

VACCINE DECISION-MAKING BEGINS IN PREGNANCY: CORRELATION BETWEEN VACCINE CONCERNS, INTENTIONS AND MATERNAL VACCINATION WITH SUBSEQUENT CHILDHOOD VACCINE UPTAKE

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Abstract

Introduction

Maternal and childhood vaccine decision-making begins prenatally. Amongst pregnant Australian women we aimed to ascertain vaccine information received, maternal immunisation uptake and attitudes and concerns regarding childhood vaccination. We also aimed to determine any correlation between a) intentions for childhood vaccination, (b) concerns about pregnancy vaccination, (c) socioeconomic status (SES) and (d) uptake of influenza and pertussis vaccines during pregnancy and routine vaccines during childhood.

Methods

Women attending public antenatal clinics were recruited in three Australian states. Surveys were completed on iPads. Follow-up phone surveys were done three to six months post delivery, and infant vaccination status obtained via the Australian Childhood Immunisation Register (ACIR).

Results

Between October 2015 and March 2016, 975 (82%) of 1184 mothers consented and 406 (42%) agreed to a follow up survey, post delivery. First-time mothers (445; 49%) had significantly more vaccine concerns in pregnancy and only 73% had made a decision about childhood vaccination compared to 89% of mothers with existing children (p-value <0.001). 66% of mothers reported receiving enough information during pregnancy on childhood vaccination. In the post delivery survey, 46% and 82% of mothers reported receiving pregnancy influenza and pertussis vaccines respectively. Vaccine intentions and some vaccine concerns were correlated with vaccine uptake post delivery. There was no association between reported maternal vaccine uptake or SES and childhood vaccine uptake.

Conclusion

First time mothers are more vaccine hesitant and undecided about childhood vaccination, and only two thirds of all mothers believed they received enough information during pregnancy. New interventions to improve both education and communication on childhood and maternal vaccines, delivered by midwives in the Australian public hospital system, may reduce vaccine hesitancy for all mothers in pregnancy and post delivery, particularly first-time mothers.

Introduction

Nearly half of Australian parents have some concern about childhood vaccines,[1, 2] manifesting as under-vaccination or rejection of all vaccines for approximately 3.3% of children. Whilst 93% of Australian children are fully immunised [3, 4], many parents report complying with the National Immunisation Program (NIP) schedule despite significant concerns [5]. Maintaining and increasing childhood vaccination rates requires that we understand parents' concerns and the optimal decision-making time points to address them.

Healthcare providers (HCPs) are the most frequently accessed source of vaccine information, [6] are highly trusted, [7, 8] and play a key role in shaping parental attitudes towards maternal [9] [10] and childhood vaccination. [11] The nature and content of HCPs vaccine discussions has been studied, [12] but little is known about the optimal timing for delivery of this information. Parents want balanced information about vaccination benefits and harms, the chance to be able to ask questions and to feel a sense of control over the process.[13, 14]

Childhood vaccine decision-making begins prenatally [15, 16]. Compared to parents who accept all vaccines, those who refuse or delay are twice as likely to report thinking about vaccines prenatally, and eight times more likely to report ongoing re-evaluation of their vaccination decisions [8]. The provision of vaccine information before the first vaccine visit has been shown to improve knowledge about vaccination, intention to vaccinate, and uptake (14) and is what parents want. [17] [18] However, the evidence suggests that vaccine discussions with parents may be more effective in addressing vaccine concerns if communication is part of the healthcare encounter [19] and they occur during pregnancy [16].

Currently there is no mandated time point in Australia to discuss childhood vaccination with expectant parents, although many antenatal providers discuss Hepatitis B vaccine at birth. Midwives in public hospitals, private and public obstetricians and GPs are encouraged to recommend and facilitate pertussis and flu vaccination in pregnancy, [9] although ensuring uptake of these vaccines is challenging.[20] In Australia, a funded, state-based maternal pertussis vaccination program was introduced in Australia in 2015, alongside the maternal influenza vaccination program. [9]

There are no data available in Australia to determine whether vaccine concerns of expectant mothers, particularly first time mothers, correlate with childhood and maternal vaccine

uptake. In this study, we aimed to ascertain whether vaccine information is received in pregnancy and post-delivery, mothers' attitudes and concerns regarding childhood vaccination and maternal immunisation uptake. We also aimed to assess correlations between maternal a) vaccine intentions for childhood vaccination and (b) vaccine concerns in pregnancy, (c) socioeconomic status (SES) and (d) uptake of influenza and pertussis vaccines during pregnancy and routine vaccines during childhood

Methods

Design, setting, participants

We sought to recruit 300 women to complete surveys at four sites (1,200 women total); two public hospitals in Melbourne, Victoria (Vic); one public hospital in Adelaide, South Australia (SA) and one in Perth, Western Australia (WA). Between October 2015 and April 2016, researchers asked pregnant women attending antenatal appointments to complete the survey using iPads. After ascertaining interest and eligibility (including English proficiency), an information sheet was provided and consent obtained. Parents with insufficient time to complete the survey were sent an e-mail link. Reminder emails were sent two and four weeks later. Consent was requested for a follow-up telephone interview 3-6 months post delivery. Courtesy emails were sent prior to telephone contact and mothers were contacted three times before being considered non-responders. Follow-up survey links were emailed to mothers who requested them and were completed online.

Main study measures

The PINA-A (Parental Immunisation Needs and Attitudes – Antenatal) survey items were developed by the study team, comprised of social scientists, vaccine experts and general paediatricians, and based on the Health belief Model.[21] Items were based on questions validated in other surveys and a previous PINA survey employed in public paediatric outpatients and community settings. [22-24] Attitudes, behaviours and concerns were measured using matrix style questions, with responses provided on a six-point Likert scale. [25] We used the Vaccine Communication Framework (VCF) [26] to group parents into five categories based on their level of vaccine hesitancy and intention to vaccinate: the 'unquestioning acceptor'; the 'cautious acceptor'; the 'hesitant'; the 'late or selective vaccinator'; and the 'refuser'(Table 3).

Parents were asked for consent to access their child's immunisation record on the Australian Childhood Immunisation Register (ACIR) to ascertain if they were "up to date" with the National Immunisation Program (NIP)[27]. Children were considered up to date if all recommended vaccines for their age had been given at 2, 4 and 6 months, with a one-month grace period. Participant postcodes were obtained to determine socioeconomic status (SES) using Socioeconomic Index for Advantage (SEIFA)[28].

Data management and Statistical analysis

Survey data were collected and managed using REDCap (Research Electronic Data Capture) hosted at the Murdoch Childrens Research Institute. REDCap is a secure, web-based application designed to support data capture and management for research studies [29]. Survey data was transferred to Stata software (Stata/IC 14.2 for Windows) for analysis from REDCap. Demographic profiles, vaccine intentions and concerns, and health system utilisation were analysed using descriptive statistics, with 95% confidence intervals to express uncertainty due to sampling variation for estimated proportions. String variables were analysed individually to assess parents' responses to open questions. Chi-square tests were conducted to compare proportions of bivariate outcomes by exposures. When the sample was small, binary regression was used to estimate the difference in proportions, including confidence intervals and p-values.. Logistic regression analysed the probability of a child being up-to-date with scheduled vaccines, using predictors of vaccination intention, vaccine attitudes, beliefs and concerns, SES, and reported vaccine uptake in pregnancy and childhood.

Ethics

Ethics approval for the Parental Immunisation Needs and Attitudes (PINA-A) study was obtained from the Royal Childrens Hospital HREC (35129A), with State-level approval from SA (HREC AU/15/92A0231) and WA (HREC 2015211EW).

Results

Participants/Demographics for initial survey in pregnancy

Between October 2015 and March 2016, 975 (82%) of 1184 of parents approached, consented to participate. By State, 464 (95%) of 490 parents consented to participate in Victoria, 231 (78%) of 295 in South Australia and 280 (70%) of 399 in Western Australia. The survey took between 10-15 minutes to complete, with the majority of women completing

the survey in the antenatal clinic. Between 16-20% of mothers were sent the survey via email link but only 27-30% completed the survey at home when prompted by an email. The majority of mothers had a tertiary education (60%), were born in Australia (62%), were partnered (92%) and 6% identified as Aboriginal / Torres Strait Islander (Table 1). 445 (49%) were pregnant with their first child and the median gestation at time of survey completion was 31 weeks.

Support for Childhood vaccination and knowledge

There was strong overall support for vaccination, with 72% and 24% of respondents' strongly and generally supportive respectively, with little variation between the states. However, 73% of mothers pregnant with their first child had made a decision regarding vaccination of their unborn child compared to 89% of mothers with children (difference in proportion 15%; 95% CI 10-21%; p-value <0.001) and 6% of first time mothers reported having not heard of vaccinations, compared to 1% of mothers with children. (Table 2). Mothers pregnant with their first child were more likely to classify themselves as hesitant on the VCF continuum (5.2 vs 1.7%) (Table 3). Overall, only 50% of mothers 'strongly agreed' and 32% 'moderately agreed' that they had enough knowledge to make a decision about vaccinating their child, with no significant difference between first-time and current mothers.

Childhood vaccination attitudes and concerns and support for maternal vaccines

There was high overall support for childhood vaccines, with the majority of parents seeing them as safe, effective and necessary and considering herd immunity important (Table 4). Three attitudes (Questions 4.4, 4.12 and 4.13) demonstrated a significant difference between first-time mothers and those with children, highlighting higher vaccine safety concerns and reliance on herd immunity for first-time mothers. Overall, 15% of mothers highlighted access as an issue distinct from acceptance (Question 4.5).

Overall, the most common concerns were that children get too many vaccines during the first two years of life (30%), that vaccines are given to children to prevent diseases that are not common (27%) and that vaccines can cause allergies (24%). There was little variation by state. There was a significant difference in nine out of the 11 concerns between first time mothers and those with children. Concerns around vaccine safety, immunity, and beliefs that VPDs are not serious or common and that natural immunity from the diseases may be preferable were more common amongst first time mothers (Table 5).

92% of mothers > 28 weeks pregnant agreed that pertussis vaccine was important and 76% reported a HCP recommendation for vaccination during pregnancy. Of all recommendations, most were made by midwives (61%), particularly in WA (73%) compared to Vic (51%), followed by GPs (49%) and obstetricians (29%). In contrast, 80% of mothers agreed that flu vaccine during pregnancy was important, with 51% reporting a recommendation. Of these, most were received by their GPs (69%), followed by midwives (33%) and obstetricians (21%).

Information Sources, Satisfaction and Trust and interest in further information on vaccines

Just over half of parents (56%) had discussed or accessed information about childhood vaccination during pregnancy, with higher information-seeking amongst WA mothers (74%) compared to SA (54%) and Victoria (46%). Overall, midwives (66%), particularly in WA (80%), and General Practitioners (58%) were the most highly accessed resource in pregnancy, with only 38% of respondents discussing vaccines with their obstetrician. Family and friends (34%), the Internet (26%) and Department of Health websites (20%) were also accessed. Mothers' satisfaction and trust was highest in HCPs (93-95%), especially midwives (96%), compared to family and friends (90%), the Department of Health websites (88%) and the Internet (82%). Parents also perceived their HCPs as highly supportive of vaccination: midwives (94%), GPs (94%) and obstetricians (96%). Two thirds of mothers wanted more information on vaccine safety (65%), particularly on how vaccines are tested (66%), possible risks (64%) and side effects of vaccines (64%). Fewer mothers wanted information on VPDs (58%) and risks of not having vaccines (50%).

Follow Up Survey

406 (42%) of 975 mothers participated in the follow up survey post delivery, with 173 (77%) of 225 mothers from Vic, 63 (58%) of 108 from SA and 51 (70%) of 73 from WA completing it. Of the 406 mothers, 237 (58%) consented to ACIR access, including 87% from Vic, 63% from SA and 88% from WA. Overall ACIR access was obtained for 230 mothers (7 were excluded for incorrect or missing information). Significantly more first-time mothers provided ACIR consent than mothers with existing children (87 vs 76%; p-value 0.013).

(i) Information in pregnancy and planned childhood vaccines

In the follow up survey, only 190 (66%; 95% CI 60-72) of 290 mothers felt that they had received enough information regarding childhood vaccination during pregnancy, with Vic mothers (50%) reporting receiving less information compared to SA (92%) and WA (78%). Apart from birth dose Hepatitis B vaccine, many mothers stated that there was little or no discussion about childhood vaccines in pregnancy.

Post delivery, only 152 (52%) of 289 mothers reported discussing childhood vaccination with their main HCP whilst pregnant and 122 (80%) reported that their HCP made a recommendation to vaccinate the baby. In response to open-ended questions, many mothers felt that they had to initiate the discussion for both childhood vaccines and vaccines in pregnancy, and HCPs assumed the mother would vaccinate without making explicit recommendations. The majority of mothers wanted balanced, simple information on NIP and maternal vaccines early in pregnancy during routine antenatal appointments or midwife-led childbirth education classes.

When asked post delivery, 190 (66%) of 290 mothers planned to give all recommended vaccines with 256 (88%) of 290 mothers deciding to give Hepatitis B vaccine at birth compared to 96-100% for the vaccines at 2 months of age. Concerns around birth Hepatitis B vaccine centered on potential effects on breast feeding, low risk of exposure to Hepatitis B infection and the perception that the vaccine was given too early in life.

(ii) Vaccines in pregnancy

When asked post delivery, 46% of mothers reported receiving flu vaccine and 82% pertussis vaccine in pregnancy (Table 6). 5% (13/246) of mothers and 60% of partners received a pertussis vaccine after delivery. The most common barrier reported to receiving maternal vaccines was that they were not offered in the antenatal clinic (32/290, 12%; 95% CI 8-16).

(iii) Correlation between childhood vaccine uptake and vaccine concerns

Among the 230 mothers whose infants' ACIR records were accessed, 11 were excluded due to missing data in ACIR i.e. missing the 2 month vaccines with only ACIR record of the 4 and 6 month vaccines. Of the 219 remaining, 24 (11%, 95% CI 7.4-15.9%) were not up to date and 195 (89%, 95% CI 84-93%) were up to date for their age.

The mother's level of hesitancy according to reported VCF during pregnancy, was correlated with vaccine uptake post delivery. Infants of mothers who reported "a lot of concern" in pregnancy were less likely to be up to date compared to mothers who had no concerns (OR 0.03, 95% CI 0.01-0.51, $p = 0.02$). Two attitudinal factors were also correlated with vaccine uptake: belief that "vaccines are safe for my child" (vaccine uptake 91% in those who agreed compared to 44% in mothers who did not agree; difference in proportion 47%: 95% CI 14-79%, $p = 0.005$) and being prepared to give any new vaccine that was available, even if it was not on the NIP (vaccine uptake 94% compared to 84% in mothers who did not agree; difference in proportion 10%: 95% CI 1-18%, $p = 0.025$). Two attitudinal factors were suggestive of a positive relationship but the difference in proportions, although large, were not statistically significant due to the small sample size: concern that vaccines can cause allergies (vaccine uptake 79% in those who agreed compared to 91% in mothers who did not agree; difference in proportion 12%: 95% CI -1%, 26%, $p = 0.079$) and belief that there are better ways to protect children against disease than vaccines (uptake 69% compared to 90% in mothers who disagreed; difference in proportion 21%: 95% CI -4%, 46%, $p = 0.104$).

(iv) Correlation between childhood vaccine uptake and maternal vaccine uptake in pregnancy

There was no association between childhood vaccine uptake and uptake of pertussis or flu vaccines in pregnancy. There was, however, a correlation between mothers who reported a recommendation for vaccines in pregnancy and receipt of the vaccine (86% who received a recommendation for pertussis compared to 64% who didn't received the vaccine (OR 3.5; 95% CI 1.6-7.8, p -value 0.002); 58% who received a flu recommendation compared to 31% who didn't (OR 3.1; 95% CI 1.9-5.0, p -value 0.000)). Furthermore, 52% of mothers who believed the flu vaccine was important, compared to 17% who didn't, received a flu vaccine (OR 5.1; 95% CI 2.4-10.9, p -value 0.000). This was not significant for pertussis vaccine.

Discussion

This study confirms that vaccine decision-making begins prenatally with many expectant mothers undecided about vaccinating their child after delivery. This was most significant for first time mothers who reported higher levels of vaccine hesitancy, expressed greater vaccine concerns and were more undecided about vaccinating their unborn child than mothers with children. Furthermore, only half of all expectant mothers strongly agreed that they had enough knowledge to make a decision about vaccinating their child.

To address their concerns about childhood vaccines, over half of all mothers had discussed or accessed information during pregnancy and only two thirds believed that they had received enough information. Midwives were the most frequently accessed and trusted source of vaccine information. Only a third of women had discussed childhood vaccines with their obstetrician, perhaps reflecting limited obstetric consultations in this more midwife-led model of care or that obstetricians may not see childhood vaccine recommendations as their role. A 2012 US study reported that whilst the majority (98%) of obstetrician's believed childhood vaccination was important, less than half felt that they could influence mothers' vaccination decisions [30]. Many mothers wanted more information on the risks and benefits of scheduled vaccines, non-scheduled vaccines and selective schedules, consistent with previous studies [7]. Mothers reported a reluctance to give the birth dose Hepatitis B vaccine compared to the 2-month or later vaccines. However, 11% of infants were still not up to date with the routine two to six-month vaccines despite high stated intentions, highlighting both un-addressed vaccine concerns and possible logistical factors.

We have shown that intentions, attitudes and concerns regarding childhood vaccines correlate with behavior. Attitudes and concerns that correlated with childhood vaccine uptake post delivery could be used to measure and detect vaccine concerns in pregnancy, particularly amongst first time mothers and within communities with higher rates of vaccine refusal. Such questions, which are predominantly around vaccine safety, could be used as part of a vaccine hesitancy tool to monitor vaccine hesitancy. More work needs to be done on identifying and validating vaccine concern survey items, and possibly composite items, that correlate with behavior in different populations with larger sample sizes.

Maternal pertussis vaccine was perceived to be more important with higher uptake compared to flu vaccine. Evidence suggests that motivation for these vaccines differs, with influenza vaccine perceived to be related to maternal protection and pertussis vaccine to infant protection. [31] This may relate to a sociological concept known as reproductive citizenship, whereby a pregnant woman self-regulates her behavior to protect and ensure optimal development of her unborn child. [32] Availability of maternal vaccines in public antenatal clinics was a key barrier to delivery and is an obvious target to improve uptake. In SA and WA, which have higher coverage than Victoria, pregnancy vaccines are available in some

maternity hospitals. There is a strong correlation between recommendation for both vaccines in pregnancy and receipt of the vaccine, underpinning the vital role of the HCP in maternal vaccine uptake.[33, 34] For flu, in addition to a provider's recommendation, mothers need to be convinced of the importance of the vaccine to improve uptake.

A maternal and childhood immunisation platform needs to be developed and delivered in pregnancy to normalise vaccine education, communication and practice among antenatal care providers. Multi-component interventions have not demonstrated an increase in maternal vaccine uptake [34] or changes in attitudes and beliefs [35], although there is some evidence of antenatal provision of information and uptake for childhood vaccines.[36] An intervention in pregnancy incorporating tailored education and communication on childhood and maternal vaccination, delivered by midwives in the Australian context, could achieve this goal. Work is needed to identify how midwives can best be supported in advocating for immunisation given that some midwives are hesitant to promote vaccines due to concerns about safety and the idea that an overt recommendation clashes with the midwifery philosophy of patient empowerment and the prerogative of choice. [37, 38] However, by framing vaccination as a means for mothers to protect their babies even before birth, midwives discussion and promotion of vaccination could be couched as patient empowerment.

There were several limitations to our study. Despite a large sample size, only 43% of mothers agreed to the follow up study and we could only access ACIR records for a quarter. However, these mothers were mostly from the lower end of the hesitancy spectrum and thus would have been more likely to report acceptance of vaccines in pregnancy[20] or express less childhood vaccine concerns. Furthermore, the study only included English speaking women, low numbers of indigenous women and those accessing a public model of antenatal care, which may account for the high involvement of midwives compared to obstetricians, limiting generalisability. However, this was intentional, as new interventions to address vaccine hesitancy would be best trialed in a public setting with predominantly midwifery-led models of care.

Conclusion

Australian pregnant women birthing in the public system are strongly supportive of childhood vaccination. First time mothers are more vaccine hesitant and undecided about childhood vaccination and only two thirds of all mothers believed they received enough information

during pregnancy. New interventions to improve both education and communication on childhood and maternal vaccines, delivered by midwives in the Australian public hospital system, may reduce vaccine hesitancy for mothers in pregnancy and post delivery.

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Table 1: Demographics of study participants surveyed in pregnancy, by location

	Vic	SA	WA	Total
Mean pregnancy gestation (median (IQR))	31 (24 – 36)	32 (22 – 36)	31 (25 – 34)	31 (25 – 34)
Level of education n(%)				
< Year 12	16(6)	19(10)	39(16)	74(10)
Year 12	32(10)	35(18)	38(16)	105(14)
TAFE / Apprenticeship	38(12)	33(18)	41(18)	112(16)
University Degree	228(72)	104(54)	116(50)	448(60)
Total	314	191	234	739
Country of Birth n (%)				
Australia	181(58)	151(78)	122(52)	454(62)
Other	133(42)	41(22)	112(48)	286(38)
Total	314	192	234	740
Marital status n (%)				
Single/Never married	16(6)	21(10)	17(8)	54(8)
Married / De-facto /Partnered	296(94)	165(86)	212(90)	673(92)
Separated / Divorced / Widowed	2(0)	5(2)	5(2)	12(2)
Total	314	191	234	739
No of Children n (%)				
0 (first child)	241 (58)	113 (50)	91 (35)	445 (49)
1	128 (31)	64 (29)	98 (38)	290 (32)

2	31 (7)	36 (16)	44 (17)	111 (12)
3	11 (3)	9 (4)	15 (6)	35 (4)
>=4	4 (1)	4 (2)	12 (5)	20 (2)
Aboriginal / Torres Strait Islander n (%)				
No	303(96)	179(94)	216(92)	698(94)
Yes	11(4)	11(6)	18(8)	40(6)
Total	314	190	234	738

Table 2: Position regarding vaccinations for unborn child during pregnancy, by parity

Position on vaccinations for unborn child	First child				1 or more children			
	Vic n (%)	SA n (%)	WA n (%)	Total n (%)	Vic n (%)	SA n (%)	WA n (%)	Total n (%)
I have not heard about vaccinations	18 (7)	6 (5)	3 (3)	27 (6)	3 (2)	1 (1)	2 (1)	6 (1)
I have heard about vaccinations but have not thought about vaccinating my unborn child	24 (10)	11 (10)	9 (10)	44 (10)	6 (3)	3 (3)	9 (5)	18 (4)
I have thought about vaccinations for my unborn child, but am undecided about giving them	19 (8)	15 (13)	16 (18)	50 (11)	3 (2)	9 (8)	15 (9)	27 (6)
I have decided what I will do in regards to vaccinating my unborn child	180 (75)	81 (72)	63 (69)	324 (73)	160 (93)	100 (89)	143 (85)	403 (89)
Total (n)	241	113	91	445	172	113	169	454

Table 3: Plans to vaccinate unborn child according to the Vaccine Communication Framework (VCF), by parity

First child	Unquestioning acceptor – no concerns, give all vaccines n (%)	Cautious acceptor – minor concerns, give all vaccines n (%)	Hesitant – serious concerns, give all vaccines n (%)	Delayed or selective vaccinator serious concerns; delay 1 or more vaccines n (%)	Refuser - serious concerns refuse all vaccines n (%)	Total n (%)
No	271 (67.4)	111 (27.6)	7 (1.7)	7 (1.7)	6 (1.5)	402
Yes	194 (60.2)	100 (31.1)	17 (5.3)	7 (2.2)	4 (1.2)	322
Total	456 (64.2)	211 (29.1)	24 (3.3)	14 (1.9)	10 (1.4)	704

Table 4: Percentage of parents who agreed (strongly / moderately / slightly) with the following attitudes and behaviours about childhood vaccination, by parity

Vaccine attitudes and behaviours	n	First child n (%)	1 or more children n (%)	Total n (%)	p-value
1. I would do whatever it takes to get my child fully vaccinated	887	420 (96)	424 (94)	824 (95)	0.312
2. When it comes to vaccines for my child, I will take any that are on offer	884	368 (84)	407 (91)	775 (88)	0.0001
3. Vaccines will be important for my child	883	428 (98)	436 (98)	864 (98)	0.79
4. I worry that vaccines will do my child more harm than good	881	108 (25)	73 (16)	181 (21)	0.002
5. I think it will be difficult to get my child vaccinated	880	71 (16)	57 (13)	128 (15)	0.15
6. I think that the current schedule of recommended vaccines will be appropriate for my child	876	403 (93)	413 (94)	816 (93)	0.73

7. Vaccines will be safe for my child	875	412 (95)	421 (95)	833 (95)	0.95
8. Vaccines will be effective for my child	873	418 (97)	423 (96)	841 (96)	0.75
9. Vaccines will be necessary to protect my child	873	420 (97)	423 (96)	843 (97)	0.49
10. The current childhood vaccination schedule is designed by experts who care about children's health	872	423 (98)	423 (96)	846 (97)	0.12
11. It is important for my child to be vaccinated in order to protect others in the community	871	417 (97)	421 (96)	838 (96)	0.41
12. Because other children are vaccinated, it isn't necessary to have my child vaccinated	869	33 (8)	19 (4)	52 (6)	0.04
13. I would give my child any new vaccine that was available, even if it was not on the National Immunisation Schedule	867	189 (44)	254 (58)	443 (51)	0.00

Table 5: Percentage of parents who agreed (strongly / moderately / slightly) with the following statement regarding their vaccine concerns about childhood vaccination, by parity

Vaccine concerns	n	First child n (%)	1 or more children n (%)	Total n (%)	p-value
1. Children get too many vaccines during the first two years of life	859	152 (36)	103 (24)	255 (30)	0.00
2. Children's immune systems could be weakened by vaccines	857	122 (29)	72 (17)	194 (23)	0.00
3. Vaccines contain ingredients that can cause serious harm	856	122 (29)	77 (18)	199 (23)	0.00
4. The pain of vaccine needles is too great for children to bear	853	63 (15)	52 (12)	155 (14)	0.23

5. Vaccines are given to children to prevent diseases that are not serious	848	76 (18)	53 (12)	129 (15)	0.02
6. Vaccines are given to children to prevent diseases that are not common	848	135 (32)	90 (21)	225 (27)	0.00
7. Children should get natural immunity from diseases rather than immunity from vaccines	848	75 (18)	53 (12)	128 (15)	0.03
8. Vaccines can cause autism	847	68 (16)	39 (9)	107 (13)	0.002
9. Vaccines can cause allergies	847	118 (28)	87 (20)	205 (24)	0.01
10. There are better ways to protect children against disease than vaccines	847	57 (14)	45 (11)	102 (12)	0.18
11. Serious side effects from vaccines are too common for me to accept	845	61 (15)	37 (9)	98 (12)	0.008

Table 6: Reported vaccine uptake for Pertussis and flu vaccines in pregnancy post delivery

	Vic		SA		WA		Total		95% CI
	N	n(%)	N	n(%)	N	n(%)	N	n(%)	
Pertussis	175	145 (82)	64	47 (74)	51	44 (86)	290	236 (82)	78-86
Flu	175	82 (46)	64	30 (46)	51	20 (40)	290	132 (46)	40-52
Partner received pertussis vaccine	173	115 (66)	63	31 (50)	51	25 (50)	287	171 (60)	54-66