pass" policy, which required proof of vaccination or polymerase chain reaction (PCR) test results for access to public places such as restaurants and cafes. Although some saw this policy as encouraging vaccination, others criticized it, arguing that "people who did not vaccinate because of their health have to be respected for their choices."

3.2. Theme 2. COVID-19 vaccine hesitancy

3.2.1. Safety concerns

Some participants were concerned about the potential short- and long-term adverse effects of vaccination on mothers and babies, including birth defects, stillbirth, and premature birth. Those who searched for information on online forums for mothers encountered both positive and negative posts: some expressed acceptance of vaccination and others highlighted cases of miscarriage or stillbirth after vaccination. The unvaccinated participants considered it safer not to undergo vaccination. In some cases, their belief that vaccine safety was insufficient was reinforced by news reports about the rapid development of new vaccines or about ordinary people who had died suddenly or developed adverse events after being vaccinated. Such stories led them to consider vaccination very dangerous and likely to result in complications, including irregular menstruation or irregular vaginal bleeding, or hormonal abnormalities. As one participant explained, "I thought it was better not to get vaccinated. Even if there is a 0.1% or 0.001% chance of getting side effects, if it happens to me, it is a 100% chance."

3.2.2. History of high-risk pregnancy and adverse effects

Some participants had a negative perception of vaccination due to their medical condition. For example, those who had experienced miscarriages or ectopic pregnancies were particularly concerned about possible adverse effects of vaccines on embryo implantation. One participant noted, "I read about women who had a miscarriage after vaccination. Thus, I became convinced that I shouldn't get the vaccine."

A few participants experienced high fever or skin problems after vaccination. One participant, who experienced swelling at the injection site after the first vaccination, developed distrust toward the vaccination and did not receive further doses. Newly pregnant participants worried that the vaccine could adversely affect the developing fetal brain and organs, thus leading to birth defects. A participant who developed a high fever after vaccination shared her concern about receiving a third dose: "I had a fever after the second vaccination, and I heard that having a fever is dangerous to the fetus, so I was worried that I would get a fever again."

3.2.3. COVID-19 infection during pregnancy

Some participants found the COVID-19 self-test kits provided by public centers helpful. Some women became infected even after

complete vaccination, and others contracted the virus after receiving one or two doses. These participants expressed feeling "surprised," "nervous," "stunned," "depressed," and doubtful of the vaccine's effectiveness. One participant said, "I thought it might [have been] a 'water' vaccine. I am 31 weeks [pregnant]. The idea of getting the third vaccination has somewhat diminished."

Participants infected with COVID-19 expressed significant concerns for fetal well-being. One woman reported having visited the obstetric clinic "as soon as quarantine was over" and being relieved to hear that "[the] baby's heart is beating well, and [the baby is] moving actively." In contrast, another participant reported feeling anxious on hearing that the "baby was small for her gestational age." Regardless of vaccination status, participants were concerned about infection or reinfection with a SARS-CoV-2 mutation around delivery. Those infected before completing the vaccination series hesitated to receive the remaining doses. Participants also worried that a severe cough and high fever could cause birth complications, including bleeding, miscarriage, stillbirth or premature delivery. One participant, who contracted Omicron in her eighth week of pregnancy, feared that high fever might cause a miscarriage: "I was coughing a lot. When I cough, my stomach gets a little hard, so I thought the baby might have a hard time."

3.3. Theme 3: Needs for quality maternal care

3.3.1. Strengthening pregnancy-related information

Participants perceived a lack of sufficient information from the government regarding vaccination during pregnancy. They hoped for more detailed reporting from the news media, including "objective figures," and called for a national website to provide information on vaccination and infection. Meanwhile, most participants turned to a popular online community website for pregnant women to gather information related to vaccination and COVID-19 infection during pregnancy. Although they found it helpful to learn about others' experiences, they felt overwhelmed by the abundance of information and wanted experts to specify relevant content and verify facts. As one participant explained,

People are anxious and look for information on mom café [an online community for mothers]. Each person's experiences are overflowing with unclear information, such as "You can take this [medicine]" and "You cannot take this." I think this kind of overflow of unclear information makes me feel more anxious.

Participants wanted pregnancy-related information tailored to their individualized needs, beyond the basic guidance provided by public health centers and non-obstetric clinics. Those who received notifications of positive test results through text messages received only basic self-quarantine instructions, with no specific information for pregnant women. Participants who received vaccinations at non-obstetric clinics reported a lack of detailed instructions for pregnant women.

3.3.2. Reinforcing comprehensive maternal care systems

Participants perceived healthcare facilities for pregnant women as limited. Most visited clinics for vaccinations, COVID-19 tests, and prescriptions; others used telehealth services. A few were unaware of telehealth availability. One participant who used telehealth services in obstetrics stated, "I was relieved [at] being able to talk to my doctor on the phone and get a prescription, and the telehealth system was good." Additionally, participants worried about the shortage of delivery facilities for infected mothers, especially as Omicron infections increased. They expressed concern after hearing news reports of pregnant women with COVID-19 being transported to health centers in "other regions" to give birth.

4. Discussion

This study highlights the need to provide women with up-to-date information regarding the safety and benefits of COVID-19 vaccination for maternal and fetal health. Current guidelines recommend vaccination at all stages of pregnancy [27]. Notably, a recent population-based retrospective cohort study reported improved obstetric outcomes associated with multidose mRNA vaccines compared to viral vector vaccines [28].

Some participants in this study expressed trust in vaccination, while others were hesitant due to safety concerns—a finding consistent with previous research identifying maternal safety concerns as a significant barrier to vaccination [29,30]. However, evidence shows that COVID-19 vaccination during pregnancy does not increase the risk of miscarriage, preterm birth, pulmonary embolism, or low birth weight [31,32]. Additionally, a recent review confirmed that maternal anti-SARS-CoV-2 immunoglobulins are transferred to newborns after vaccination [33], underscoring the need to educate pregnant women about the safety and benefits of vaccination for both maternal and neonatal health.

Participants who received recommendations from HCPs were more likely to accept vaccination, consistent with evidence that prenatal discussions with caregivers significantly boosted vaccination uptake. This underscores the crucial role of HCPs in effectively communicating with pregnant women [30,34,35]. Moreover, participants who supported the COVID-19 vaccination expressed positive beliefs about its safety and preventive effects. This is consistent with studies conducted among Chinese pregnant women, which revealed higher vaccine acceptance among those perceiving it as beneficial and safe [36,37]. Some participants reported being influenced by the South Korean government's vaccine pass policy, implemented on January 3, 2022, which requires proof of vaccination, a negative PCR test result [12], and workplace vaccination norms. Research indicates that workplace vaccination requirements can significantly increase vaccination rates [38], suggesting that organizational and national initiatives can effectively promote vaccination among pregnant women. Cultural attitudes and policies, such as vaccine mandates, significantly influence vaccination behaviors. Countries with stricter mandates or stronger collective norms often achieve higher vaccination rates [39,40]. Conversely, misinformation or inadequate information contributes to increased hesitancy [41]. Understanding these contextual factors is crucial for enhancing maternal vaccination rates and maternal health, which is a shared global priority.

Some participants realized that they were pregnant after receiving a COVID-19 vaccine, mistaking pregnancy symptoms for vaccine side effects. This highlights the importance of assessing menstrual cycles and pregnancy symptoms before vaccinating women of childbearing age. Additionally, participants who contracted COVID-19 after vaccination questioned its effectiveness and viewed booster doses as unnecessary due to presumed antibody development, consistent with previous studies identifying past infection as a barrier to vaccination [11]. Such skepticism and misinformation may contribute to incomplete three-dose vaccinations. During prenatal care visits, HCPs should verify vaccination status and assess fetal well-being following quarantine. Some participants believed that the risks of COVID-19 vaccination outweighed those of infection. However, a systematic review and meta-analysis indicated that vaccination reduces the risks of infection and hospitalization without causing maternal or fetal complications [42]. This finding underscores the critical need to effectively communicate the risks associated with COVID-19 infection and vaccination benefits.

Participants also reported challenges accessing birthing facilities due to a shortage of negative-pressure delivery rooms required for mothers with confirmed or suspected infections [43]. Although South Korea expanded its delivery room capacity, the Omicron outbreak on December 1, 2021, caused demand to exceed supply, highlighting the importance of robust preparedness planning. Increasing the availability of negative-pressure delivery rooms as part of pandemic preparedness is essential to ensure maternal care during outbreaks. Telehealth services introduced during the pandemic have significantly benefited maternal care by enabling remote access to healthcare. They contribute to the continuity of safe care while lowering health care disparities and

financial burdens [44–46]. They also help address vaccination hesitancy [47] and support overall well-being through counseling [48]. Providing pregnant women with a list of available telehealth facilities could further enhance access.

The findings of this study highlight that vaccine hesitancy and acceptance are common global issues influenced by factors such as safety concerns, insufficient information, and trust in HCPs. These insights can guide the development of educational campaigns and HCP training programs to effectively address these issues. Additionally, the findings emphasize the critical role of telehealth services in mitigating these challenges, offering a scalable solution to improve maternal health worldwide and support progress toward achieving the UN's Sustainable Development Goals.

Consistent with previous research indicating that pregnant women often lack adequate information about COVID-19 vaccination [49], the participants in our study reported limited access to reliable information. Many sought guidance on vaccination and COVID-19 infection through online communities. While social networking platforms can provide valuable support and information for pregnant women [50], they also risk disseminating unverified content and spreading misinformation [51]. Establishing public websites with evidence-based information on vaccination and pregnancy could address these gaps and counter misinformation. A global study from 40 countries revealed a strong link between belief in COVID-19 misinformation and vaccine hesitancy [52]. To address this, effective public health communication is essential, avoiding scare tactics that may worsen misinformation [53]. Instead, efforts should focus on addressing concerns about novel vaccines [54] through strategies that enhance health literacy, leverage digital technology, and ensure clear, consistent, and timely communication [55].

The pregnant women in our study expressed a strong need for more detailed information, particularly from non-obstetric clinics and public health centers. They emphasized the importance of understanding signs and symptoms that require emergency attention and guidance on how to navigate the healthcare system. Providing comprehensive information tailored for pregnant women—including signs of complications and where to seek care—would offer them essential support.

4.1. Strengths and limitations

This study provides a comprehensive exploration of pregnant women's experiences with COVID-19 vaccination, highlighting their attitudes, concerns, and maternal care needs. The findings offer valuable insights into the factors influencing vaccination acceptance and hesitancy, particularly in the context of the global impact of the COVID-19 pandemic. While the pandemic is transitioning to an endemic one, our findings remain valuable for understanding the experiences and attitudes of pregnant women during a critical period. These insights can support efforts to enhance maternal care and guide preparations for future health emergencies. By examining a specific cultural context—South Korea—this study highlights how national policies, societal pressures, and cultural norms influence women's experiences, contributing a unique and valuable perspective to the discourse on vaccination during pregnancy.

This study has several limitations. First, all participants were pregnant women in South Korea, which limits the generalizability of the findings due to cultural specificity. Nonetheless, this regional focus provides valuable insights into cultural, social, and healthcare-specific factors influencing COVID-19 vaccination attitudes—areas underrepresented in the existing literature. Our study contributes to the global understanding of vaccine acceptance and helps to address gaps in diverse geographical contexts. Second, the varying severity of the COVID-19 pandemic and differences in vaccination policies worldwide may influence the experiences and attitudes of pregnant women in other regions, further limiting the applicability of the findings. Third, the study relied on Zoom™ for focus group interviews, which may have excluded potential technical challenges or constrained the ability to capture nonverbal cues, potentially affecting the depth of qualitative insights. Last, the sample consisted exclusively of college graduates, which may not fully represent the broader population of pregnant women. Future studies should include participants from diverse socioeconomic and educational backgrounds, particularly those who are vaccine-hesitant, to develop a more comprehensive understanding of vaccination attitudes among pregnant women.

Despite these limitations, this study enhances our understanding of pregnant women's experiences with COVID-19 vaccinations. Future research should explore how attitudes toward COVID-19 vaccinations evolved over time, providing deeper insights into the factors influencing vaccination decisions. Furthermore, exploring HCPs' perceptions of vaccination during pregnancy could reveal how their attitudes impact vaccine acceptance and maternal care. Future studies could investigate strategies to effectively disseminate accurate, evidence-based information on COVID-19 vaccination to pregnant women with the aim of addressing information gaps and countering misinformation. Comparative studies examining the experiences of pregnant women from diverse cultural backgrounds and educational levels would offer a broader perspective on how factors shape vaccination decisions. Furthermore, research examining changes in vaccination attitudes within this population post-pandemic could shed light on how perceptions evolve over time, incorporating participants from diverse socioeconomic and educational backgrounds. Moreover, research into the relationship between COVID-19 vaccination attitudes and the underlying reasons for vaccine acceptance or hesitancy would provide a more comprehensive understanding. Finally, long-term studies examining the health outcomes of women vaccinated during pregnancy and their children would also offer valuable insights to inform healthcare policies and practices.

5. Conclusion

This study highlights the diversity in pregnant women's attitudes toward COVID-19 vaccination, with some exhibiting hesitancy or incomplete vaccination while others confidently completing the vaccination series. To promote acceptance among vaccine-hesitant pregnant women, it is crucial to engage with them and provide quality, evidence-based information on the safety and efficacy of COVID-19 vaccinations during pregnancy. HCPs should actively assess vaccination hesitancy among pregnant women and engage in discussions with them during prenatal care about the importance of completing the vaccination series. Moreover, maternal care should be strengthened by ensuring adequate infrastructure to support pregnant women. Our findings highlight that at the national level, it is important to increase the number of facilities where infected mothers can safely give birth, as well as to establish an infrastructure that ensures easy access to reliable information for pregnant women. Additionally, it is crucial to address the anxiety pregnant women may experience due to concerns about the potential effects of vaccination or the risk of infection during pregnancy. Providing pregnancy-specific information on COVID-19 vaccinations, along with psychological counseling when needed, is essential for supporting their well-being.

CRediT authorship contribution statement

Hee Sun Kang: Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **So Youn Kim:** Writing – review & editing, Investigation, Data curation. **Jennie C. De Gagne:** Writing – review & editing, Visualization. **Sun-Mi Chae:** Writing – review & editing, Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper.

Data availability

The data that has been used is confidential.

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