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Incorporating immunisations into routine obstetric care to facilitate Health Care Practitioners in implementing maternal immunisation recommendations

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Abbreviations:
HCPs – health care professionals
VPDs – vaccine preventable diseases
GPs – general practitioners
MMR – measles, mumps and rubella
SA – South Australia
SAPR – South Australian Pregnancy Record
AWHPR – Australian Woman Held Pregnancy Record
Abstract

Objectives

Immunisation against pertussis, influenza and rubella reduces morbidity and mortality in pregnant women and their offspring. Health care professionals (HCPs) caring for women perinatally are uniquely placed to reduce maternal vaccine preventable diseases (VPDs). Despite Australian National guidelines recommending immunisation during the perinatal period, maternal uptake remains low and variable across these VPDs. This qualitative study explored the role of obstetricians, general practitioners (GPs) and midwives in maternal vaccine uptake including which vaccine interventions they instigate and how their attitudes, knowledge and motivations affect the advice and interventions they provide.

Methods

Semi-structured interviews (n=15) were conducted with perinatal HCPs at a tertiary maternity hospital in South Australia. HCPs were asked to reflect on their knowledge, beliefs and practice relating to immunisation advice and vaccine provision. Interviews were transcribed and coded using thematic analysis. Data collection and analysis was an iterative process, with collection ceasing with data saturation. Current pregnancy documentation, professional vaccine references, and parent information brochures, were also examined.

Findings

Participants unanimously supported maternal vaccination as an effective way of reducing the risk of disease in this vulnerable population, however only rubella immunity detection and immunisation is embedded in routine care. Amongst the
professionals in our study, delegation of responsibility for maternal immunisation was unclear and knowledge about maternal immunisation was variable. Influenza and pertussis vaccine prevention measures were not included in standard pregnancy record documentation, information provision to patients was ‘ad hoc’ and vaccinations not offered on-site. The key finding was that the incorporation of maternal vaccinations into standard care through a structured process is an important facilitator for immunisation uptake.

Conclusions

Incorporating vaccine preventable disease management measures into routine obstetric care including incorporation into the Pregnancy Hand Held Record would facilitate HCPs in implementing recommendations. Rubella prevention provides a useful ‘template’ for other perinatal vaccines.

Background

Pertussis, influenza, and rubella are vaccine preventable diseases with potentially severe consequences for newborn infants and in the case of influenza and pertussis, for pregnant women.[1-3] Maternal vaccination is a recommended part of perinatal care to provide protection for both mother and infant.[1-4] However, in Australia, perinatal maternal uptake of pertussis and influenza vaccines is low[5-8] and, despite a universal childhood immunisation programme, pertussis control remains problematic with epidemics occurring every 3-4 years.[9] Infants < 6 months, too young to have completed the recommended immunisation course, are most at risk:[1] over 2009-2011, at least seven Australian infants in this category died.[10] The cocooning strategy provides indirect infant protection through targeted
vaccination of adults in direct contact with the newborn.[1, 11] and pertussis
vaccination is now recommended in the third trimester of pregnancy in Australia.[9]
the UK and USA. Maternal morbidity and mortality during the H1N1 09 influenza
pandemic re-focused attention on the vulnerability of pregnant women to influenza
infection.[3] Influenza vaccination is the only vaccine both recommended and
provided free for women during pregnancy in Australia.[9] Rubella immunisation
programs have been very successful, with rubella disease rare in Australia.[2]
However, travel and migration from countries with lower levels of rubella control
and the severity of sequelae from rubella in pregnancy, mean current vaccination
schedules should continue.[2]
Perinatal health care professionals (HCPs) are uniquely placed to provide appropriate
maternal vaccinations.[12] Recommendation by HCPs of maternal vaccination has
been shown to increase influenza vaccine uptake in pregnancy.[7, 13] Australian
studies have investigated the roles of midwives, GPs and nurses in postnatal,
newborn and childhood vaccine uptake. However in Australia maternity care is
largely team based, involving obstetricians, general practitioners (GPs) and
midwives. The contribution across these three occupational groups to perinatal
maternal vaccine uptake has not been investigated.
In this qualitative study, we explored HCPs knowledge, attitudes, beliefs and current
practice relating to maternal vaccine uptake in the Australian context.

Methods

Setting and participants
A tertiary teaching hospital in Adelaide was chosen as the study setting as South Australia’s (SA) largest provider of maternity and obstetric services (24.6% births in 2008-9).[14] The study setting provided four models of private and public care (Table 1) similar in scope to the other two large public hospitals, a mix of clientele by socio-economic status and access to a range of HCPs involved in perinatal care. This diversity makes the setting ideal for examining the reasons for low rates of maternal influenza and pertussis vaccination in SA.

Potential participants were identified from respondents to a general email and announcements at two midwifery education seminars (antenatal and postnatal) and through targeted recruiting. Participants were purposively recruited, stratified by occupation (midwives, GPs and obstetricians) and across models of care to provide a sample with maximum variability.[15] Data collection aimed to capture “programmatic variations and significant common patterns within that variation”. [15, p.172]

Participants (n-15) were GPs(3), obstetricians(6) and midwives(6) (Table 1) capturing perspectives from each professional group, and model of care; senior staff responsible for whole department functioning; and a balance of senior and junior obstetricians and midwives, experienced in public and private practice.

**Data collection and analysis**

Semi-structured interviews were conducted January-April 2012, digitally recorded and transcribed verbatim. The interviews utilized open-ended questioning to explore
participants' vaccine management practice, professional vaccine information sources

safety concerns and attitudes and beliefs about vaccinations as well as barriers and

facilitators to incorporating vaccine management into perinatal care. Data collection

ceased when no new themes emerged from three sequential interviews. Words in

square brackets in quoted excerpts have been inserted by the researchers for clarity

and to ensure confidentiality is maintained and meaning retained.

NVivo 9 software[16] was used to facilitate coding. Iterative thematic analysis was

undertaken to enable understanding of processes occurring, participants’

experiences and reasons for participant responses.[17] This process allowed the

researchers to move between data collection and analysis as codes were interpreted

and themes developed. After initial coding, codes were grouped under themes

describing the facilitators and barriers to perinatal vaccine management. The roles of

the three professional groups' and team interactions in vaccine preventable disease

(VPD) management were analysed and compared. Professional VPD information

sources referred to by participants, and information brochures intended for parents,

were examined for references to VPD prevention. Alignment between

documentation, guidelines and practice as described in the interviews, was

examined. The first author coded the data and a second researcher (JS) coded three

interviews. Any differences between the two coding schemes were discussed and

resolved with all researchers.
Ethics Approval

Research ethics approval was granted by the Children, Youth & Women’s Health Service Human Research Ethics Committee.

Findings

Participants revealed a high degree of trust in vaccine approval processes in Australia. One midwife observed that attitudes to vaccines amongst her colleagues had changed since the 2009, H1N1 09 influenza pandemic with greater awareness of the consequences of influenza during pregnancy and increased willingness to recommend vaccination to protect patients. Participants did not question the safety of vaccines recommended in the Australian immunisation schedule; this included the (then potential) recommendation of pertussis booster during pregnancy. However, two midwives qualified their approval adding they would need to do their own research before feeling confident to recommend a new maternal vaccine.

Participants were unanimously supportive of maternal vaccine provision as a preventive health measure but indicated that, in practice, influenza and pertussis vaccination were not consistently recommended, information was not consistently distributed and access to these vaccines was not provided in the study setting. It was noteworthy that these barriers were not present for rubella prevention, because postnatal rubella was ‘part of routine care’. Sample quotes from the participants illustrating the emergent themes discussed below, are shown in Table 2.
1. Barriers to implementing vaccine recommendations

   a. Poor definition of responsibility for VPD management

   All participants accepted responsibility for vaccine management but understood it to be a team effort, each group having a different role with final responsibility for team care being at an organizational level. Several participants recommended centralisation of responsibility for maternal immunisation at an organisational or population level. There were differences across the professional groups in their implementation of vaccine management measures. While obstetricians were supportive of vaccinations as a preventive measure, two obstetricians indicated that their focus was high-risk pregnancy care and therefore they delegated ‘routine’ preventive measures to junior doctors or midwives. GPs saw vaccination as part of their work outside of the hospital setting, but indicated that there were no mechanisms in place to provide vaccination within the hospital setting. Midwives saw their role as including the education of women about preventive health measures for both mother and baby. Postnatal midwives believed it was their responsibility to give neonatal Hepatitis B immunisations and provide parents with vaccine information for the baby. In addition, midwives indicated they followed up rubella titre results and provided MMR (measles, mumps, rubella) vaccination when needed, following set protocols which required an order by a medical officer.

   However, their role in other maternal vaccines was limited. All participants referred women, in the study setting, to their GP for vaccination other than MMR.
b. Variable HCP Knowledge

Participants’ knowledge of maternal vaccine recommendations varied across the vaccines and the professional groups. Influenza immunisation recommendations during pregnancy were well known, excepting midwives working exclusively in postnatal settings. However some participant obstetricians were unsure of the safety of first trimester vaccination and vaccination timing in relation to gestation. Pertussis booster vaccine recommendations, particularly the strategy of cocooning, were less well known. All GPs and most obstetricians interviewed were aware of pertussis vaccine recommendations but most midwives and some obstetricians were not. In contrast to these gaps in knowledge, all participants were aware of MMR vaccine requirements, procedures to identify low rubella immunity and mechanisms ensuring women received MMR vaccine postnatally, if needed.

c. Inconsistency across the information resources

Significantly, the professional resources chosen by participants to source information lacked vaccination recommendations. The South Australian Perinatal Care Guidelines cited by several obstetricians, as a source for vaccination information, contained no vaccine recommendations. Similarly the hospital intranet, suggested by some participants as an information source, also had no links to current vaccine recommendations. The GP Shared Care guidelines (devised for GPs involved in shared care), included appropriate recommendations for rubella screening, and MMR and influenza vaccination, but not pertussis vaccination. The Australian Immunisation Handbook in hard copy was not an integral part of clinic resources and was better known among participants as a source of childhood immunisation
information. GPs received immunisation updates in their private practice from the
SA Health Communicable Disease Branch but not in the hospital setting.

d. Absence of vaccine references in documentation

There was no entry point into documentation for influenza and pertussis vaccines in
the study setting. Maternal vaccines were not included as a discussion point in the
South Australian Pregnancy Record (SAPR).[18] In contrast the SAPR reminds health
professionals to discuss breast feeding, conduct antenatal education, and complete a
smoking assessment. In addition, immunisation history is not part of the lengthy
medical, psycho-social, surgical and family history taken at a woman’s first antenatal
visit. As a consequence, maternal influenza and pertussis vaccines are offered
largely in response to requests by women. Participants observed that demand
fluctuated in response to media coverage. In those cases where vaccination was
recommended by participants, there was no mechanism for documenting the
response or following up. Participants stated that education about influenza and
pertussis booster vaccines is not routinely included in perinatal care. This may be a
particular issue in the public clinic care model where a woman may see a different
HCP each visit.

e. Inconsistent education provision for women

Brochures were available in self-help stands in the antenatal clinic however women
were not routinely directed to these resources. A folder given to women at the first
antenatal visit contained the SAPR[18] and written information on topics such as
breast feeding, nutrition in pregnancy, oral health and SIDS. Further information and
advertising was given to all women in ‘Bounty bags’.[19] Immunisation brochures
were not included in either resource. The first visit was not viewed as the ideal time
to introduce vaccination information because of the overwhelming amount of
information provided to the women at that time. Postnatally, vaccination
information focussed on the newborn except for potential postpartum rubella
vaccination. Rubella titre is individually mentioned in the SAPHHR as part of the
initial antenatal screening tests, including a discussion point for test results and a
place for postnatal follow-up where low immunity is documented. One midwife
volunteered that women rarely refuse or question this test.

2. Barriers to accessing immunisations

Participants indicated that in the study setting, pertussis and influenza vaccines were
not offered to women before, during or after pregnancy. There was no routine
mechanism for women to receive a vaccination in hospital. At best women were
referred to their GP. Some participants were concerned that referring patients
elsewhere could discourage or delay vaccination and that it undermined the public
health message. Some HCPs were concerned that cost and the process presented
barriers to women accessing pertussis vaccine. Participants recognised that
influenza and pertussis vaccines were not part of the routine system of care.

3. Being part of a structured or systematic process

In contrast to influenza and pertussis vaccine management, interventions for MMR
immunity detection, follow-up and the offer of postpartum vaccination, when
necessary, were described by all participants across each occupational group as
being part of systematic process that works. MMR screening and follow up is
embedded in routine care and is considered part of a midwife’s role. Constant
communication about a woman’s infectious disease status also assists MMR follow-up in the context of a team environment. Table 3 summarises the components, identified in our study, of facilitators and barriers to management of MMR, pertussis and influenza vaccines in the study setting. All the components required to ensure delivery of MMR vaccine were embedded in routine pregnancy care. In comparison many components were absent for influenza and pertussis booster vaccines.

**Discussion**

Our findings concur with Schrag et al.[12] that barriers to maternal vaccine uptake are not pregnancy specific; in particular, we found all participants were supportive of maternal vaccination as a preventive strategy. Previous research has identified barriers including: lack of HCP recommendation,[7, 8] cost,[20, 21] HCPs knowledge, [22, 23]lack of patient oriented information or misinformation,[7, 20, 23, 24] inconsistent advice , vaccine access ,[7, 8] and lack of clarity with respect to responsibility for implementing vaccine strategies.[20, 22] We found similar barriers present in our study setting but significantly only for influenza and pertussis vaccines. In particular, there was no clearly defined strategy for perinatal maternal vaccination against influenza and pertussis within the hospital setting, no entry point into the system of care and immunisation history was not routinely collected in the medical history. None of these barriers were present in MMR vaccine management. This leads us to conclude that the failure in implementation is primarily due to a failure to incorporate pertussis and influenza vaccines into routine practice.

Halladay and Bero in their review of research into the implementation of evidence-based practice, grouped intervention strategies into three broad types: practitioner-
provided, organisational and system-wide.[25] To implement change to current
vaccination practice, strategies at each level would be required.

Practitioner strategies: The division between GPs and midwives, on the one hand,
who saw provision of vaccinations and vaccine education as part of their role and, on
the other, obstetricians who saw vaccination as outside their responsibility, has been
reported previously.[12] Currently responsibility for perinatal vaccinations, which are
not part of routine care, lack clear definition, so by default rest with individual
practitioners, or the women themselves who may lack health literacy or
empowerment to seek this intervention. The different but complementary roles of
the three professional groups providing perinatal care require clear definition for
vaccine management and cross-disciplinary communication strategies. Embedding
ultimate responsibility for perinatal vaccination at an organisational or population
health level, as suggested by some participants, would clearly demonstrate the value
of the vaccines to HCPs and support maternal vaccine delivery. In addition,
vaccination recommendations in shared web-based resources, in conjunction with
staff skill training, would improve HCP knowledge.

Organisational strategies: Embedding a vaccine in routine pregnancy care has been
demonstrated to increase maternal vaccine uptake. Healy et al demonstrated that
when a maternal postpartum pertussis vaccination was embedded in routine
practice - such as standing orders for vaccines - maternal vaccine uptake
increased.[11] Our findings support this contention. Embedding MMR vaccination
into routine care ensured implementation, and as such offers an effective template
for other perinatal vaccine management. (Table 3). Dedicated immunisation staff
may improve access without increasing perinatal HCP workload.

Vaccination health literacy could be increased by the inclusion of materials in the
folder provided to each woman at the first appointment. Consideration could be
given to state-wide distribution from a central distribution point. Information sheets
could be developed for staff to use when seeking maternal consent for vaccination
such as are used for MMR vaccination.

**System wide strategies:** The ‘template’ for maternal influenza and pertussis vaccines
would include: 1. protocols and documentation supporting vaccine delivery; 2) HCP
training and role definition within the protocols 3) routine provision of information
to patients and 4) ready access to vaccination for women. Directives, protocols,
standing orders, and ‘tick boxes’ are essential documentation elements serving to
communicate across the team of HCPs, reminding staff to attend to preventive
interventions.

An Australian Woman Held Pregnancy Record (AWHPR) has been developed and can
be used by individual Australian States to develop their own individual patient
pregnancy record.[26] These records are ‘held’ by pregnant women, taken to ante-
natal appointments and are a continuous record of their pregnancy. In addition to
rubella screening the AWHPR includes a checkbox for influenza but not pertussis
vaccination.[26] Of all the Australian states, only Queensland’s record includes
reminders for both influenza and pertussis vaccination.[27, p.4]
Related to access is the provision of funded vaccines. Influenza vaccination for at-risk populations, including pregnant women, is funded by the Federal government. Pertussis booster funding is state based and while some Australian states had funded pertussis vaccination programmes during the recent epidemic, the SA government only provided funding for three months in 2010. Women requesting a pertussis booster vaccine from their GP would need to fill and pay for a script at a pharmacy.

In contrast, as an inpatient medication in a public hospital, MMR vaccine is provided free of charge to patients in the study setting.

**Limitations**

This study was conducted at only one hospital, although six participants practiced obstetric care in other settings concurrently or recently and were able to provide wider insights. However, absence of funding for maternal pertussis vaccine (except in NSW and Northern Territory), inconsistent inclusions of both influenza and pertussis recommendations in pregnancy records of the States, and lack of pertussis vaccine recommendations in the AWHPR, suggest our findings are reflective of current practice across Australia. In SA, maternal vaccine provision in the two other public maternity hospitals is patchy: one hospital routinely provides influenza vaccine in antenatal clinic but pertussis booster postpartum is not provided and in the other influenza vaccine is not provided antenatally but pertussis booster may be offered to some private patients.

**Conclusions and Implications**

Our study found that strategies embedded into routine care to ensure rubella immunity detection and MMR vaccination during pregnancy, functioned well.
Embedding influenza and pertussis booster vaccines into routine pregnancy care would remove the logistical barriers to implementation and provide the structures needed to ensure women are routinely offered these interventions. These findings have implications for delivery of these vaccines internationally since similar barriers to those found in our study have been described in other studies. What has not been previously described is the link between successful delivery of maternal vaccines and embedding the vaccines in routine care. Australian MMR vaccine interventions provide a possible ‘template’ on which to base other perinatal vaccine interventions and thereby ensure implementation of national and international recommendations for vaccination during pregnancy.

Acknowledgements

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Funding Statement

This study was partly funded by Immunisation Branch, SA Health.
Conflict of Interest Statement

We wish to draw the attention of the Editor to the following facts which may be considered as potential conflicts of interest and to significant financial contributions to this work.

Helen Marshall is an investigator on vaccine trials. Her institution has received funding for investigator-led research from vaccine manufacturers including GlaxoSmithKline and Novartis Vaccines and Diagnostics. Helen Marshall has received travel support from Novartis Vaccines and Diagnostics and GlaxoSmithKline to present scientific data at international conferences.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property.

In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.
We understand that Jackie Street is the sole contact for the Editorial process
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of revisions and final approval of proofs. We confirm that we have provided a
current, correct email address which is accessible by the Corresponding Author and
which has been configured to accept email from Vaccine.

Signed by all authors as follows on 4/9/13:

Heather Webb

Jackie Street

Helen Marshall
References


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perinatal infection prevention practices among obstetrician-gynecologists. Obstetrics and

[21] Power ML, Leddy MA, Anderson BL, Gall SA, Gonik B, Schulkin J. Obstetrician-
gynecologists' practices and perceived knowledge regarding immunization. American journal
of preventive medicine 2009 Sep;37(3):231-4.

[22] Tong A, Biringer A, Ofner-Agostini M, Upshr R, McGeer A. A cross-sectional study of
maternity care providers' and women's knowledge, attitudes, and behaviours towards
May;30(5):404-10.

[23] Broughton DE, Beigi RHMM, Switzer GEP, Raker CAS, Anderson BLMM. Obstetric
Health Care Workers' Attitudes and Beliefs Regarding Influenza Vaccination in Pregnancy.

Mothers' Attitudes, Knowledge, and Trust Regarding Vaccination. Maternal and Child Health

[25] Halladay M, Bero L. Getting Research into Practice: Implementing Evidence-Based

[26] Australian Woman Held Pregnancy Record. The Maternity Services Inter-

Table 1. Examples of participant responses within key theme areas

<table>
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<tr>
<th>1. Barriers to implementing vaccine recommendations</th>
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<tr>
<td><strong>Poor definition of responsibility for VPD management.</strong></td>
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<tr>
<td>i) “You know if that’s what the community wants, I think you should centralize that process of responsibility...you know the alternative is the status quo at the moment and that is that it’s the individual’s responsibility to do all that, and err hence it’s done in so many different individual ways that it’s ineffective and by and large non-existent I'd suspect”. Obstetrician 3</td>
</tr>
<tr>
<td>ii) “The doctors are very busy and so for example in the private clinic we run at capacity so we’re turning women away, so we basically have to apply um err almost triage principles to how we run our consultations but we do have a um midwife there with us who is our personal sort of assistant if you like. So things like breastfeeding and err analgesia in labour and vaccinations although I don’t know if they mention vaccinations I’ll be honest. We tend to delegate to them. The longer we make the consultations basically the less patients we can see.” Obstetrician2</td>
</tr>
<tr>
<td>iii) “My understanding is that [maternal immunisation] is not done at the hospital; that the hospital’s just not set up for giving it. I’ve never known it to be done in here” GP2</td>
</tr>
<tr>
<td>iv) “We don’t have any role in that [maternal vaccination]. We don’t organise that, I usually send them off to their GP. If you want influenza vads you can get it through your GPs the best place.” Midwife6</td>
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<th>1. Barriers to implementing vaccine recommendations</th>
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<tr>
<td><strong>Lack of documentation</strong></td>
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<tr>
<td>i) “But there isn’t a tick box or something in the handheld record even. So the handheld record could have a box where it could be ticked influenza vaccine as a prompt. Because I might see somebody once in their pregnancy and they could see a different person every time” Midwife5</td>
</tr>
<tr>
<td>ii) “I think generally current practice is that it’s reactive to questions rather than proactive and out there ..... and in some ways that’s sad, that’s disappointing but I think that’s the reality of it, is that it’s reactive not, not..... But they’ll be asking the questions”. Obstetrician3</td>
</tr>
<tr>
<td>iii) “None, ... If they present with flu-like symptoms then we ask whether they’ve had the vaccination that year. That’s really the only time we ever routinely ever ask about whether they’ve been vaccinated”. Obstetrician 5</td>
</tr>
<tr>
<td>iv) “There’s no routine. And of course time is the essence, ... it’s often you know a very under the pump clinic so you know one it’s gotta be in the forefront of your mind to think and I don’t know how the other non GP’s go but I think us GP’s are probably a little bit more aware of that I would imagine....um because we do that routinely in our general practice.” GP4</td>
</tr>
</tbody>
</table>
Inconsistent education provision for women

i) “There are a couple of information pamphlets. One is talking about general vaccines and one more the influenza vaccine. But there’s no requirement to give them to all women”. Midwife5 (antenatal)

ii) “I think if you have a look at what’s happening at that first triage visit in a clinic, it’s just horrendously busy. And there’s a million people and a lot of information being given out. So I think to add something else in there is possibly not a good idea “. Midwife6

iii) “So heavily sort of weighted towards the baby, you know the vaccination of the baby and that ongoing sort of health and you know educating the parents about the schedule for the baby. We don’t (laughed as she talked on) we don’t ever talk about the mother sort of thing, which is quite bizarre when you stop and think you know…” Midwife1(postnatal)

2. Barriers to accessing immunisations

i) “So even if they’re having all their care done in the hospital they are being told to go to their GP to get flu, flu immunization done...the same with pertussis; that’s ‘oh go back to your GP and get that sorted out’.”GP2

ii) “… but ‘do they have a GP?...some women don’t have a GP and a lot of women we see are using an interpreter as well, so you know it’s all difficult’. GP4

iii) They’ve got to take it to a pharmacist and fill it and bring it back. Which’d cost them 70 bucks ... and the timing of it ... and a, then again the temperature you know the cold chain and things like that potentially disrupted as well, so .... I don’t see it as ideal.” Obstetrician3

3. Being part of a structured or systematic process

i) “...I was only talking about this the other day with a group of GPs. And one person in the group had had to pick it up when [an] MMR hadn’t been done in the hospital, but everybody else said ‘no it was always done before they leave, even the early discharges have always had their MMR, we don’t have to do that, the hospital does it’. ” GP2

ii) “Yes, I would say it is nearly never forgotten because it’s part of what we do. It’s like gettin’ up in the morning and brushing your teeth. Midwife4

iii) “... that’s the whole idea of standard care, is that it gets picked up along the way. And if it doesn’t become part of policy or a clinical guideline, well then you open it up to being missed a bit more regularly and as a result maybe a negative sequelae as a result of that ... And you know it would be common sense that if it’s severely going affect mortality morbidity, that it would be part of [a] standard because our hospital would be liable in that situation... ” Midwife2
<table>
<thead>
<tr>
<th>Clinic model</th>
<th>Public/private</th>
<th>Team</th>
<th>Setting*</th>
<th>Participants in study**</th>
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</thead>
<tbody>
<tr>
<td>Medical Antenatal Care</td>
<td>Public</td>
<td>Obstetricians and midwives</td>
<td>A: outpatients’ clinic, antenatal ward, D: hospital delivery suite P: postnatal ward.</td>
<td>3 senior obstetricians, 1 obstetrician, 2 obstetric registrars, 2 senior midwives and 3 midwives</td>
</tr>
<tr>
<td>Midwifery Group Practice</td>
<td>Public</td>
<td>Single midwife supported by midwifery team</td>
<td>A: community and outpatients’ clinic D: hospital delivery suite P: community</td>
<td>1 senior midwife 1 midwife</td>
</tr>
<tr>
<td>Shared Care Model</td>
<td>Public</td>
<td>GPs and midwives</td>
<td>A: general practice and outpatients clinic; D: hospital delivery suite P: postnatal ward and general practice.</td>
<td>3 GPs, 1 midwife</td>
</tr>
<tr>
<td>Private Obstetrician</td>
<td>Private</td>
<td>Single Obstetrician</td>
<td>A: obstetrician’s consulting rooms D: Hospital delivery suite P: postnatal ward and obstetrician’s rooms</td>
<td>2 senior obstetricians</td>
</tr>
</tbody>
</table>

*A – antenatal care, D – delivery, P – postnatal care

**Note: some participants are included more than once if they work across models of care
Table 3. Vaccine components present in the study setting for rubella, influenza and pertussis booster vaccines.

<table>
<thead>
<tr>
<th>Component</th>
<th>Rubella (offered as MMR)</th>
<th>Influenza</th>
<th>Pertussis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended by NHMRC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Identification of need</td>
<td>✓ Antenatal blood screen</td>
<td>X No immunisation history collected</td>
<td>X No immunisation history collected</td>
</tr>
<tr>
<td>Practitioner knowledge</td>
<td>✓</td>
<td>X Uncertainty about timing and seasonal nature of vaccine</td>
<td>X Recommendations not well known, except GPs</td>
</tr>
<tr>
<td>’Tick-box ’reminder in documentation for HCPs to discuss immunisation</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>’Flagged’ in documentation for post-natal follow-up</td>
<td>✓</td>
<td>Not applicable</td>
<td>X</td>
</tr>
<tr>
<td>Place in documentation for recording vaccination</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Listed in commonly used resources:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Perinatal Care Guidelines (SA)</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. GP Shared Care Guidelines (SA)</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Written patient focused Information:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Available on site</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Given to women</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Vaccine funded – free to women</td>
<td>✓ As inpatient</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Vaccine stocked for maternal use</td>
<td>✓ On ward</td>
<td>X</td>
<td>X On individual demand through pharmacy for inpatient</td>
</tr>
<tr>
<td>Prescription (Stat order) written for inpatient administration</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Vaccine offered in hospital</td>
<td>✓</td>
<td>X No – referred to GP</td>
<td>X No – referred to GP</td>
</tr>
<tr>
<td>Staff trained to administer</td>
<td>✓ Midwives</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend: ✓ - is provided; X - not provided; SA - South Australia; MMR - measles-mumps-rubella vaccine; GP - General practitioner