

Weighing up risks – Vaccine decision-making in pregnancy and parenting.

ABSTRACT

Background

Immunisation is universally accepted as one of the most significant health initiatives in recent times. However, vaccine hesitancy is increasing in Australia and other high- and middle-income countries. There is evidence to suggest that many parents, even those who elect to immunise, may have a degree of vaccine hesitancy. The recommendation of a healthcare professional is a predictor for vaccine uptake.

Aim

The purpose of this study was to explore the values, beliefs and choices made by vaccine hesitant parents and pregnant women, regarding their decision not to vaccinate their child or children. The aim being to determine the factors that influence this decision making and to give a voice to vaccine hesitant parents.

Methods

A qualitative exploratory online survey of 106 vaccine hesitant parents and pregnant women was conducted in 2021. The survey utilised closed and open-ended questions.

Findings

Pregnant women and parents obtained most of their immunisation education from nurses, midwives, and general practitioners. Vaccine decision-making was however, influenced by multiple factors including vaccine safety concerns, the sources of information accessed, and a previous negative immunisation experience. Other influential factors included the use of alternative therapies, diet, and lifestyle factors.

Discussion

Along with general practitioners, nurses and midwives are a popular, respected and a vital source in the provision of accurate and timely immunisation education.

However, further education is required at an undergraduate level to adequately prepare them for their role of listening to and educating vaccine hesitant pregnant women and parents.

Key Words

Vaccine; vaccination; decision-making; pregnancy; parents.

Statement of Significance

Problem	What is known	What this paper adds
Vaccine hesitancy in parents and pregnant women.	<p>Vaccine hesitancy is increasing in middle- and high-income countries.</p> <p>Maintaining high levels of immunisation is vital for herd immunity.</p> <p>There is no reliable way to measure uptake of pregnancy vaccines including COVID-19 which is currently suboptimal.</p> <p>The recommendation of a healthcare professional is a predictor for vaccine uptake.</p>	<p>Pregnant women and parents receive most of their immunisation information from midwives, nurses and general practitioners who are a trusted source of immunisation information.</p> <p>Vaccine safety concerns are a major factor in vaccine compliance by parents and pregnant women including anxiety about vaccine contents.</p> <p>Vaccine decision-making is influenced by multiple factors including information sources, vaccine safety concerns, previous negative experiences and are often accompanied by alternative lifestyle factors.</p> <p>Vaccine hesitant pregnant women and parents are unlikely to accept a COVID-19 vaccine in pregnancy or for their child under 12 years.</p>

		Vaccine hesitant parents reject the expression “vaccine hesitant” in favour of “Pro-Choice”.
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Weighing up the risks – Vaccine decision-making in pregnancy and parenting.

1. Introduction

Immunisation is universally accepted as one of the most significant public health initiatives in recent times. Childhood vaccines alone have been credited with saving 2-3 million lives annually ¹. However, vaccine hesitancy is a growing problem in middle - and high-income countries and has recently overtaken vaccine access as the primary barrier to immunisation uptake. Vaccine hesitancy has been described as the reluctance or refusal to vaccinate despite the availability of vaccines. This problem was included in the *Ten threats to global health* by the World Health Organisation (WHO) in 2019 ¹. Australia has high levels of childhood vaccine uptake, with national coverage reported at 95.09% for five-year-old children ². However, this figure conceals areas of low vaccine uptake and subsequent low herd immunity which can result in the resurgence of disease ³. Immunisation in Australia is not mandated; however, the no job – no pay and no job - no play legislations were introduced in 2016 and 2017 respectively as a financial incentive to encourage families to immunise children ⁴. Whilst successful, this legislation has created considerable anger amongst vaccine hesitant families and had a greater impact of families from lower socio-economic areas. Vaccine hesitancy remains evident in all areas of immunisation including pregnancy immunisation which continues to reflect suboptimal uptake ⁵.

In Australia, the COVID-19 guidelines and recommendations in pregnancy and breastfeeding became available on completion of the data collection phase of this

study. COVID-19 Vaccines became available in March 2021 to healthcare professionals and selected vulnerable groups and eventually were included in schedule for pregnant women in August 2021 ⁶. There are currently three vaccines recommended for pregnant women in Australia, including, Bordetella Pertussis (whooping cough), influenza and COVID-19 was added to the recommendations in June 2021 ⁷. Additionally, the risks to pregnant women and their unborn child from COVID-19 became more evident and widely known in mid to later 2021. Pregnancy places women at increased risk of morbidity and mortality from vaccine preventable diseases and whilst there are limited studies on the impact of COVID-19 in pregnancy, the virus is thought to exacerbate these risks ^{8,9}. However, antenatal immunisation uptake remains suboptimal in Australia, with only approximately 80.50% uptake for Bordetella pertussis (Whooping Cough) and 51.70% for Influenza. No data is currently available on the uptake of the COVID-19 vaccine ^{10,11}. Pregnancy is also a time of high information needs and when vaccine decision-making begins. With evidence to suggest that nearly half of Australian parents have concerns about the safety and the necessity of vaccines, pregnancy is the optimal time to discuss vaccine concerns ^{12,13}.

A review of the literature revealed that multiple factors were influential in the decision to accept or reject vaccines ¹⁴. These include vaccine safety concerns and perceived risk, the availability of accurate immunisation information, alternative views, and access to other influences including social media, religion, friends, and family ^{13,15,16}. Parents are highly anxious about the perceived risks of vaccination and may underestimate the risk of harm associated with vaccine preventable diseases ^{12,17}.

Parents have expressed a desire for simple balanced information about vaccines including pregnancy and childhood vaccines ¹⁸. Evidence suggests that healthcare professionals have a critical role to play in education, information provision, responding to the concerns of parents and pregnant women and the promotion of immunisation ¹⁹. However, many healthcare professionals have reported feeling

challenged by encounters with vaccine hesitant parents, having the potential for a breakdown in communication and translation of evidence ^{13,20-23}. If Healthcare Professionals are not equipped to effectively communicate with parents, this presents a lost opportunity for developing trust and providing evidence-based information. The potential impact of poor therapeutic relationships and missed opportunities to promote immunisation may result in increased vaccine hesitancy with its potential for serious sequelae, particularly during and in the aftermath of a global pandemic. The purpose of this study was to explore the values, beliefs and choices made by vaccine hesitant parents and pregnant women, regarding their decision not to vaccinate their child or children. The aim being to determine the factors that influence this decision making and to give a voice to vaccine hesitant parents. Additionally, COVID-19 vaccines became available for adults and were included in the schedule for pregnant women in 2021, hence, questions about this were included. Further research on vaccine hesitancy for pregnant women and parents would add to the existing body of knowledge in this area.

2. Method

A qualitative exploratory online survey was conducted on vaccine hesitant parents and pregnant women (n=106) as part of a larger study, using an on-line survey via Qualtrics^{XM}.²⁴. This methodology was chosen as vaccine hesitant parents have shown a preference for an online environment, where they can choose to participate in an environment free of criticism ^{15,25,26}. The survey included a combination of closed and open-ended questions (Additional File 1).

Convenience sampling was used to recruit pregnant women and parents who identified as vaccine hesitant. The survey was promoted by a paid advertisement placed on a research specific Facebook page. The Facebook page was entitled "Vaccine hesitancy in pregnancy and early childhood". The dissemination of this Facebook page was not limited geographically, however participants were

predominantly Australian with two participants from the United States of America. Prior to dissemination, the survey was piloted on parents and pregnant women (n=29) to assess readability and usability. Survey dissemination began in January 2021 and remained live until June 2021. The survey was developed by the primary author (SS) in consultation with all other authors (AD, NS, LL) with questions based largely on the results of an Integrative Literature Review carried out in 2021¹⁴. The survey included 30 questions with a combination of demographic information, attitudes to immunisation, information sources, influences, and opinions on COVID-19 (Additional File 1).

Quantitative analysis was conducted using IBM Statistical Package for Social Sciences (SPSS) (version 25). This study compared the incidence of vaccine hesitancy with SEIFA (Socio economic index for areas) scores according to Australian postcodes using an analysis of variance (ANOVA)²⁷. Open ended data were obtained from thirteen questions (Additional File 1). Data analysis was performed initially by the principal author (SS). Investigator triangulation took place between the principal author and all other authors (AD, NS, LL). Regular meetings and ongoing discussions took place during the analysis phase to resolve any conflicts. Qualitative data were analysed using inductive thematic analysis and manual coding was conducted²⁸. Ethics approval was obtained through Flinders University Research Ethics Committee, Project Number 2464. The principles of beneficence, dignity and justice were assured by ensuring participant informed consent, anonymity, respect, and access to counselling if required.

Data analysis of the open-ended responses was undertaken manually, using thematic analysis²⁸. This study adopted an inductive approach as the aim was to build new knowledge. Thematic analysis treats the data as a mass of information which is broken down and synthesised into small but significant pieces under themes. Initial thematic analysis was undertaken by all authors to ensure accuracy of themes. The findings are presented in three sections including, parenting, pregnancy, and COVID-19.

3. Findings

Data were obtained from (n=106) participants who stated they were not in favour of immunisation or were unsure. Of the total participants (n=106), 70% self-reported that they were unimmunised and 30% were partially immunised. This was a personal assessment of immunisation status and not specific to any individual vaccine.

Specific gender was not a prerequisite for participation in the survey nor was it asked as opinions were valued from both mothers and father. Some participants identified as being pregnant (15%) with participant ages ranging from 18-29 years (10%), aged 30-39 years (42%), aged 40-49 years (33%) and aged 50 years and over (15%).

Table 1 – Demographics

Country of residence	Number	Australian State of residence	Number of participants	Age of participants	Percentage
Australia	104	SA	38	18-29	10%
USA	2	QLD	19	30-39	42%
		VIC	19	40-49	33%
		NSW	18	50+	15%
		WA	10		
Total	106		104		100%

Data were obtained from participants across 85 Australian postcodes; however, two participants were from the United States of America and were unable to be included in this analysis of Australian postcodes but were included in all other analysis. Data were used to compare the self-reported level of childhood vaccine hesitancy with socio-economic status according to the Australian SEIFA rankings²⁹. Analysis was conducted using IBM Statistical Package for Social sciences (SPSS) (version 25) to compare levels of vaccine hesitancy with SEIFA score according to postcodes using

an analysis of variance (ANOVA). Whilst the results were not significant, they demonstrated a trend for vaccine hesitant parents and pregnant women to reside in areas of higher socio-economic status $F(1,82) = 2.50$, $p = 0.118$ ³⁰. These results could indicate that the No Job - No pay legislation introduced by the Australian government had a greater effect on people of lower to middle economic status. The legislation was described as “taking advantage of lower socioeconomic families and a “coerced choice” (Participant 72). For some families (n=7) the No Job – No Pay legislation resulted in the loss of a substantial second income for a minimum of five years or until a child commenced school.

This survey had a strong focus on personal immunisation beliefs and practices, as well as factors that influenced decision-making. Of the 106 surveys completed (88%) clearly stated that they were not in favour of immunisation in general, whilst (12%) identified as undecided. Thematic analysis was conducted on data obtained from open ended questions and the findings are presented in three sections which include parenting, pregnancy and COVID-19. The themes are presented through short descriptive passages as a narrative strategy to reflect the voices of the participants.

Parenting

Data were obtained from parents and impending parents and includes their values, beliefs and choices. Eleven initial themes were identified from the data and included: concerns about vaccine contents; vaccine reactions; insufficient information; corruption in health and pharmaceutical companies; pro-choice; risk versus benefits; financial constraints; too many vaccines-too early; vaccines being unnecessary; no adverse event liability and alternative practices. These initial themes were subsumed into one major theme entitled personal immunisation beliefs and practices and four sub themes including: vaccine safety concerns; mandated vaccines; pro-choice and alternative practises developed.

3.1 Personal immunisation beliefs - Vaccine Safety Concerns

The sub theme of Vaccine safety included concerns about vaccine contents, general safety concerns and legal issues. Vaccine safety was a major consideration for both pregnant women and parents. Concerns raised largely followed the risks versus benefits debate with many participants rating the risks associated with the side effects of vaccines to be far greater than the risks associated with acquiring diseases. Many participants (91%) strongly agreed that vaccines were more dangerous than the diseases they protected against whilst a small number (9%) disagreed or were unsure. For example, one participant stated,

There is a reason for concern regarding all vaccines. All vaccines should be considered dangerous medical interventions. When dealing with otherwise entirely healthy members of the population, there must be transparency about the risk/benefit. It should not be one size fits all, nor should vaccination be dismissed as "safe and effective" without due attention given to the reality of side effects (Participant 70).

Additionally, many participants (94%) raised concerns about vaccine contents. One participant stated, *"I believe many vaccines contain substances that are unhealthy"* (Participant 15). Vaccine reactions including vaccine injury, insufficient testing of vaccines and the timing and number of vaccines given to children were also raised by multiple participants (92%). One participant stated that *"There are way too many and they are given too soon"* (Participant 65). Another participant discussing immunisation stated that *"It has not been proven safe, effective nor for the benefit of society"* (Participant 37). Parents and pregnant women also expressed concerns about most scheduled vaccines as well as Vitamin K (Konakion), a vitamin supplement given at birth to prevent vitamin K deficiency bleeding (VKDB) of the newborn, a condition which can cause bleeding into the brain and is at times fatal

^{31,32}. Concern was also raised about the new mRNA (Messenger Ribonucleic Acid) COVID-19 vaccines, whilst others had more general concerns. Despite this, most participants strongly agreed or agreed that they knew enough about the risks and benefits of immunisation (88%), whilst a small number disagreed, strongly disagreed or were unsure (12%) Similarly, participants also expressed concerns about the apparent declining health of children *“Health decline in children, seeing first-hand vaccine injury, the ingredients are terrifying”* (Participant 63). Additionally, the issue of personal immunity was also raised by one participant who stated that *“Our bodies have their own way of creating immunity and adding dangerous chemicals only creates problems to our systems”* (Participant 26).

Evidence also suggests that negative immunisation experiences can adversely affect future decision-making ³³. Participants were asked whether they or someone they knew had a negative experience during or after an immunisation which may have affected their decision to reject vaccination. A large number answered yes to this question (90%) whilst only a few (10%) answered no. This question also included an open-ended component which sought more information. Participants (n=23) included a wide variety of responses to this question ranging from experiences of seizures, Kawasaki disease, autism, SIDS (sudden infant death syndrome), Guillain Barre Disease and death.

My much younger cousin suffered seizures following her MMR vaccinations which resulted in permanent brain damage. My sister in the 70's had an anaphylactic reaction to her infant vaccinations which prompted our GP to advise my parents not to vaccinate me (Participant 103).

Other issues raised by several participants (n=15) were the legal issue of informed consent, the effect of current legislation and the feeling that vaccines have been mandated.

3.2 Personal immunisation beliefs - Mandated Vaccines

The sub-theme of Mandated Vaccines included concerns about insufficient information being provided about vaccine contents, hence not achieving the legal requirement for informed consent. Other issues raised included corruption in both the health and the pharmaceutical industry, the lack of liability and poor adverse event reporting. Several participants (30%) believed that there was “*insufficient safety data*” (Participant 72) and definitely “*...not enough information given to make informed consent*” (Participant 7). Whilst another participant asked, “*why have the vaccine companies been made exempt from liability?*” (Participant 102). Similarly, the “*...lack of proper reporting on adverse reactions*” were raised on several occasions (Participant 38). The issue of the No Job – No pay and No Job – No Play legislation was also raised on several occasions with one participant referring to the legislation as a “*coerced choice*” (Participant 37).

“I am in favour of one having the choice to vaccinate, without mandate or coercion from the government by withholding family payments or excluding my child from certain centres/activities (Participant 10).

I immunise ... *“For childcare purposes but really don’t want to, but as a single mum on low income I don’t have much choice if I wish to return to work sooner than 5 years (school age)” (Participant 89).*

Another stated that they were delaying all vaccines until “*... they can make the choice themselves as consenting adults*” (Participant 90).

3.3 Personal immunisation beliefs - Pro Choice

The sub theme entitled Pro-Choice related to a general resistance to the term vaccine hesitant. This sub theme was also linked strongly to an individual's right to decide what, if any vaccines were right for their family. *"I believe everyone has the right to choose whether themselves or their children are vaccinated"* (Participant 15). Resistance to the term "vaccine hesitant" became apparent in responses to this question. Several participants (n=15) expressed frustration and irritation at the term "vaccine hesitant" and its suggestion that they were undecided or hesitant about their decision not to vaccinate their children. One participant made her point by stating *"We are not hesitant; we want to be able to make an informed decision and be Pro-Choice"* (Participant 47).

3.4 Personal immunisation beliefs - Alternative influences

Parental decision-making was influenced by many factors including those already discussed. Factors evident in previous studies, were the use of alternative practises to support health and wellbeing. Participants were asked about alternative practices used to support their child's immunity. Many responses (n=92) highlighting a variety of practices were received. These included alternative therapies, lifestyle factors, dietary practices and supplements and public health factors. Homeoprophylaxis, or the use of highly diluted preparations to prevent infectious diseases was mentioned by some participants (n=15) as was long-term breastfeeding³⁴.

Homeopathic immunisation, healthy lifestyle, and diet. We ensure my daughter is kept home if unwell in case she catches a disease so she can recover and not spread to vulnerable people (Participant 47).

This survey demonstrated the variety of alternative health practices used by parents to support their child's wellbeing. In the next phase of the survey the focus shifts to pregnancy and the decisions made at that time.

Pregnancy

Participants were asked what vaccines they would accept in pregnancy. Most stated (91%) that they would accept no vaccines during pregnancy, whilst a small number stated that they would accept the pertussis vaccine (whooping cough) (5%), one stated that they would accept the influenza vaccine, and some (4%) stated that they were unsure. Of the 106 participants, 69% were advised by a healthcare professional to be immunised during their pregnancy, whilst over 31% received no recommendations or were unsure. Many stated that their general practitioner provided immunisation information during pregnancy (33%), whilst a similar number received information and advice from their nurse or midwife (32%). Only a small number stated that they received information from an obstetrician (16%). Many participants also stated that they relied on scientific evidence (72%). Medical professionals, including midwives, nurses, general practitioners and to a lesser extent, obstetricians, were a popular and trusted source of immunisation information. The internet and social media also featured prominently in information sources. Friends and family were also influential. Most participants stated that their source of immunisation information was chosen based on perceived soundness and trustworthiness. This was despite those sources ranging from social media platforms to internet-based websites and allied health practitioners. One participant stated, *"I can't remember anyone giving me (immunisation) information"* (Participant 65). Another stated *"I was asked if I wanted to get the vaccines by both my GP and Midwife, I explained that I would not be and gave my reasons. As they felt that I am making an informed decision they respected my choice"* (Participant 63).

Participants were invited to provide information on any additional sources of information they sought during pregnancy. These included information from specialists, scientific sources, academic journals, inserts from vaccine packets, and government websites. However, many participants (n=94) included non-traditional information sources such as media and allied health and personal sources. Several participants cited “*academic studies and peer reviewed papers*” and “*vaccine inserts*” as important sources of information. Additional information sought in pregnancy ranged from none to considerable self-research.

I have always been open to getting information from both sides and weighing up the risks (Participant 37).

Pregnancy has been shown to be a time of high information needs, however, it was clear that in just over a third of cases, this information was not being provided resulting in the need to seek information from other sources.

COVID-19

This research was undertaken during a Global Pandemic and COVID-19 vaccines were under development and testing throughout data collection. Vaccines became available for adults and were included in the schedule for pregnant women in 2021⁶. For this reason, questions were asked about COVID-19 and the impact on both pregnant women and parents. At the time that this data was collected (January to June 2021) most participants (90%) believed that the current COVID-19 pandemic was of minimal risk to their children whilst a small number (4%) agreed it was a risk or were unsure (7%). Participants were asked whether they would give their child a COVID-19 vaccine when one became available, and all stated they would not give the COVID-19 vaccine. Participants expressed greater concern about the vaccines than potential risk of COVID-19 disease. One participant cited a “*0.0006% risk of children catching the disease*” (Participant 103) whilst others were very concerned about the

new mRNA (Messenger Ribonucleic Acid) technology in use for some vaccines. All participants (100%) surveyed stated they would refuse a COVID-19 vaccine in pregnancy. Distrust in science was expressed by one participant who stated:

Distrust in the system. No animal trial phases for COVID vaccine. No long term studies. No children in test data. Already 329 deaths reported in VAERS from it let alone disabilities listed. So no thank you to being a guinea pig when there's such a high recovery rate and we focus so highly on keeping our bodies healthy to be able to fight recoverable viruses (Participant 38). (VAERS is the vaccine adverse event reporting system in use in the United States of America).

The refusal of most antenatal vaccines including the rejection of COVID-19 immunisation by vaccine hesitant women in pregnancy places both women and their infants at considerable risk of morbidity and mortality⁸⁻¹⁰.

4. Discussion

This exploratory survey included mainly participants who held anti-vaccination beliefs or were undecided and there was a trend for participants to reside in middle to high income areas. Most significant was the number of participants (91%) who would accept no vaccines during pregnancy. Thus, placing both women and infants at risk of severe morbidity and mortality⁸⁻¹⁰. Also significant was the 31% of participants who received no recommendation to be immunised from a healthcare professional¹⁶. This is a lost opportunity to discuss concerns and/or receive valuable advice during pregnancy. The inclusion of a reminder in state and territory pregnancy handbooks may result in improved antenatal immunisation education. There is also no way of accurately measuring antenatal immunisation uptake as pregnancy is not included as a reason for immunisation in the Australian Immunisation Register or in all states perinatal outcome statistics^{35,36}. The lack of accurate antenatal data makes planning for immunisation programmes difficult.

The most cited information sources were general practitioners, nurses and midwives (65%), whilst only 16% cited obstetricians as an information source. This is despite 21.60% of women receiving pregnancy care from an obstetrician in 2017 ³⁷.

Pregnancy is a time of high information needs and a time when vaccine decision-making often commences ¹². This study confirmed that over 70% of participants began thinking about immunisation during their pregnancy. This is the optimal time to provide information about both pregnancy and childhood immunisation ¹⁶. Of those who did receive advice, nurses and midwives were cited as the most trusted source of immunisation information in pregnancy (96%). Along with general practitioners, midwives and nurses, play a significant role in the provision of antenatal immunisations. However, nurses and midwives currently receive minimal under-graduate immunisation education. Studies have shown that Australian midwives receive on average, less than four hours of immunisation education in a three-year degree with many reporting inadequate preparation for their role ^{20,38,39}.

A further area of concern raised by parents was the lack of information provided by healthcare professionals which affected their ability to give informed consent. General practitioners also featured as an important source of immunisation information. However, only those women who elect shared care or a midwifery model of care, will have access to these important sources. Additionally, women who elect an obstetric model of care, could arguably remain underinformed ⁴⁰.

Participants (94%) expressed concern about vaccine safety including vaccine contents, however, did not differentiate between vaccines and vitamin K ⁴¹. A large number (90%) also reported experiences of negative immunisation experiences affecting both themselves and others close to them. These factors combined with considerable distrust of "Big Pharma" resulted in high levels of anxiety which negatively impacted their immunisation decision-making. The use of alternative therapies was also evident in this survey and whilst not considered to be a direct

cause of vaccine hesitancy, was associated with a lifestyle choice which supported wellbeing and immunity.

Finally, an issue of concern was the term “vaccine hesitant”. Participants objected strongly to this term and were of the opinion they were not “hesitant” but were certain that their decisions were informed, although subject to constant reassessment by some. Participants preferred the term “Pro-choice” as some were happy to receive travel vaccines and other vaccines if vaccine safety were improved. Some families who were affected by the no job – no pay and no job-no play legislation, immunised only enough to continue to receive government support and access to childcare and kindergarten for their children ⁴².

5.Limitations

The data used in this study were collected online with participants recruited from a Facebook page established for the purpose of research. Whilst two participants were international, the majority lived in Australia, hence the results of the study cannot be generalized to other countries. The small number of participants also contribute to the results not being generalisable. Additionally, a limitation of this study is the lack of a question regarding gender. The decision was originally taken that gender would not be relevant, hence both mothers and fathers were included in this study. However, throughout the progress of the study it become clear that knowledge of gender may have contributed to the outcome of the study, hence this is a limitation. A further limitation of this and any study investigating antenatal immunisation uptake in Australia, is the absence of accurate pregnancy immunisation statistics. This can be attributed to the absence of “pregnancy” as a reason for immunisation on the Australian Immunisation Register (AIR) and the lack of immunisation status currently included in some state and territory pregnancy outcome statistics ^{35,36}.

5. Conclusion

This survey provided valuable information on the beliefs and understandings of vaccine hesitant pregnant women and parents. A key factor in vaccine-decision making is the source of information received. Nurses, midwives and general practitioners are a trusted source of information however, there is a clear need to develop an enhanced syllabus to support nurse and midwifery under-graduate immunisation education across Australian universities, including in areas such as vaccine hesitancy, and motivational counselling. There is also a need for a reminder in the all Australian state and territory pregnancy handbooks to discuss both pregnancy and childhood immunisation at the first pregnancy visit ⁴³. This survey also revealed considerable concern regarding COVID-19 vaccines in pregnancy and early childhood. This is a new vaccine, and more information should be provided to parents about the benefits of this vaccine, particularly in pregnancy. This study has shown that many vaccine hesitant parents and pregnant women are from areas of middle- to high-income, hence immunisation promotion activities should be focussed in this area. This study has also revealed that a previous negative immunisation experience influenced vaccine decision-making. It has become clear that adverse events, even minor ones must not be overlooked as potentially influential in future choices. Finally, concerns over vaccine safety are a major influence on vaccine uptake and this is an area that needs support with accurate and timely information in pregnancy, along with assistance to work through the risks and benefits debate.

6. Recommendations

1. Development of an enhanced syllabus to support nurse and midwifery under-graduate immunisation education across Australian universities.

2. Inclusion of a reminder in the Pregnancy Handbook of all Australian States and Territories to discuss both pregnancy and childhood immunisation at the first pregnancy visit (see reference for example) ⁴³.
3. Inclusion of pregnancy as a reason for immunisation in the Australian Immunisation Register (AIR) to ensure access to accurate data.
4. Inclusion of immunisation status in all pregnancy outcomes statistics to provide accurate data on perinatal outcomes associated with vaccine status.
5. Immunisation education and promotion must be universal but should include families from middle- to high-income settings for greatest effect.

6. Conflict of interests

The authors declare that they have no known conflict of interests or competing financial interest of personal relationships that could have appeared to influence this paper. The first author is in receipt of the Flinders University Research training programme and the Healthy Development Adelaide and Channel 7 PhD Excellence Award.

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Exploratory Survey

Q2 Do you consent to take part in the survey?

- Yes (1)
- No (2)

Q3 Are you over 18 years?

- Yes (1)
- No (2)

Q4 Please select your age range.

- 18-29 years (1)
- 30-39 years (2)
- 40-49 years (3)
- 50+ years (4)

Q5 Where do you live?

- Country (4)

- Postcode/Zip code (5)

Q6 Are you fully immunised?

- Yes (1)
- No (2)
- Unsure (3)

Q7 Is your partner fully immunised?

- Yes (1)
- No (2)
- Unsure (3)

Q8 Are you in favor of vaccination?

- Yes (1)
- No (2)
- No, can you tell us why?

- Undecided (3)
- OPEN ENDED DATA

Q9 Are you currently pregnant?

- Yes (1)
- No (2)

Q10 Were you advised to have vaccinations during your pregnancy?

- Yes (1)
- No (2)
- Unsure(3)
- OPEN ENDED DATA

Q11 Who gave you information about immunisation?

- General Practitioner (1)
- Obstetrician
- Midwife (2)
- Nurse (3)
- Other, please tell us who?
- No one gave me information (6)
- OPEN ENDED DATA

Q12 What vaccines would you accept in pregnancy?

- Whooping Cough (2)
- Influenza (3)
- None (5)
- Unsure
- OPEN ENDED DATA

Q13 Did you receive any information from a health professional about childhood immunisations during your pregnancy?

- Yes (1)
- No (2)
- Unsure (3)

Q14 Did you start thinking about your child's/children's immunisation during your pregnancy?

- Yes (3)
- No (4)
- Unsure (5)

Q15 During your pregnancy, did you seek different opinions on the risks and benefits of immunisation?

- Yes
- No

- Unsure
- OPEN ENDED DATA

Q16 Are you the parent or caregiver of a preschool aged child?

- Yes (1)
- No (2)

Q17 What ages are your children?

- Birth-1 year (4)
- 1 year - 2 years (5)
- 2 years - 3 years (6)
- 3 years to 5 years. (7)
- 5 years and greater

Q18 Are any of your children not immunised?

- Yes (1)
- No (2)

Q19 Are any of your children partially immunised?

- Yes (1)
- No (2)

Q20 Are you considering immunising your children but delaying it?

- Yes (1)
- No (2)
- Unsure (4)

Q21 I know enough about the risks and benefits of immunisation.

- Strongly Agree (1)
- Agree (2)
- Unsure (3)
- Disagree (4)
- Strongly Disagree (5)
- OPEN ENDED DATA

Q22 Do you believe that vaccines are more dangerous than the childhood diseases?

- Yes (1)
- Which vaccines are you most concerned about?
- No (2)
- Unsure (3)

Q23 What were the sources of immunisation information that you received?

- General Practitioner (1)
- Midwife (2)
- Nurse (3)
- Internet (4)
- Social Media (5)
- Friends/family (6)
- Scientific evidence (7)
- Other If you used a website or social media page or blog can you tell us which one?
- OPEN ENDED DATA

Q24 What were your sources of information not to vaccinate? OPEN ENDED DATA

Q25 Can you tell us why you chose this information? OPEN ENDED DATA

Q26 Have you or someone you know had a negative experience during or after an immunisation which may have affected your decision to not vaccinate?

- Yes (1)
- No (2)
- Can you tell us about this?
- OPEN ENDED DATA

Q27 What alternative practices, if any, do you use in place of vaccination?
Please describe? OPEN ENDED DATA

Q28 Do you believe that the current COVID pandemic is a risk to your children?

- Yes (3)
 - No (4)
 - Unsure (5)
 - Can you tell us why you believe this?
 - OPEN ENDED DATA
-

Q29 If there was a COVID vaccine for children, would you choose to have your children vaccinated?

- Yes (1)
- No (2)
- Unsure (3)
- OPEN ENDED DATA