

## ACCEPTED VERSION

Heather Webb, Jackie Street, Helen Marshall

### **Incorporating immunizations into routine obstetric care to facilitate Health Care Practitioners in implementing maternal immunization recommendations**

Human Vaccines & Immunotherapeutics, 2014; 10(4):1114-1121

© 2014 Landes Bioscience

*This is an Accepted Manuscript of an article published by Taylor & Francis Group in **Human Vaccines & Immunotherapeutics** on 7 February 2014 , available*

*online: <http://www.tandfonline.com/10.4161/hv.27893>*

#### PERMISSIONS

<http://journalauthors.tandf.co.uk/copyright/sharingYourWork.asp>

As a Taylor & Francis author, you can post your Accepted Manuscript (AM) on your departmental or personal website at any point after publication of your article (this includes posting to Facebook, Google groups, and LinkedIn, and linking from Twitter).

To encourage citation of your work we recommend that you insert a link from your posted AM to the published article on [Taylor & Francis Online](#) with the following text:

*"This is an Accepted Manuscript of an article published by Taylor & Francis in [JOURNAL TITLE] on [date of publication], available online: [http://www.tandfonline.com/\[Article DOI\]](http://www.tandfonline.com/[Article DOI])."*

The AM is defined by the [National Information Standards Organization](#) as:

"The version of a journal article that has been accepted for publication in a journal."

This means the version that has been through peer review and been accepted by a journal editor. When you receive the acceptance email from the Editorial Office we recommend that you retain this article for future posting.

Embargoes apply (see [PDF](#) | [Excel](#) for applicable embargo periods) if you are posting the AM to an institutional or subject repository, or to academic social networks like Mendeley, ResearchGate, or Academia.edu.

Embargo for Human Vaccines & Immunotherapeutics not listed.

10 March 2015

<http://hdl.handle.net/2440/82473>

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

**Authors:** Heather Webb<sup>1,2,3</sup>, Jackie Street<sup>3\*</sup>, Helen Marshall<sup>1,2,3,4</sup>

**Author affiliations:** <sup>1</sup> Vaccinology and Immunology Research Trials Unit, Women's and Children's Hospital, Adelaide, South Australia

<sup>2</sup> School of Paediatrics and Reproductive Health, University of Adelaide, Adelaide, South Australia

<sup>3</sup> School of Population Health, University of Adelaide, Adelaide, South Australia

<sup>4</sup> Robinson Institute, University of Adelaide, Adelaide

\*corresponding author

**Corresponding author details:**

Dr Jackie Street  
Australian National Preventive Health Agency Fellow  
School of Population Health  
The University of Adelaide

Mail Drop 650 550  
Level 7, 178 North Terrace  
The University of Adelaide, AUSTRALIA 5005  
Ph : +61 8 8313 6498  
Fax : +61 8 8313 6885  
e-mail: [jackie.street@adelaide.edu.au](mailto:jackie.street@adelaide.edu.au)

**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

1 **Abstract**

2 **Objectives**

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

12 **Methods**

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

20 **Findings**

21 Participants unanimously supported maternal vaccination as an effective way of  
22 reducing the risk of disease in this vulnerable population, however only rubella  
23 immunity detection and immunisation is embedded in routine care. Amongst the

24 professionals in our study, delegation of responsibility for maternal immunisation  
25 was unclear and knowledge about maternal immunisation was variable. Influenza  
26 and pertussis vaccine prevention measures were not included in standard pregnancy  
27 record documentation, information provision to patients was 'ad hoc' and  
28 vaccinations not offered on-site. The key finding was that the incorporation of  
29 maternal vaccinations into standard care through a structured process is an  
30 important facilitator for immunisation uptake.

### 31 **Conclusions**

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

### 36 **Background**

37 Pertussis, influenza, and rubella are vaccine preventable diseases with potentially  
38 severe consequences for newborn infants and in the case of influenza and pertussis,  
39 for pregnant women.[1-3] Maternal vaccination is a recommended part of perinatal  
40 care to provide protection for both mother and infant.[1-4] However, in Australia,  
41 perinatal maternal uptake of pertussis and influenza vaccines is low[5-8] and, despite  
42 a universal childhood immunisation programme, pertussis control remains  
43 problematic with epidemics occurring every 3-4 years.[9] Infants < 6 months, too  
44 young to have completed the recommended immunisation course, are most at  
45 risk:[1] over 2009-2011, at least seven Australian infants in this category died.[10]  
46 The cocooning strategy provides indirect infant protection through targeted

47 vaccination of adults in direct contact with the newborn.[1, 11] and pertussis  
48 vaccination is now recommended in the third trimester of pregnancy in Australia,[9]  
49 the UK and USA. Maternal morbidity and mortality during the H1N1 09 influenza  
50 pandemic re-focussed attention on the vulnerability of pregnant women to influenza  
51 infection.[3] Influenza vaccination is the only vaccine both recommended and  
52 provided free for women during pregnancy in Australia.[9] Rubella immunisation  
53 programs have been very successful, with rubella disease rare in Australia.[2]  
54 However, travel and migration from countries with lower levels of rubella control  
55 and the severity of sequelae from rubella in pregnancy, mean current vaccination  
56 schedules should continue.[2]

57 Perinatal health care professionals (HCPs) are uniquely placed to provide appropriate  
58 maternal vaccinations.[12] Recommendation by HCPs of maternal vaccination has  
59 been shown to increase influenza vaccine uptake in pregnancy.[7, 13] Australian  
60 studies have investigated the roles of midwives, GPs and nurses in postnatal,  
61 newborn and childhood vaccine uptake. However in Australia maternity care is  
62 largely team based, involving obstetricians, general practitioners (GPs) and  
63 midwives. The contribution across these three occupational groups to perinatal  
64 maternal vaccine uptake has not been investigated.

65 In this qualitative study, we explored HCPs knowledge, attitudes, beliefs and current  
66 practice relating to maternal vaccine uptake in the Australian context.

## 67 **Methods**

### 68 **Setting and participants**

69 A tertiary teaching hospital in Adelaide was chosen as the study setting as South  
70 Australia's (SA) largest provider of maternity and obstetric services (24.6% births in  
71 2008-9).[14] The study setting provided four models of private and public care (Table  
72 1) similar in scope to the other two large public hospitals, a mix of clientele by socio-  
73 economic status and access to a range of HCPs involved in perinatal care. This  
74 diversity makes the setting ideal for examining the reasons for low rates of maternal  
75 influenza and pertussis vaccination in SA.

76

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

84

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

### 89 **Data collection and analysis**

90 Semi-structured interviews were conducted January-April 2012, digitally recorded  
91 and transcribed verbatim. The interviews utilized open-ended questioning to explore

92 participants' vaccine management practice, professional vaccine information sources  
93 safety concerns and attitudes and beliefs about vaccinations as well as barriers and  
94 facilitators to incorporating vaccine management into perinatal care. Data collection  
95 ceased when no new themes emerged from three sequential interviews. Words in  
96 square brackets in quoted excerpts have been inserted by the researchers for clarity  
97 and to ensure confidentiality is maintained and meaning retained.

98

99 NVivo 9 software[16] was used to facilitate coding. Iterative thematic analysis was  
100 undertaken to enable understanding of processes occurring, participants'  
101 experiences and reasons for participant responses.[17] This process allowed the  
102 researchers to move between data collection and analysis as codes were interpreted  
103 and themes developed. After initial coding, codes were grouped under themes  
104 describing the facilitators and barriers to perinatal vaccine management. The roles of  
105 the three professional groups' and team interactions in vaccine preventable disease  
106 (VPD) management were analysed and compared. Professional VPD information  
107 sources referred to by participants, and information brochures intended for parents,  
108 were examined for references to VPD prevention. Alignment between  
109 documentation, guidelines and practice as described in the interviews, was  
110 examined. The first author coded the data and a second researcher (JS) coded three  
111 interviews. Any differences between the two coding schemes were discussed and  
112 resolved with all researchers.

## 113 **Ethics Approval**

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

## 116 **Findings**

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

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



133 **1. Barriers to implementing vaccine recommendations**

134 **a. Poor definition of responsibility for VPD management**

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

154           **b. Variable HCP Knowledge**

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

166           **c. Inconsistency across the information resources**

167   Significantly, the professional resources chosen by participants to source information  
168   lacked vaccination recommendations. The South Australian Perinatal Care  
169   Guidelines cited by several obstetricians, as a source for vaccination information,  
170   contained no vaccine recommendations. Similarly the hospital intranet, suggested by  
171   some participants as an information source, also had no links to current vaccine  
172   recommendations. The GP Shared Care guidelines (devised for GPs involved in  
173   shared care), included appropriate recommendations for rubella screening, and  
174   MMR and influenza vaccination, but not pertussis vaccination. The Australian  
175   Immunisation Handbook in hard copy was not an integral part of clinic resources and  
176   was better known among participants as a source of childhood immunisation

177 information. GPs received immunisation updates in their private practice from the  
178 SA Health Communicable Disease Branch but not in the hospital setting.

179 **d. Absence of vaccine references in documentation**

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

194 **e. Inconsistent education provision for women**

195 Brochures were available in self-help stands in the antenatal clinic however women  
196 were not routinely directed to these resources. A folder given to women at the first  
197 antenatal visit contained the SAPR[18] and written information on topics such as  
198 breast feeding, nutrition in pregnancy, oral health and SIDS. Further information and  
199 advertising was given to all women in 'Bounty bags' .[19] Immunisation brochures

200 were not included in either resource. The first visit was not viewed as the ideal time  
201 to introduce vaccination information because of the overwhelming amount of  
202 information provided to the women at that time. Postnatally, vaccination  
203 information focussed on the newborn except for potential postpartum rubella  
204 vaccination. Rubella titre is individually mentioned in the SAPHHR as part of the  
205 initial antenatal screening tests, including a discussion point for test results and a  
206 place for postnatal follow-up where low immunity is documented. One midwife  
207 volunteered that women rarely refuse or question this test.

## 208 **2. Barriers to accessing immunisations**

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

## 217 **3. Being part of a structured or systematic process**

218 In contrast to influenza and pertussis vaccine management, interventions for MMR  
219 immunity detection, follow-up and the offer of postpartum vaccination, when  
220 necessary, were described by all participants across each occupational group as  
221 being part of systematic process that works. MMR screening and follow up is  
222 embedded in routine care and is considered part of a midwife's role. Constant

223 communication about a woman's infectious disease status also assists MMR follow-  
224 up in the context of a team environment. Table 3 summarises the components,  
225 identified in our study, of facilitators and barriers to management of MMR, pertussis  
226 and influenza vaccines in the study setting. All the components required to ensure  
227 delivery of MMR vaccine were embedded in routine pregnancy care. In comparison  
228 many components were absent for influenza and pertussis booster vaccines.

## 229 **Discussion**

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

244 Halladay and Bero in their review of research into the implementation of evidence-  
245 based practice, grouped intervention strategies into three broad types: practitioner-

246 provided, organisational and system-wide.[25] To implement change to current  
247 vaccination practice, strategies at each level would be required.

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

262 Organisational strategies: Embedding a vaccine in routine pregnancy care has been  
263 demonstrated to increase maternal vaccine uptake. Healy et al demonstrated that  
264 when a maternal postpartum pertussis vaccination was embedded in routine  
265 practice - such as standing orders for vaccines - maternal vaccine uptake  
266 increased.[11] Our findings support this contention. Embedding MMR vaccination  
267 into routine care ensured implementation, and as such offers an effective template

268 for other perinatal vaccine management. (Table 3). Dedicated immunisation staff  
269 may improve access without increasing perinatal HCP workload.

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

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

282 An Australian Woman Held Pregnancy Record (AWHPR) has been developed and can  
283 be used by individual Australian States to develop their own individual patient  
284 pregnancy record.[26] These records are 'held' by pregnant women, taken to ante-  
285 natal appointments and are a continuous record of their pregnancy. In addition to  
286 rubella screening the AWHPR includes a checkbox for influenza but not pertussis  
287 vaccination.[26] Of all the Australian states, only Queensland's record includes  
288 reminders for both influenza and pertussis vaccination.[27, p.4]

289 Related to access is the provision of funded vaccines. Influenza vaccination for at-risk  
290 populations, including pregnant women, is funded by the Federal government.  
291 Pertussis booster funding is state based and while some Australian states had funded  
292 pertussis vaccination programmes during the recent epidemic, the SA government  
293 only provided funding for three months in 2010. Women requesting a pertussis  
294 booster vaccine from their GP would need to fill and pay for a script at a pharmacy.  
295 In contrast, as an inpatient medication in a public hospital, MMR vaccine is provided  
296 free of charge to patients in the study setting.

### 297 **Limitations**

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

### 309 **Conclusions and Implications**

310 Our study found that strategies embedded into routine care to ensure rubella  
311 immunity detection and MMR vaccination during pregnancy, functioned well.



312 Embedding influenza and pertussis booster vaccines into routine pregnancy care  
313 would remove the logistical barriers to implementation and provide the structures  
314 needed to ensure women are routinely offered these interventions. These findings  
315 have implications for delivery of these vaccines internationally since similar barriers  
316 to those found in our study have been described in other studies. What has not been  
317 previously described is the link between successful delivery of maternal vaccines and  
318 embedding the vaccines in routine care. Australian MMR vaccine interventions  
319 provide a possible 'template' on which to base other perinatal vaccine interventions  
320 and thereby ensure implementation of national and international recommendations  
321 for vaccination during pregnancy.

322

### 323 **Acknowledgements**

324 We would like to thank the obstetricians, GPs and midwives who gave their time to  
325 participate in this study. We acknowledge the funding support for the project from  
326 SA Health. We would also like to thank Natalie Thomas Anne Webster and Susan Lee  
327 for assistance with study processes and Dr Joanne Collins for comment on initial  
328 drafts. Preliminary findings were presented by HW at the Public Health Association  
329 of Australia's National Immunisation Conference in Darwin in June 2012. Conference  
330 attendance was sponsored by Pfizer Australia.

### 331 **Funding Statement**

332 This study was partly funded by Immunisation Branch, SA Health.

333

334 **Conflict of Interest Statement**

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

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

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

347 We confirm that we have given due consideration to the protection of intellectual  
348 property associated with this work and that there are no impediments to  
349 publication, including the timing of publication, with respect to intellectual property.  
350 In so doing we confirm that we have followed the regulations of our institutions  
351 concerning intellectual property.

352 We further confirm that any aspect of the work covered in this manuscript that has  
353 involved human patients has been conducted with the ethical approval of all  
354 relevant bodies and that such approvals are acknowledged within the manuscript.

355 We understand that Jackie Street is the sole contact for the Editorial process  
356 (including Editorial Manager and direct communications with the office). She is  
357 responsible for communicating with the other authors about progress, submissions  
358 of revisions and final approval of proofs. We confirm that we have provided a  
359 current, correct email address which is accessible by the Corresponding Author and  
360 which has been configured to accept email from Vaccine.

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

362

363



364 Heather Webb

365

366



367 Jackie Street

368

369



370 Helen Marshall

## 371 **References**

372

- 373 [1] McIntyre P, Wood N. Pertussis in early infancy: disease burden and preventive  
374 strategies. *Current Opinion in Infectious Diseases* 2009;22(3):215-23  
375 10.1097/QCO.0b013e32832b3540.
- 376 [2] Song N, Gao Z, Wood JG, Hueston L, Gilbert GL, MacIntyre CR, et al. Current  
377 epidemiology of rubella and congenital rubella syndrome in Australia: Progress towards  
378 elimination. *Vaccine* 2012;30(27):4073-8.
- 379 [3] RANZCOG. The Royal Australian College of Obstetricians and Gynaecologists. New  
380 College Statement. Influenza Vaccination for Pregnant Women (C-Obs 45). [homepage on  
381 the internet] [cited 2011; Available from: <http://www.ranzcog.edu.au/>
- 382 [4] Zaman K, Roy E, Arifeen SE, Rahman M, Raqib R, Wilson E, et al. Effectiveness of  
383 maternal influenza immunization in mothers and infants. *The New England journal of*  
384 *medicine* 2008 Oct 9;359(15):1555-64.
- 385 [5] Australian Institute of Health and Welfare. 2009 Adult Vaccination Survey: summary  
386 results. [serial online] 2011 [cited 2011 15 November]; cat.no.PHE 135:[Available from:  
387 <http://www.aihw.gov.au/publication-detail/?id=10737418409>
- 388 [6] Wong C TN, Marshall H. The uptake of and attitudes towards pregnancy related  
389 immunisations in South Australian parents. . PHAA National Immunisation Conference.  
390 Darwin, Australia, 2012.
- 391 [7] Wiley KE, Massey PD, Cooper SC, Wood NJ, Ho J, Quinn HE, et al. Uptake of influenza  
392 vaccine by pregnant women: a cross-sectional survey. *The Medical journal of Australia* 2013  
393 Apr 15;198(7):373-5.
- 394 [8] McCarthy EA, Pollock WE, Nolan T, Hay S, McDonald S. Improving influenza  
395 vaccination coverage in pregnancy in Melbourne 2010-2011. *The Australian & New Zealand*  
396 *journal of obstetrics & gynaecology* 2012 Aug;52(4):334-41.
- 397 [9] National Health and Medical Research Council (NHMRC). *The Australian*  
398 *immunisation handbook 10th edition*. [homepage] 2013 [cited 2013 August 30];  
399 10th:[Available from:  
400 <http://www.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook10-home>
- 401 [10] Wiley KE, Massey PD, Cooper SC, Wood N, Quinn HE, Leask J. Pregnant women's  
402 intention to take up a post-partum pertussis vaccine, and their willingness to take up the  
403 vaccine while pregnant: A cross sectional survey. *Vaccine* 2013 Aug 20;31(37):3972-8.
- 404 [11] Healy CM, Rench MA, Baker CJ. Implementation of Cocooning against Pertussis in a  
405 High-Risk Population. *Clinical Infectious Diseases* 2011 January 15, 2011;52(2):157-62.
- 406 [12] Schrag SJ, Fiore AE, Gonik B, Malik T, Reef S, Singleton JA, et al. Vaccination and  
407 perinatal infection prevention practices among obstetrician-gynecologists. *Obstetrics and*  
408 *Gynecology* 2003;101(4):704-10.
- 409 [13] Tong A, Biringer A, Ofner-Agostini M, Upshur R, McGeer A. A cross-sectional study of  
410 maternity care providers' and women's knowledge, attitudes, and behaviours towards  
411 influenza vaccination during pregnancy. *Journal of Obstetrics and Gynaecology Canada*  
412 2008;30(5):404-10.
- 413 [14] Chan A, Scheil W, J S, Nguyen AM, L S. *Pregnancy Outcomes in South Australia*. [pdf]  
414 2009 June 19, 2012 [cited 2012 June 28]; Available from:  
415 [http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/reso](http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/resources/reports/annual+reports/pregnancy+outcome+sa+2009-operations-pou-20110815.pdf)  
416 [urces/reports/annual+reports/pregnancy+outcome+sa+2009-operations-pou-20110815.pdf](http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/resources/reports/annual+reports/pregnancy+outcome+sa+2009-operations-pou-20110815.pdf)
- 417 [15] Patton M. *Qualitative evaluation and research methods*. In: *Designing qualitative*  
418 *studies: purposeful sampling*. Beverly Hills, CA: Sage, 1990: 172.
- 419 [16] QSR International Pty Ltd. NVivo qualitative analysis software. Version 9. 2010.

- 420 [17] Hansen EC. Successful Qualitative Health Research: A practical introduction.  
421 Berkshire, England: Open University Press, 2006.
- 422 [18] SA Pregnancy Hand Held Record. [pdf] 2012 [cited 2012 April 8]; Version  
423 5:[Available from:  
424 <http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/health+information/health+information+for+the+clinician/sa+pregnancy+record>  
425
- 426 [19] Bounty Bags. [cited 30/8/13; Available from: <http://www.bountybags.com.au/>  
427
- 428 [20] Schrag SJ, Fiore AE, Gonik B, Malik T, Reef S, Singleton JA, et al. Vaccination and  
429 perinatal infection prevention practices among obstetrician-gynecologists. *Obstetrics and gynecology* 2003 Apr;101(4):704-10.
- 430 [21] Power ML, Leddy MA, Anderson BL, Gall SA, Gonik B, Schulkin J. Obstetrician-  
431 gynecologists' practices and perceived knowledge regarding immunization. *American journal of preventive medicine* 2009 Sep;37(3):231-4.  
432
- 433 [22] Tong A, Biringer A, Ofner-Agostini M, Upshur R, McGeer A. A cross-sectional study of  
434 maternity care providers' and women's knowledge, attitudes, and behaviours towards  
435 influenza vaccination during pregnancy. *Journal of obstetrics and gynaecology Canada*: 2008  
436 May;30(5):404-10.
- 437 [23] Broughton DE, Beigi RHMM, Switzer GEP, Raker CAS, Anderson BLMM. Obstetric  
438 Health Care Workers' Attitudes and Beliefs Regarding Influenza Vaccination in Pregnancy.  
439 *Obstetrics & Gynecology* 2009;114(5):981-7.
- 440 [24] Wu A, Wisler-Sher D, Griswold K, Colson E, Shapiro E, Holmboe E, et al. Postpartum  
441 Mothers' Attitudes, Knowledge, and Trust Regarding Vaccination. *Maternal and Child Health Journal* 2008;12(6):766-73.  
442
- 443 [25] Halladay M, Bero L. Getting Research into Practice: Implementing Evidence-Based  
444 Practice in Health Care. *Public Money & Management* 2000 2000/10/01;20(4):43-50.
- 445 [26] Australian Woman Held Pregnancy Record. The Maternity Services Inter-  
446 Jurisdictional Committee. Australian Government.
- 447 [27] Queensland Government. Pregnancy Health Record. [pdf] 2010 [cited 2012;  
448 Available from: [www.health.qld.gov.au/psq/pathways/docs/pregnancy\\_rec.pdf](http://www.health.qld.gov.au/psq/pathways/docs/pregnancy_rec.pdf)

449

450

451

**Table 1. Examples of participant responses within key theme areas**

<b>1. Barriers to implementing vaccine recommendations</b>	
	<b>Poor definition of responsibility for VPD management.</b>
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
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
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
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 vacs you can get it through your GPs the best place.” Midwife6
	<b>Lack of documentation</b>
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
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
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
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

***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 2: Description of models of care in the study setting and participants drawn from each model**

Clinic model	Public/ private	Team	Setting*	Participants in study**
Medical Antenatal Care	Public	Obstetricians and midwives	A: outpatients' clinic, antenatal ward, D: hospital delivery suite P: postnatal ward.	3 senior obstetricians, 1 obstetrician, 2 obstetric registrars, 2 senior midwives and 3 midwives
Midwifery Group Practice	Public	Single midwife supported by midwifery team	A: community and outpatients' clinic D: hospital delivery suite P: community	1 senior midwife 1 midwife
Shared Care Model	Public	GPs and midwives	A: general practice and outpatients clinic; D: hospital delivery suite P: postnatal ward and general practice.	3 GPs, 1 midwife
Private Obstetrician	Private	Single Obstetrician	A: obstetrician's consulting rooms D: Hospital delivery suite P: postnatal ward and obstetrician's rooms	2 senior obstetricians

\*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.**

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

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

