



# An exploration of midwives' role in the promotion and provision of antenatal influenza immunisation: A mixed methods inquiry

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## ABSTRACT

**Problem:** No South Australian study has previously investigated the role of midwives in the promotion and provision of antenatal influenza immunisation.

**Background:** Influenza acquired in pregnancy can have serious sequelae for both mother and foetus. Recent studies have demonstrated that influenza vaccine in pregnancy is both safe and effective. Despite this, evidence suggests that vaccine uptake in pregnancy is suboptimal in both Australia and worldwide.

**Aim:** The aim of this study was to investigate the role of midwives in the promotion and provision of antenatal influenza vaccine and, to provide a statistical and thematic description of the barriers and enablers midwives encounter.

**Methods:** This mixed method study incorporated a cross sectional on-line survey and in-depth interviews conducted with midwives, employed in urban and regional South Australia.

**Findings:** Quantitative data were available for 137 midwives and 10 midwives participated in the interviews. Recruitment for the interview phase was through the last question on the survey. Whilst all midwives indicated that education and vaccine promotion were part of their role, immunisation knowledge varied between Registered Nurse/Midwives (RM/RN) 80% and Registered Midwives (RM) 48.90% ( $p = 0.001$ ). Quantitative data showed that only 43% of midwives felt sufficiently educated to provide the vaccine. Midwives who had received formal immunisation training were more likely to recommend the vaccine 93.7% ( $p = 0.001$ ). Qualitative data confirmed these results and identified the lack of immunisation education as a barrier to practise.

**Conclusion:** Midwives identified an immunisation knowledge deficit. Midwives who had received immunisation education were more likely to actively promote and provide the vaccine to pregnant women. These findings indicate the need for more immunisation education of midwives in both tertiary and practice settings.

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### Statement of significance

The role of midwives in the promotion and provision of antenatal influenza vaccine is unknown.

### Problem

The role of midwives in antenatal influenza promotion and provision is unknown.

### What is known?

Serious sequelae exist for mother and baby when influenza is acquired in pregnancy. The vaccine is safe and effective.

Healthcare provider recommendation is a predictor in the uptake of the vaccine.

### What this paper adds?

Evidence that less than half the midwives felt comfortable providing the vaccine. An understanding of the knowledge and practise deficits that exist. An understanding of the enablers and barriers that midwives identify in the promotion and provision of Influenza Vaccination.

## 1. Introduction

Influenza is a highly contagious disease which, if acquired in pregnancy, can result in significant morbidity and mortality of both pregnant women and their foetus. This may include severe

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respiratory infection, congenital abnormalities, spontaneous abortion, premature birth, low birth weight and death in both mother and baby [1]. Pregnant women are particularly susceptible to respiratory infections due to their immunosuppressed state; however, evidence suggests that there is a far higher risk of serious sequelae in acquiring influenza, than the currently circulating Novel Corona Virus (COVID 19), in pregnancy. Current evidence suggests that the risk of COVID 19 in pregnancy appears no higher than in non-pregnant adults [2]. However, whilst little is known on this new virus and limited data exists there is some evidence to suggest that acquiring COVID 19 in the third trimester may involve risks [3]. Morbidity and mortality of pregnant women has been high in influenza epidemics, with evidence suggesting that up to 50% of women of childbearing age who have died in epidemics were pregnant [4]. Additionally, deaths of pregnant women in both Chicago and Minnesota in 1918 and 1957 respectively, were between 20–27% of the affected population [5]. More recently, during the 2009 H1N1 pandemic in New South Wales, 28% of women admitted to Intensive Care Units were pregnant or immediately post-partum (Australian Influenza Immunisation Update, 2009). The United States of America reported 4693 pregnancy related deaths between 1998–2005. Of these, 78 women died from influenza or pneumonia [6].

Pregnancy and early infancy are a time of relative immune depression. This is thought to be due to changes in cell mediated immunity combined with physiological changes required to maintain a pregnancy [1,7,8]. Infants are also greatly at risk due to their immature immune system [9].

Influenza is considered a priority disease by the World Health Organisation [10]. In 2012 the WHO released a position statement stating that pregnant women should be the highest priority for seasonal influenza vaccination [11]. Maternal immunisation in pregnancy can provide dual benefits, by reducing the disease burden for both mother and baby. With a single immunisation, two high priority groups (pregnant women and babies) can be protected from the disease for the influenza season and up to six months of age for the baby [12]. A review of the literature revealed that the vaccine is both safe and effective to administer in any trimester of pregnancy [7,8].

Despite this, immunisation rates in pregnancy are reported to be low in both Australia and overseas [13–15]. Western Australian research has reported rates as low as 40% in 2013 [16]. A Victorian study reports 39% of pregnant women were vaccinated between July 2015–June 2017 [17]. A more recent South Australian study revealed that immunisation rates were able to be raised to 76% by utilising a midwifery led immunisation programme in one hospital [18]. This poor uptake of the inactivated influenza vaccine is thought to be caused by several factors ranging from: low knowledge and the need for further education amongst health professionals; and women's lack of knowledge in this area [16,17,19]. In Australia several on-line courses are available to both RN and RM on immunisation knowledge and provision and these courses are a way of closing the knowledge gap which exists for some and provides a basis for immunisation accreditation in some states [20,21].

There is currently no reliable and accurate method of ascertaining the exact numbers of pregnant women who receive influenza immunisation. This is despite the introduction of the Australian Immunisation Register (AIR) in 2016 [22]. The AIR is a lifelong register which has the capacity to provide valuable data. However, the website currently has no ability to record pregnancy state as a reason for immunisation. Additionally, immunisation status has yet to be added to Australian perinatal outcomes databases hence, the data available is neither complete nor reliable.

Studies have shown that maternal knowledge of the risks associated with contracting influenza in pregnancy is low. Few

women are aware of the dangers of acquiring the disease and, they are generally unaware of the danger to their unborn child [23]. Research has demonstrated that a health professional's recommendation is the single most important influence on the decision to accept or reject an immunisation [23]. It has been described as fundamentally important and can overcome a mother's concerns about the safety of a vaccine [23,24]. One Australian study which included a small number of midwives ( $n=6$ ) as well as obstetricians and general practitioners, stated that barriers to immunisation uptake can, in some cases, be attributed to the lack of a healthcare providers recommendation [25]. To date no South Australian studies have fully investigated the role midwives play in the promotion or provision of influenza immunisation in the antenatal period.

The aim of this study was to provide a statistical and thematic description of the barriers and enablers to midwives promoting and providing antenatal influenza immunisation. By adopting a mixed methods approach using a convergent parallel design, this study obtained two different perspectives, one drawn from cross sectional closed ended survey response data and one from open ended semi-structured interviews, thereby providing methodological triangulation [26]. This combination of both worldviews, incorporating statistical trends with thematic analysis, is thought to result in a collective strength of understanding [27].

## 2. Participants, ethics and methods

Ethics approval was obtained through the Women's and Children's Health Network Human Research Ethics Committee South Australia, on the 23rd July 2018. Site specific approval was sought, and approval received from all three Regional Research Governance offices. Survey dissemination commenced on the 22nd August 2018 and was completed on the 25th January 2019. The sites ranged from large birthing hospitals to small regional hospitals located within an 80 Km range of Adelaide, the capital of South Australia.

Once ethics approval was obtained the survey was validated on 12 midwives. The survey was presented to these midwives on two separate occasions. This test–retest process was utilised to ensure reliability of the survey. Responders reported no issues with comprehension of the survey. Whilst the second responses varied in some cases from the first, this was thought to be for several reasons. In some cases, completion of the survey may have elicited a desire for more knowledge. In other cases, responders may change their opinions as a result of completing the survey, or they may become tired or bored on the second occasion, resulting in more haphazard responses. All these things contribute to a slight variation in responses. On completion of the test-retest process, Cohens' Kappa coefficient was calculated. Cohens Kappa is a statistical test which assesses consistency of survey results. By comparing both the test and the retest results interrater reliability can be calculated. In this case a score of  $K=0.804$  was obtained which is considered an excellent result, and denotes an acceptable level of agreement, thereby confirming the reliability of the survey [28].

A mixed methods approach using a convergent parallel design was undertaken for this study, with both quantitative and qualitative data being included [29]. Mixed methods research is a growing trend in both behavioural and social sciences and is thought to provide a better understanding of the research problem than if either of the major paradigms were employed independently [30]. This approach uses a combination of both worldviews, incorporating statistical trends with thematic analysis, and is thought to result in a collective strength of understanding and provide method triangulation [27].

The quantitative study has taken the form of an observational descriptive cross-sectional design utilising convenience sampling to measure the attitudes, knowledge and practises of midwives working in urban and regional Adelaide. Recruitment was via an email sent to midwives employed in four birthing hospitals across urban and regional Adelaide. A link to the survey was embedded within that email using the Qualtrics<sup>sm</sup> research software. Additional recruitment to the survey was conducted via social media advertisements, advertisements in Australian College of Midwives newsletter and via posters placed at universities, community health centres and other sites where midwives were employed. In 2018, there were 2411 Registered Midwives working in South Australia [31]. Response rate was calculated at 5.5% of the population. No reminders were sent as the response to recruitment was considered satisfactory.

The survey was constructed using a combination of questions obtained from various international studies and adapted for an Australian audience [13,32]. Midwives were selected as the focus of this study as there is evidence to suggest that they are the main source of immunisation information to women and their recommendation is vital to the uptake of influenza vaccine [33]. General practitioners and obstetricians were not included in this study as this area has been investigated in previous Australian and overseas studies [32,34,35]. The final survey was piloted on Registered Midwives ( $n = 10$ ) to assess readability, usability and the survey instrument was found to be valid ( $k = 0.804$ ). The survey included 31 questions incorporating a combination of demographic, influenza disease knowledge and its implication in pregnancy and influenza vaccine knowledge. The final question on the survey sought volunteers for the interview phase of the study. The survey also investigated personal immunisation status and midwives' opinions about workplace immunizations. Most significantly the survey explored midwives' understanding of their role in the promotion and provision of antenatal influenza immunisation. The survey instrument utilised a five-point Likert scale. Inclusion criteria required that the participants be midwives registered with the Australian Health Practitioners Regulation Agency [31]. No specific exclusion criteria were applied, to ensure justice by not limiting access to the study. Statistical analysis of the survey data was performed using SPSS (Statistical Package for the Social Science) V25. Pearson's Chi squared ( $\chi^2$ ) test was used to examine associations between categorical variables of interest.

The qualitative aspect of the study did not use a framework but adopted an "operating logic" as described by Thorne et al. [36], which relies on a nursing disciplinary framework to underpin it. This form of qualitative research is not prescriptive, rather it is designed for use in an applied field such as nursing or midwifery. It has been described as a methodological framework with a wide range of options that fits well within a mixed methods approach [37]. Rigour was maintained by using investigator triangulation, a careful audit trail, concurrent collection, coding, and analysis of data. Semi-structured interviews were conducted to investigate the knowledge, attitudes and practices of midwives and to gain an in depth understanding of the midwifery role. Midwives volunteered to be included in this study via the final question in the survey. Two of the ten midwives taking part in the qualitative study had undergone immunisation training and were actively immunising. Five interviews were conducted face to face and five conducted via telephone subject to personal choice of the interviewees. The mean duration of the interviews was 31 min. All interviews were conducted in a time and place nominated by the midwife. The interviews were recorded, and pseudonyms assigned. Interviews continued until data saturation was achieved. This was achieved when no new data was obtained in continuing interviews. contact at a time and place of their choosing. Interviews were conducted by the principal investigator using

probing open-ended questions and prompts to focus the answer. The interviews were audio recorded and transcribed verbatim. Participants assumed a pseudonym for the interview and no identifying features were attached to the transcripts. Transcription and coding were conducted by the principal investigator simultaneously around the time of the interview [28,38]. Once transcriptions were completed and coding performed, a copy of the transcript was forwarded to the participants by mail for the purposes of member checking. Themes were sought from the transcripts using an iterative approach [38]. Initial thematic analysis was performed by the principal investigator. Thematic analysis treats the data as a mass of information, the analysis which takes place breaks the data down into small but significant pieces. In this study due to the small number of participants, a hands-on approach was adopted in order to gain a thorough understanding of the topic. Once familiar with the data, the principal investigator compiled a list of themes. At this time investigator triangulation was employed to confirm the accuracy of the themes. In this study, data analysis took an inductive approach as the study aim was not to test a theory, but to build new knowledge. The ethical principles of beneficence, dignity and justice were met by ensuring anonymity, access to counselling if required, the right to access their transcripts and the right to withdraw at any time.

### 3. Quantitative findings

Data was obtained from 137 surveys and ten interviews of midwives recruited from the final question in the survey. Of the 137 surveys included in data analysis 64.7% were Registered Nurse/Midwives (RN/RM) and 35.3% were Registered Midwives (RM) only. Of these midwives 71.9% were employed within the South Australian public sector with 28.2% employed in the private sector. Most of midwives ( $n = 60$ ) completing the survey had over fifteen years' experience in the role of a midwife (45.5%). Those having worked under five years were the next most prevalent group ( $n = 39$ ) 29.6%, with 15.2% of midwives working between 5–9 years ( $n = 20$ ) and 9.9% between 10–14 years ( $n = 13$ ). Five midwives did not answer this question (Tables 1–3).

RN/RM surveyed demonstrated significantly greater knowledge than their RM counterparts ( $p = 0.001$ ). Also, midwives who had received formal immunisation training demonstrated considerably greater knowledge and a greater likelihood of recommending the vaccine than those who were not trained ( $p = 0.006$ ). Additionally, midwives who were more experienced demonstrated more knowledge than midwives with less than five years' experience, suggesting that a degree of immunisation knowledge was acquired with experience, as opposed to during undergraduate training ( $p = 0.001$ ). However, no apparent difference in knowledge or practise was demonstrated between midwives employed in the public or private setting ( $p = 0.0198$ ). There was also a link between immunisation status (had received the influenza vaccine in the last few months) and professional practice ( $p = 0.048$ ). Midwives who were fully immunised were more likely to recommend the vaccine to women/clients than their unimmunised or under-immunised peers, which suggests that midwife's immunisation status is a predictor of their professional practice ( $p = 0.006$ ). There was also a trend for midwives who had received immunisation training to be fully immunised ( $p = 0.074$ ).

### 4. Qualitative findings

The midwives who volunteered for the semi structured interviews were employed across a variety of work sites ranging from birth and assessment, antenatal, post-natal, Child and Family Health Service (CAFHS) and General Practices (GP). Two of the ten

**Table 1**  
Responses to Online survey questions.

Question	Strongly Agree %	Agree %	Unsure %	Disagree %	Strongly Disagree %
Influenza vaccine is effective in preventing illness ( <i>n</i> = 137).	41.6	39.5	8.0	2.9	8.0
Women are more vulnerable to adverse effects from vaccinations in pregnancy ( <i>n</i> = 137).	8.0	11.6	21.2	37.9	21.3
Influenza vaccine can subsequently cause a person to be sick with influenza ( <i>n</i> = 137).	1.5	2.9	8.0	31.4	56.2
Influenza vaccine may induce preterm contractions ( <i>n</i> = 137).	0.7	1.3	15.9	37.8	44.3
Influenza may cause more illness in pregnant women than non-pregnant women ( <i>n</i> = 137).	28.4	29.2	20.5	13.9	8.0
Pregnant women are more likely to be hospitalized for influenza than non-pregnant women ( <i>n</i> = 137).	37.3	37.9	17.5	5.1	2.2
The foetus may benefit from maternal influenza vaccination whilst in-utero ( <i>n</i> = 137).	28.4	42.3	21.9	5.1	2.3
Influenza immunisation in pregnancy can have a protective effect on the infant in its first year of life ( <i>n</i> = 137).	21.1	38.7	33.5	3.8	2.9
I am concerned about the side effects of the influenza vaccine ( <i>n</i> = 137).	2.9	9.4	7.4	47.5	32.8
Healthcare workers should be immunised against influenza ( <i>n</i> = 137).	55.2	30.8	5.9	5.8	2.3
All vaccines should be avoided in pregnancy ( <i>n</i> = 137).	2.9	0.7	4.4	44.5	47.5
Influenza vaccines should be avoided in pregnancy ( <i>n</i> = 137).	2.2	0.7	8.0	37.9	51.2
It is my responsibility to discuss influenza vaccination with my women/clients ( <i>n</i> = 137).	47.7	43.4	4.5	3.7	0.7
Influenza vaccine is beneficial in protecting against influenza infection ( <i>n</i> = 137).	43.9	45.9	6.5	2.9	0.8
The influenza vaccine is safe if given in pregnancy ( <i>n</i> = 137).	38.7	49.6	9.5	0.0	2.2
I always recommend the influenza vaccine in pregnancy ( <i>n</i> = 137).	35.3	45.7	14.7	2.9	1.4
It is not my responsibility to offer the influenza vaccine.	2.9	12.5	8.8	37.5	38.3
Offering the influenza vaccine to pregnant women is not a midwifery role ( <i>n</i> = 137).	1.5	7.4	8.7	37.9	44.5
I feel equipped to educate pregnant women on influenza immunisation ( <i>n</i> = 137).	24.1	43.8	9.5	21.9	0.7
Midwives are sufficiently trained to provide immunisation ( <i>n</i> = 137).	13.9	29.9	15.4	33.5	7.3
All pregnant women should receive the influenza vaccine ( <i>n</i> = 137).	34.3	32.1	18.3	12.4	2.9
I have given the influenza vaccine to pregnant women in the 2018 influenza season ( <i>n</i> = 137).	16.4	15.5	8.2	25.1	34.8

**Table 2**  
Comparison of knowledge between midwives who were immunisation trained v untrained.

Survey question	Trained %	Untrained %	<i>p</i>
Influenza causes increased illness in pregnancy.	76.2	50.0	0.007#
Influenza results in increased hospitalization of pregnant women.	88.1	70.2	0.044#
Vaccine benefits the foetus.	88.1	59.5	0.002#
Vaccine protects infant.	73.8	52.4	0.034#
Routinely recommend the vaccine.	93.7	74.5	0.001#
Fully immunised.	92.9	83.3	0.074#

Statistical Significance = #This table represents the percentage of trained and untrained midwives. Additional training was either online or as a postgraduate course who correctly answered the questions listed.

**Table 3**  
Comparison of knowledge between midwives who were experienced v inexperienced >5 years.

Survey question	Experienced Midwife	Inexperienced Midwife <5 years	<i>p</i>
Vaccine induces premature contractions	87.8	69.4	0.020#
It is possible to catch the flu from the vaccine	92.2	77.8	0.033#
Foetus benefits from vaccine.	78.9	41.7	<0.001#
Infant benefits from antenatal vaccine.	64.4	44.4	0.047#

Statistical Significance = #.

midwives interviewed had completed on-line immunisation education. The main themes were the role of the midwife; immunisation provision; risks of influenza in pregnancy; attitudes and behaviours to personal immunizations and the enablers and barriers identified by the midwives.

#### 4.1. The role of the midwife

All midwives interviewed demonstrated an understanding of the risks of contracting influenza in pregnancy and most demonstrated an understanding of the impact of the disease on both mother and foetus. They used phrases such as: “*mum at high risk*”; “*worse increased risk of prematurity*”, “*risk to the fetus*”. All midwives interviewed were aware of the importance of discussing influenza immunisation with pregnant women and saw education a midwifery role. Phrases were used such as: “advise women”;

“educate women”; “promote the vaccine”; “talk through concerns” and “encourage”.

“ . . . I believe our role is health education, so informing women about the importance of getting the influenza vaccine in pregnancy”. (Jane, Birth Centre)  
To give them options and to give them all the tools to make a clear choice . . . (Michelle, Labour and Delivery)

#### 4.2. Immunisation provision

Um I am ok with that; we administer um immunizations to babies. (Sarah – Antenatal).  
I would hope that in the future we would be able to administer it ourselves because I think that should be within our scope of practise” (Jane – Birth Centre).

#### 4.3. The risks of acquiring influenza in pregnancy

I am aware that the woman is more susceptible . . . (Sarah, Antenatal)

It's a big worry for us as care providers of managing women who are really sick with it, um and obviously pregnancy you are already in a compromised state, so you don't want women to get the flu . . . (Michelle, Labour and Delivery)

#### 4.4. Attitudes and behaviours to personal immunizations

Midwives expressed that they were happy to receive workplace immunizations although most were aware that some health professionals refused the vaccine. Several midwives, whilst in favour of receiving the vaccine personally, did not believe that it should be compulsory whereas others felt that all healthcare workers should be immunised.

. . . whilst I understand that from a community health standpoint staff should have some vaccinations um to protect those who are more susceptible, I don't think it should be mandatory . . . (Sarah, Antenatal)

Um, I think it is essential if you are working in health or many fields with pregnant women and babies, families, then workplace immunization is essential. (Fiona, CAFHS)

#### 4.5. Enablers and barriers identified

Most midwives interviewed, expressed a personal desire for more education in immunisation and identified lack of knowledge as a barrier to providing immunisation. Whilst most midwives identified lack of knowledge and opportunity as barriers to the provision of antenatal influenza immunisation all those interviewed felt capable of administering a vaccine. Midwives who regularly immunised pregnant women were mostly employed in a GP setting, although most midwives working in a post-natal setting stated that they were regularly required to immunise babies.

"Part of my role has been to do the immunization course . . . having a general understanding and knowledge of vaccination immunology purely in my role working in general practise has been helpful. It really helped me to understand exactly what I was doing and why". (Giselle, General Practice)

Midwives working in a hospital setting either saw immunisation as a General Practitioner or Obstetrician role. However, despite the accepted role of GP provision, some midwives were questioning this limitation to their practise.

"I would hope that in the future we would be able to administer it ourselves because I think that should be within our scope of practise. I am very pro being as autonomous as possible in maternity care". (Jane – Birth Centre).

Few of the midwives could recall any immunisation training at university and only those employed in a primary health care setting such as CAFHS or General Practice, had undergone any subsequent training in immunisation.

" . . . it would start with more education so whether it was the South Australian (SA) Health online course or just another module . . . before I did that course . . . I didn't know the sort of things I should have been telling them, what to look out for so it's been helpful having that background". (Michelle, Labour and Delivery)

Midwives who had completed further training identified the SA Health Understanding Immunisation course as very useful and a significant enabler to practise. Most importantly, all midwives

expressed a need for better immunisation education in the tertiary and practice setting. This is of significance to university education planning and policy making. The midwives also expressed a desire for more autonomy of practice in the area of immunisation and several suggested a desire for accreditation of midwives for this reason.

## 5. Discussion

This study achieved the aim of providing a statistical and thematic description of the barriers and enablers to midwives promoting and providing antenatal influenza immunisation. By using a mixed methods approach with a convergent parallel design, the qualitative results have supported and enhanced the quantitative results and through method triangulation this study has achieved a greater understanding of the problem. Up until now the role of midwives has not been fully investigated with no known South Australian study taking place. The midwives in this study all described their role in immunisation as one of education and information sharing. However, despite several midwives actively immunising in a general practise setting and having completed the SA Health Understanding Immunisation course, few of the midwives saw their role as immunisation provision [20]. Those that regularly immunised thought they should be more autonomous in this practise, particularly in an antenatal setting. The South Australian midwives surveyed were significantly more likely to recommend the vaccine (80.9%) than midwives surveyed in Belgium, which found that only 23% recommended the influenza vaccine in pregnancy [13]. Whilst most of the midwives interviewed were confident in providing the influenza vaccine, of those surveyed only 31.9% had given the vaccine in the previous year.

Knowledge of immunisation requirements and understanding of the risks associated with acquiring influenza has been shown in previous studies to be poor in pregnant women [39–41]. Lack of knowledge of the risks associated with acquiring influenza in pregnancy places greater importance on the timely education of women. Midwives are well placed to provide this education. However, this study has shown that only 67.5% of RN/RM and 44.7% of RM recognised the benefits provided by the influenza vaccine to the infant in the first year of life ( $p=0.015$ ). This is a clear knowledge deficit and one with the potential to place mothers and babies at risk. Additionally, there is a significant deviation in knowledge of the benefits of the influenza vaccine to the foetus, with more RN/RM (80.0%) than RM (48.9%) agreeing ( $p=0.001$ ). This apparent lack of knowledge of immunology suggests that one barrier to immunisation provision and promotion is the education provided in undergraduate Bachelor of Midwifery courses. However, this is not supported in international literature where midwifery students appear to have greater knowledge of immunisation than their registered counterparts [42].

Midwives who were interviewed identified lack of education in undergraduate courses as a significant barrier to practise. Additionally, survey data revealed that whilst 75.8% agreed it was their role to offer the influenza immunisation, whilst 24.2% were either unsure or disagreed. A recently published pilot study has revealed that midwives receive approximately four hours immunisation education in Australian degree courses [43]. This education can be spread across differing units and across differing years of an undergraduate course. The results of our study have demonstrated that this is inadequate. Our study has demonstrated a knowledge difference between experienced ( $\geq 5$  years) and inexperienced ( $< 5$  years) midwives ( $p=0.047$ ). This suggests that the knowledge deficit present in inexperienced midwives, can to some degree, be reversed through experience. However, this is not a satisfactory way of meeting the educational needs of midwives or midwifery students.

## 6. Conclusion

Midwives are uniquely placed to assist pregnant women in immunisation decision making however this mixed methods study has demonstrated a knowledge deficit in the area of immunisation. With women's knowledge of the risks associated with influenza demonstrated to be poor, there is an increased need for midwives to be confident and competent in recommending the influenza vaccine [44]. Midwives see lack of knowledge as a barrier to practise, and it has been demonstrated that midwives practise benefits significantly from immunisation education. There is little evidence to suggest that midwives received or benefitted from, any immunological or vaccination related education provided in Bachelor of Midwifery courses [43]. Additionally, midwives who had received training via the Understanding Immunisation courses stated that they benefitted from it in terms of both education, confidence and vaccine provision. There was also a significant difference in knowledge and practice between RM/RN and RM as well as midwives with greater experience >5 years and < 5 years. However, midwives in this study demonstrated higher levels of personal immunisation than their international counterparts [45].

## 7. Recommendations

Throughout this study, midwives identified that their practise would benefit from additional education. Midwives who had received training via the Understanding Immunisation course stated that they benefitted from it in terms of education, confidence and vaccine provision. Another course exists in South Australia which has been tailored specifically to the needs of midwives [21]. This course is also used by WA Health to educate their midwives and may be a valuable option for closing the knowledge gap for Bachelor of midwifery graduates. Both RN/RM and RM would benefit from incorporating immunisation education in undergraduate education. Further research in the benefits of immunisation education is needed.

## 8. Limitations

A limitation of this and any other study investigating antenatal immunisation uptake is the absence of accurate data on influenza uptake in pregnancy. This can be attributed to both the absence of an accurate data identification method by the Australian Immunisation Register [22] and to the absence of immunisation data recorded in the Perinatal Outcomes Information (South Australia) [46]. For this reason the numbers of pregnant women receiving the influenza immunisation is currently unknown despite estimates of around 40% [47,48]. One recent publication was able to lift that number to 76% with the aid of a midwifery led immunisation programme however, it is not yet known if this was a sustained increase in immunisation levels [18].

Cross sectional surveys represent a small period in time and can be subject to bias. Additionally, our sample size was small ( $n = 137$ ). This is a limitation but is considered an acceptable one due to the small population of midwives employed in South Australia ( $n = 2411$ ). Data obtained in surveys can also lack depth however, the qualitative data provides a balanced view as well as data and method triangulation [38]. Additionally, the survey instrument has face validity and was validated prior to data collection using a test-retest process, resulting in a Cohens' Kappa coefficient of  $K = 0.804$ .

The aim of this paper was to investigate the role of South Australian midwives in the promotion and provision of antenatal influenza immunisation. With this in mind, we sought to obtain data from a variety of sites and a from midwives across a variety of working environments. The overall aim was to obtain data that was as

generalisable and as transferable as possible within the limitations of our sampling methods. We believe that this was achieved, and our results are generalisable within the Australian midwifery community.

## Author statement

Thankyou for the opportunity to revise this paper and resubmit. All reviewer comments have been considered and included in new manuscript with thanks. Susan E. Smith.

## Author contributions

Susan E. Smith Conceptualization, Methodology, Software Data curation, Formal analysis, Writing Original draft preparation; Visualization, Investigation, Project Administration.

Lyn Gum: Reviewing and Editing.

Charlene Thornton: Supervision.

## Ethical statement

Ethics approval was obtained from the Womens and Childrens Health Network Human Research Ethics Committee on 23rd July 2018, HREC18WCHN68. Informed consent was obtained from participants involved in the qualitative phase of this study. Participants taking part in the quantitative phase of this study did so anonymously and thereby gave implied consent.

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## Conflict of interest

None declared.

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