

ORIGINAL ARTICLE

COVID-19 vaccination rates in an antenatal population: A survey of women's perceptions, factors influencing vaccine uptake and potential contributors to vaccine hesitancy

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Background: Pregnant women are at increased risk for severe COVID-19 and are a priority group for vaccination. The discrepancy in vaccination rates between pregnant and non-pregnant cohorts is concerning.

Aims: This study aimed to assess the perceptions and intentions of pregnant women toward COVID-19 vaccination and explored vaccine uptake and reasons for vaccine hesitancy.

Materials and method: A cross-sectional exploratory design was performed evaluating pregnant women receiving care in two metropolitan maternity units in Western Australia. The main measurable outcomes included vaccination status, intention to be vaccinated, and reasons for delaying or declining vaccination.

Results: In total, 218 women participated. Of these, 122 (56%) had not received either dose of the COVID-19 vaccine. Sixty (28%) claimed that vaccination was not discussed with them and 33 (15%) reported being dissuaded from vaccination by a healthcare practitioner. Compared to vaccinated women, those who had not accepted vaccination were less likely to have had vaccination discussed by maternity staff, less aware that pregnant women are a priority group, and less aware that pregnancy increased the risk of severe illness. Unvaccinated women were concerned about the side effects of the vaccine for their newborn and their own health, felt there was inadequate information on safety during pregnancy, and felt that a lack of community transmission in Western Australia reduced the necessity to be vaccinated.

Conclusion: Vaccine delay and hesitancy is common among pregnant women in Western Australia. Education of healthcare professionals and pregnant women on the recommendation for COVID-19 vaccination in pregnancy is required.

KEYWORDS

COVID-19, pregnancy, COVID-19 vaccines, vaccination hesitancy, infant, newborn

INTRODUCTION

Pregnancy is an established risk factor for severe maternal COVID-19, with studies demonstrating an increased risk of intensive care unit admission, requirement for mechanical ventilation, and death among pregnant women compared to their non-pregnant counterparts.¹⁻³ Therefore, they are a priority group for COVID-19 vaccination.¹ Pregnancy complications in particular with the Delta variant are also increased, including preterm birth, stillbirth, preeclampsia, and emergency caesarean section.⁴⁻⁶

The Royal Australian College of Obstetricians and Gynaecologists (RANZCOG) and the Australian Technical Advisory Group on Immunisation (ATAGI) acknowledge that pregnant women are a priority group for COVID-19 vaccination and should be routinely offered vaccination.

Clinical trials have demonstrated the efficacy and safety of the COVID-19 vaccine in the antenatal population. Women who received the vaccine have a significantly reduced risk of severe COVID-19, with studies citing vaccine effectiveness of 78–96% in pregnant women.⁷⁻⁹ Common systemic side effects including headache, myalgia, chills, and fever are reported as less prevalent in the pregnant population.¹⁰ Reassuringly, the COVID-19 vaccine has not been associated with adverse pregnancy or neonatal outcomes.¹⁰

Despite the evidence supporting COVID-19 vaccination safety during pregnancy, the discrepancy in vaccination rates between pregnant and non-pregnant cohorts is widely reported. In October 2021, the president of the Royal College of Obstetricians and Gynaecologists encouraged all pregnant women to accept the vaccine, acknowledging only 15% of pregnant women in the UK were vaccinated.¹¹ Data on the rates of vaccination within the pregnant population in Australia are not uniformly collected which inhibits national reporting. As such, we must rely on anecdotal reports from jurisdictional data and leading experts' estimations in non-medical journals. Despite a lack of transparency in reporting, we are led to believe that vaccination rates of pregnant people in Australia range 30–70%.¹²

Vaccine delay and hesitancy pose significant risks to public health where there is active community transmission. The population of Western Australia (WA) is a unique cohort, where no cases of COVID-19 were reported in the community for the duration of this eight-week study from September to October 2021. Anecdotally, this may be a precipitating factor in some women declining vaccination. This study aimed to assess the attitudes, perceptions, and intentions of pregnant women toward COVID-19 vaccination and explored vaccine uptake and potential reasons for vaccine hesitancy. Such information may be useful in refining public health strategies to improve vaccine uptake in this at-risk population.

MATERIALS AND METHODS

A cross-sectional exploratory design was used. Cross-sectional studies are known for their utility in providing insight into

phenomena at discrete points in time.¹³ Human research ethics approval was granted by the Women and Newborn Health Service Human Research Ethics Committee (number 42325).

Women attending two metropolitan maternity units in WA were offered an anonymous survey upon presentation regardless of gestation. Participants were presented with a participant information form alongside a QR code that, upon scanning, directed participants to an online survey. Completion of the survey constituted implied consent. Participants had access to the COVID-19 vaccine in the community for several weeks prior to commencement of the study. The study was ceased following a pre-agreed eight-week period.

There was no existing validated tool available to evaluate the perceptions and intentions regarding COVID-19 vaccination uptake in pregnant women. The survey was developed by the investigators who have expertise in survey design and maternity care. Demographic data collected included age, gestation, language spoken in the home, and Aboriginal or Torres Strait Islander status. The remainder focused on vaccination status, vaccination intention, and potential reasons for delaying or declining vaccination. Furthermore, women were asked if COVID-19 vaccination had been discussed with them by a healthcare professional and who (if anyone) had a role in influencing their decision. An outline of the survey is available in [Supplementary Appendix S1](#).

Descriptive summaries were made using median, interquartile ranges, and ranges for continuous data or frequency distributions for categorical data. Four-point Likert scale responses (strongly agree, agree, disagree, and strongly disagree) were categorised into strongly agree/agree vs disagree/strongly disagree for univariate analysis. Gestations were divided into <28, 28–35, and >36 weeks for analysis. The unvaccinated cohort were divided into three subgroups: the vaccine accepting, who agreed to accept vaccination during pregnancy; the vaccine hesitant, who were unsure regarding vaccination; and the vaccine resistant, who would decline vaccination during pregnancy. Vaccination uptake groups were compared using χ^2 or Fisher exact tests. SPSS statistical software was used for analysis. *P*-values <0.05 were considered statistically significant.

RESULTS

Participants included 218 women who completed the survey over an eight-week period with a mean age of 31.9 years and a median gestation of 33 weeks (interquartile range (IQR): 27–36, range: 13–42). Participants were booked to birth in a variety of settings, including 20 women (9%) in the co-located midwifery-led birthing unit and 33 (15%) and 164 (75%) in medically led secondary and tertiary maternity hospitals, respectively ([Table 1](#)).

At the time of survey completion 44% ($n = 96$) had at least one dose of the vaccine and 56% ($n = 122$) were unvaccinated. Of unvaccinated women, $n = 36$ (29.5%) were vaccine hesitant and $n = 77$ (63.1%) were vaccine resistant. Women at earlier gestations

TABLE 1 Demographics of participants

	<i>n</i>	%
Age (years)		
18–25	18	8.3
26–30	58	26.6
31–35	94	43.1
36–40	44	20.2
>40	4	1.8
Language spoken in the home		
English	161	73.9
Language other than English	57	26.1
Aboriginal/ Torres Strait Islander		
Yes	3	1.4
No	209	98.6
Location of antenatal care		
Community	1	0.5
Family birth centre	20	9.2
Secondary maternity hospital	33	15.1
Tertiary maternity hospital	164	75.2
Model of maternity care		
Community midwifery program	10	4.6
Midwifery group practice	49	22.5
Hospital antenatal clinic (medical or midwifery-led care)	157	72.0

were more likely to have at least one dose of the vaccine ($n = 35$ (60.3%) at <28 weeks vs $n = 37$ (43.0%) at 28–35 weeks vs $n = 24$ (33.3%) at 36+ weeks, $P = 0.004$) (Table 2). Furthermore, those who were vaccinated or vaccine accepting were more likely to have discussed vaccination with a healthcare professional ($n = 89$ (85.6%) vs 60 (53.1%), $P < 0.01$), had greater awareness they were a priority for vaccination ($n = 98$ (93.3%) vs $n = 75$ (66.4%) $P < 0.001$) and were more aware they were at increased risk of severe illness ($n = 101$ (96.2%) vs $n = 92$ (81.4%) $P < 0.01$) (Table 3).

Approximately 54.4% ($n = 31$) of women who did not speak English at home were unvaccinated. Of these women 25.8% ($n = 8$) ($P < 0.001$) were not aware that pregnant women were categorised as a priority group for vaccination.

Although not statistically significant, the midwifery group practice had the highest percentage of fully vaccinated patients (36.7% ($n = 18$)) in comparison to patients who acquired tertiary maternity care (24.8% ($n = 39$)) or community midwifery program led care (20% ($n = 10$)) ($P = 0.240$).

Among unvaccinated women, a more advanced gestation was associated with a lower intention to accept vaccination. Women at later gestations were less likely to accept the COVID-19 vaccine in pregnancy ($n = 48$ (66.7%) at 36+ weeks vs $n = 49$ (57%) at 28–35 weeks vs $n = 23$ (39.7%) at <28 weeks, $P = 0.004$) (Table 2). Among unvaccinated women, $n = 16$ (13.3%) were planning vaccination in the post-partum period ($n = 4$ (17.4%) at <28 weeks

vs $n = 7$ (14.3%) at 28–35 weeks vs $n = 5$ (10.4%) at 36+ weeks, $P = 0.07$).

Women who had not discussed the vaccination with a healthcare practitioner were more likely to be of later gestation, 36+ weeks gestation, $n = 31$ (47%) vs $n = 41$ (27.5%) and less likely to be <28 weeks gestation, $n = 10$ (15.2%) vs $n = 48$ (32.2%) compared to women who had discussed vaccination ($P = 0.006$).

Of those who were vaccine hesitant or resistant, $n = 39$ (34.8%) indicated they would like more information and $n = 73$ (65.2%) responded that they had sufficient information. Compared to vaccinated and vaccine accepting women, this group more frequently relayed concerns regarding effect of the vaccine for their newborn ($n = 99$ (91.7%) vs $n = 39$ (39.4%), $P < 0.001$) and their own health ($n = 64$ (56.6%) vs $n = 29$ (27.6%), $P < 0.001$). They also identified inadequate safety information during pregnancy ($n = 72$ (69.9%) vs $n = 25$ (25.3%), $P < 0.001$) and believed lack of community transmission of COVID-19 in WA reduced the necessity for vaccination ($n = 34$ (33.3%) vs $n = 6$ (6.1%), $P < 0.001$) (Table 3).

In total, almost one-third of patients claimed that the COVID-19 vaccine had not been discussed or were unsure if it had been discussed by a healthcare practitioner ($n = 68$, 31.2%) (Table 3). Almost 1/5 women who had been advised against vaccination reported that they had been dissuaded from accepting vaccination by a healthcare provider, including their general practitioner ($n = 20$ (17%)), midwife ($n = 8$ (7%)), or obstetrician ($n = 5$ (4%)) (Table 4). Although these numbers were small and not statistically significant, those advised against vaccination by a health professional were almost twice as likely to be vaccine hesitant or resistant compared to those who had not been so advised ($n = 17$ (25%) vs $n = 7$ (13%), $P = 0.09$) (Table 4). Women who were vaccine hesitant or resistant were more likely to be advised against vaccination by a partner or family member ($n = 32$ (47.8%) vs $n = 11$ (20.4%), $P = 0.002$) (Table 4).

DISCUSSION

To our knowledge, this is the first study reporting vaccination perceptions, intentions, and uptake by pregnant women in Australia following publication of updated ATAGI guidelines¹ in June 2021. Our research reveals the complex, interweaving factors surrounding COVID-19 vaccine uptake, delay, hesitancy, and refusal among this cohort.

Vaccine hesitancy is not a new phenomenon among pregnant women;¹⁴ however, the impacts of recommending vaccination against a virus currently in global pandemic status in a setting with no to low local community transmission is noteworthy. Even within Australia, this cohort is unique given the lack of significant community transmission in WA. As of 6 December 2021, 0.51% of confirmed Australian COVID-19 cases and 0.44% of Australian COVID-19 deaths were reported in WA.¹⁵ These low numbers are likely due to the 'hard-border' isolating WA from 'high-risk' interstate and international visitors. As such, most Western Australians

TABLE 2 COVID-19 vaccine uptake by maternal age and gestation

	Vaccine uptake			P-value
	Not had vaccine	One dose	Two doses	
	n (row %)	n (row %)	n (row %)	
Overall	122 (55.9)	37 (17.0)	59 (27.1)	
Age (years)				
18–29	39 (60.0)	15 (23.1)	11 (16.9)	0.174
30–35	59 (56.2)	14 (13.3)	32 (30.5)	
>35	24 (50.0)	8 (16.7)	16 (33.3)	
Gestation (weeks) [†]				
<28	23 (39.7)	18 (31.0)	17 (29.3)	0.004
28–35	49 (57.0)	14 (16.3)	23 (26.7)	
>35	48 (66.7)	5 (6.9)	19 (26.4)	

[†]Two missing responses for gestational age (N = 216).

have lived a relatively normal life, free from masks and restrictions. With no locally acquired infections for the duration of this study, the perception of minimal risk of exposure to COVID-19 appears to be a significant contributing factor to vaccine hesitancy and refusal by women.

However, the lack of urgency in accepting vaccination is not limited to WA. A similar British-based study demonstrated a vaccine acceptance rate of 62.1% among the pregnancy cohort.¹⁶ During this time in the United Kingdom, thousands of new infections were diagnosed daily and almost one-third of patients requiring extracorporeal membrane oxygenation were unvaccinated pregnant women.¹¹

This study reinforces the importance of positive vaccination recommendations from health professionals on vaccine uptake in pregnant women.^{17, 18} Although over 1/3 of women in this study called for further information prior to accepting COVID-19 vaccination, a significant proportion claimed vaccination had not been discussed by their maternity care providers. One Australian survey conducted in the initial stages of the vaccine roll-out (May 2021) demonstrated that only 46% of midwives felt equipped with sufficient information on the COVID-19 vaccine.¹⁷ Early data in this study indicate there may be a positive association between vaccination uptake and models that provide continuity of care by a known midwife. Vaccination uptake by women in the midwifery group practice was almost 12% higher than those receiving standard tertiary care. Further research on the impact of continuity of care on vaccination uptake in addition to other health literacy and health-seeking behaviours requires further exploration.

Opening the lines of communication between healthcare provider and patient is key to vaccine promotion, with this study demonstrating an apparent correlation between lack of discussion by healthcare providers and vaccine refusal or hesitancy and a strong desire from women for further information. This also supports the recommendation that brief intervention education regarding vaccination should be made at all maternity visits. The

possibility that education is given but not registered or understood is acknowledged – repetition is key to vaccination uptake.

The impact of COVID-19 in both the expectant mother and the neonate, in addition to the benefits of vaccination, must be addressed in the development of health counselling resources. All maternity care providers should have adequate access to these resources. These resources can be presented to women via hard copies in the antenatal clinic, QR codes displayed across the hospital setting and circulated through publication on trusted organisations' websites, eg RANZCOG and the Australian College of Midwives. These should be published in multiple languages, written in the vernacular and be user-friendly to increase the accessibility of all women to this vital information.

It is concerning that women have been actively dissuaded against COVID-19 vaccination in pregnancy from multiple sources. This study reiterates the impact that society has on pregnant women, with more women being dissuaded by their family, friends, and partners than any other source. The role of social influences in conjunction with the widespread dissemination of misinformation that is freely available to women via online forums and social media is acting as a catalyst to vaccine hesitancy. In a world where false information is as easily accessible as peer-approved research, it is imperative that we furnish not only pregnant women with information but the wider population. This could be done through ongoing informative public health campaigns via radio, television, social media, in hospital waiting areas and so on, and include information on where to access further accurate advice. Recurrent passive uptake of these facts may assist with increasing vaccine rates in pregnant women in addition to those who play active supporting roles in the pregnancy.

From a systemic point of view, hospital-based maternity care providers should be informed of a woman's vaccination status upon the initial referral by the general practitioner to the antenatal clinic. In a busy tertiary hospital where continuity of care can be lacking, it may be beneficial to have multiple open conversations surrounding vaccination with information routinely

TABLE 3 Comparisons of women who had previously been vaccinated or were intending to become vaccinated during pregnancy (vaccine accepting) compared with women who were vaccine hesitant (unsure regarding vaccination) or resistant (declining vaccination)

	Have been vaccinated or intend to have vaccination during pregnancy		P-value
	Yes N = 105	No/unsure N = 113	
	n (%)	n (%)	
Has been discussed by staff	89 (85.6)	60 (53.1)	<0.001
Discussed by:			
Not discussed	11 (10.6)	49 (43.4)	<0.001
Unsure if discussed	4 (3.8)	4 (3.5)	
Midwife	55 (52.9)	36 (31.9)	
Doctor	34 (32.7)	24 (21.2)	
Aware that pregnant women are a priority group	98 (93.3)	75 (66.4)	<0.001
Aware that pregnancy is high risk for severe illness	101 (96.2)	92 (81.4)	0.001
Likert scale questions			
Worried about side effects for myself	29 (27.6)	64 (56.6)	<0.001
Worried about side effects for my baby	39 (39.4)	99 (91.7)	<0.001
Inadequate information on safety during pregnancy	25 (25.3)	72 (69.9)	<0.001
Decreased rates of COVID-19 in WA reduces need for vaccination	6 (6.1%)	34 (33.3%)	<0.001

Likert scale questions were categorised into agree/strongly agree vs disagree/strongly disagree for the comparison.

offered at all antenatal visits and accordingly documented. Regular reinforcement of the importance of vaccination with the patient and support person is an important strategy to build and maintain trust. Furthermore, regular audits should be performed to ascertain the up-to date vaccination rates, including 'booster' vaccines targeting new strains of COVID-19. Ongoing education and support should be provided for all clinicians in addition to hospital-specific vaccination audit results to support and improve professional recommendations.

The fact data regarding pregnancy/breastfeeding status at time of vaccination are not collected by the national immunisation register must be urgently addressed.¹⁹ The absence of long-term safety data in pregnancy is consistently cited by those who are vaccine hesitant or resistant.^{14,17,20} This centralised collection would facilitate critical phase IV studies to complement

TABLE 4 Comparisons of women's Covid-19 vaccination status versus sources of dissuasion against vaccination

	Have been vaccinated or intend to have vaccination during pregnancy		P-value
	Yes N = 54	No/unsure N = 67	
	N (%)	N (%)	
Advised against vaccination by:			
Partner/family	11 (20.4)	32 (47.8)	0.002
Friends	35 (64.8)	25 (37.3)	0.003
Online forums/social media	31 (57.4)	28 (41.8)	0.088
Health professional (GP, obstetrician, midwife)	7 (13.0)	17 (25.4)	0.089
GP	6 (11.1)	14 (20.9)	
Obstetrician	1 (1.9)	4 (6.0)	
Midwife	3 (5.6)	5 (7.5)	
Advised against by more than one source	31 (57.4)	38 (56.7)	0.939

GP, general practitioner.

121 women responded to this question.

the emerging safety data¹⁰ and confirm the long-term safety and benefit conferred by vaccination of pregnant and breastfeeding women, in addition to enabling targeted public health campaigns outside of pandemic times.

Our study suggests that public health strategies aimed at increasing vaccination uptake among pregnant women should adopt bimodal approaches. Firstly, there should be education for all maternity care providers emphasising the importance of brief intervention, and routine recommendation for vaccination during pregnancy. Secondly, there should be provision of public health resources that specifically target and support decision making in pregnant and breastfeeding women. Protection of the unborn baby is undoubtedly a key concern of pregnant women regardless of vaccination intention or status as confirmed by this study.

The active exclusion of pregnant women from the initial phase II/III clinical trials for vaccine and therapeutic drug trials has delayed the ability of national scientific safety advisory groups to provide timely guidance. International maternity specialists have called for the safe inclusion of pregnant women in clinical trials for vaccines^{21,22} and therapeutic drugs which would allow recommendations to be made for this unique cohort in a way that is safely aligned with general population advice.

Our findings suggest that vaccine delay and hesitancy are prevalent among the antenatal population in WA. Pregnant women are often concerned about vaccine safety, particularly with respect to long-term offspring outcomes highlighting the

importance of adequate studies of vaccine safety in pregnancy facilitated by inclusion of pregnant women in phase II/III clinical trials and routine data collection allowing phase IV trials. Pregnant women are influenced both positively and negatively by their maternity care providers, indicating the importance of education for these providers in improving information provision and vaccine recommendation. At every antenatal visit, unvaccinated women should be supported with information, professional vaccination recommendation and a forum to discuss and ask questions to support positive vaccination choices.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Patient survey: COVID-19 vaccination intentions and uptake in pregnant women at King Edward Memorial Hospital / Osborne Park Hospital.