

# Influenza vaccination among pregnant women in two hospitals in Sydney, NSW: what we can learn from women who decline vaccination

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## Key points

- Reasons for some pregnant women declining influenza vaccination are infrequently explored and can provide insight into vaccine uptake behaviour during pregnancy
- Pregnant women may not be receiving adequate information on influenza vaccination – in particular, subgroups of women such as those with comorbidities
- A recommendation from maternity care providers remains key to vaccine acceptance; however, pregnant women still lack confidence around vaccine safety and efficacy, highlighting the need for more effective communication

## Abstract

**Objective:** Pregnant women are recognised as being at risk of serious illness from influenza. Despite this, and longstanding national recommendations for vaccination in pregnancy, vaccine uptake remains suboptimal. This study aims to determine factors associated with women declining influenza vaccination in pregnancy.

**Method:** We surveyed pregnant women from antenatal clinics at two Sydney hospitals as part of an evaluation of the New South Wales (NSW) Health 2017 influenza vaccination in pregnancy campaign. Factors associated with a woman's decision to decline influenza vaccination were assessed using Pearson's chi-square test and multivariable logistic regression.

**Results:** Among 642 women surveyed, 58% self-reported influenza vaccination during pregnancy and 19% reported they had declined vaccination. Factors associated with a decision to decline vaccination included lack of a recommendation from a maternity care provider (adjusted odds ratio [aOR] 6.06; 95% confidence interval [CI] 3.50, 10.50), recommendation against vaccination (aOR 4.17; 95% CI 2.07, 8.38), having never previously been vaccinated for influenza (aOR 2.75; 95% CI 1.64, 4.59) and, among third-trimester women, not having been vaccinated for pertussis (aOR 2.55; 95% CI 1.32, 4.89). On univariate analyses, women who declined vaccination were more likely to disagree or feel uncertain about vaccine safety or effectiveness compared with women who chose to be vaccinated.

**Conclusion:** Recommendations from maternity care providers remain key to a woman's decision to be vaccinated for influenza during pregnancy. Time should be allocated for vaccine discussions early in pregnancy as part of routine care. Continued efforts are needed to improve messaging to pregnant women on the benefits, safety and efficacy of influenza vaccination.

## Introduction

Pregnant women are more vulnerable to severe morbidity or mortality from influenza than the general population, including adverse pregnancy outcomes such as congenital abnormalities<sup>1</sup>, premature birth, pregnancy loss and stillbirth.<sup>1-3</sup> Infants aged less than 6 months, who are too young to be immunised for influenza, are also at high risk of hospitalisation from influenza.<sup>4,5</sup> Influenza vaccination in pregnancy is an essential prevention strategy to protect both mother and infant from influenza and its associated complications.

In Australia, influenza vaccine has been recommended for use in pregnancy by the Australian Technical Advisory Group on Immunisation since 2000.<sup>6</sup> Since 2010, it has been freely available under the National Immunisation Program for all pregnant women.<sup>7</sup> Although national data on uptake of the influenza vaccine in pregnancy are lacking, recent estimates of uptake from several Australian states and territories range from 39% to 76%<sup>8-14</sup>, suggesting that at least 24% – and up to 61% – of pregnant women, do not currently receive the vaccine.

This study aimed to determine factors associated with why pregnant women decline influenza vaccination, to inform program and messaging strategies for improving influenza vaccine uptake in pregnancy.

## Methods

Data for this study were collected as part of an evaluation of the New South Wales (NSW) Health 2017 influenza vaccination in pregnancy campaign. Eligible women were aged older than 18 years, pregnant and English speaking. Recruitment occurred in the waiting rooms of antenatal clinics at two tertiary referral hospitals in Sydney: Westmead Hospital in Sydney's west and Royal North Shore Hospital (RNSH) in Sydney's north, with 5800 and 2800 births, respectively, in 2017.<sup>15</sup> Women were recruited between July 2017 and September 2017 at Westmead Hospital and between September 2017 and October 2017 at RNSH. Women had the opportunity to be vaccinated after the influenza vaccine became available in late March 2017.

Participants were individually approached and asked to self-complete a paper-based survey that included questions on demographics, self-reported influenza and pertussis vaccination behaviour during their current pregnancy, recommendations received regarding vaccination, access to vaccine-related information and prior history of vaccination. Both women who had declined vaccination and those who had been vaccinated were included in the study. Women who were undecided, stated they were still planning to be vaccinated at the time of the survey or indicated that they were vaccinated before their pregnancy with the same year's vaccine were excluded from analysis. Women who declined vaccination were defined as those who answered "no" to the following

question: "Have you had or are you planning to have the flu vaccine during this pregnancy?" They could choose from the following responses: "No, I would never have it at all", "No, I would never have it while pregnant" and "No, it is too late in the flu season for me to get it". To assess knowledge and perception of influenza and vaccination in pregnancy, survey questions based on Likert scales (strongly agree, agree, neither agree or disagree, disagree, strongly disagree) were used to elicit responses, which were first grouped into three categories (agree, neither agree or disagree, disagree). These categories were further grouped by merging responses for "neither agree or disagree" with other responses to create two categories: 1 – "agree" and 2 – "disagree" for use in regression analysis. Specifically, the "neither agree or disagree" responses were merged with "disagree" responses for questions where the "agree" response supported the statement that spoke to the benefit of vaccination or understanding of the impact of influenza (e.g. "I know what to do if my baby gets the flu"). Similarly, responses to "neither agree or disagree" were merged with "agree" responses where the "disagree" response supported the statement that spoke to the benefit of vaccination or understanding of the impact of influenza (e.g. "Having the flu in pregnancy is not severe"). Women were also asked: "Has anyone said you SHOULD NOT have a flu vaccine in your pregnancy" and could answer from multiple choice: "friend", "family member", "nurse", "midwife", "GP", "obstetrician", "I can't remember" or "other". Data were analysed using STATA (Texas: Stata Corporation; version 15). Descriptive and comparative analyses were performed using Pearson's chi-square or Fisher's exact test, where relevant, with a significance level set at  $\alpha = 0.05$ . Frequency distributions were calculated excluding missing values. Within demographic characteristics, the Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) for the pregnant woman's area of residence was determined using postcode. IRSAD scores from 1 to 10 were grouped as low (1-4), medium (5-7) and high (8-10).<sup>16</sup> Study factors (Table 1) were selected for inclusion in regression analysis of women who declined vaccination compared with those who were vaccinated if they correlated with the outcome of interest at a significance level of  $p < 0.2$  from the Pearson chi-square test. Factors were analysed using backwards stepwise multivariable logistic regression, producing odds ratios and 95% confidence intervals [CI]. Variables were retained in the model if they remained statistically significant at  $p < 0.05$  while adjusting for hospital site.

Participation by both RNSH and Westmead Hospital was approved by the Sydney Children's Hospitals Network Human Research Ethics Committee (LNR/16/SCHN/275).

## Results

At Westmead Hospital, 544 women were approached to participate, of whom 354 (65.1%) completed surveys. At RNSH, 308 women completed surveys; the total number approached was not recorded. Of the 662 women surveyed, 17 (2.6%) did not provide a response to the question on influenza vaccination in pregnancy, and three women (0.5%) were excluded after indicating in free text that they had already been vaccinated before their pregnancy with the same year's vaccine. The remaining 642 women were divided into vaccinated for influenza in current pregnancy (369; 57.5%), planning to be vaccinated (77; 12.0%), unaware/undecided (73; 11.4%) and declined vaccination (123; 19.2%). Further analysis

focused specifically on comparing women who declined vaccination ( $n = 123$ ) with women who had already been vaccinated ( $n = 369$ ).

Characteristics of women who were vaccinated or declined vaccination are outlined in Table 1. Among those who declined vaccination, more women came from Westmead Hospital than from RNSH, and women aged 25–34 years were more likely to be vaccinated (81.5%) than older ( $\geq 35$  years; 65.7%) and younger (18–24 years; 57.9%) women. Women who did not have a tertiary degree and women who reported that it was their first pregnancy were less likely to decline vaccination than women with a tertiary degree or who had previous pregnancies (Table 1).

**Table 1.** Characteristics and factors among women who declined vaccination or were vaccinated for influenza in their pregnancy ( $N = 492$ )

Characteristic/factor	Total $n$ (%)	Declined $n$ (%)	Vaccinated $n$ (%)	$p$ value
<b>Total women</b>	492 (100.0)	123 (25.0)	369 (75.0)	
<b>Hospital</b>				
Royal North Shore Hospital	238 (48.4)	50 (21.0)	188 (79.0)	0.048
Westmead Hospital	254 (51.6)	73 (28.7)	181 (71.3)	
<b>Age, years (<math>N = 491</math>)</b>				
18–24	38 (7.7)	16 (42.1)	22 (57.9)	<0.001
25–34	313 (63.8)	58 (18.5)	255 (81.5)	
35 and older	140 (28.5)	48 (34.3)	92 (65.7)	
<b>Trimester at time of interview (<math>N = 485</math>)</b>				
Trimester 1 (0–12 weeks)	8 (1.7)	2 (25.0)	6 (75.0)	0.576
Trimester 2 (13–26 weeks)	146 (30.1)	41 (28.1)	105 (71.9)	
Trimester 3 ( $\geq 27$ weeks)	331 (68.3)	78 (23.6)	253 (76.4)	
<b>Aboriginal and/or Torres Strait Islander (<math>N = 490</math>)</b>				
No	484 (98.8)	122 (25.2)	362 (74.8)	1.000
Yes	6 (1.2)	1 (16.7)	5 (83.3)	
<b>Level of education (<math>N = 490</math>)</b>				
Primary or secondary school to year 12	57 (11.6)	18 (31.6)	39 (68.4)	0.034
Trade, apprenticeship, certificate or diploma	111 (22.7)	36 (32.4)	75 (67.6)	
Tertiary graduate or postgraduate degree	322 (65.7)	69 (21.4)	253 (78.6)	
<b>Language spoken at home (<math>N = 492</math>)</b>				
English only	236 (48.0)	67 (28.4)	169 (71.6)	0.095
Other language(s)	256 (52.1)	56 (21.9)	200 (78.1)	
<b>Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) (<math>N = 481</math>)</b>				
Low (1–4)	68 (14.1)	22 (32.4)	46 (67.6)	0.243
Medium (5–7)	109 (22.7)	23 (21.1)	86 (78.9)	
High (8–10)	304 (63.2)	76 (25.0)	228 (75.0)	

(continued)

**Table 1.** Characteristics and factors among women who declined vaccination or were vaccinated for influenza in their pregnancy (*N* = 492) (continued)

Characteristic/factor	Total <i>n</i> (%)	Declined <i>n</i> (%)	Vaccinated <i>n</i> (%)	<i>p</i> value
<b>Antenatal care (<i>N</i> = 471)</b>				
Primary doctor based at hospital clinic	298 (63.3)	76 (25.5)	222 (74.5)	0.563
Shared care: doctor based elsewhere	173 (36.7)	40 (23.1)	133 (76.9)	
<b>Summary of underlying medical conditions (<i>N</i> = 474)</b>				
No underlying medical conditions	429 (90.5)	106 (24.7)	323 (75.3)	0.773
Underlying medical condition	45 (9.5)	12 (26.7)	33 (73.3)	
<b>Underlying medical conditions (<i>N</i> = 45)</b>				
Chronic illness (including diabetes or kidney failure)	11 (24.4)	2 (18.2)	9 (81.8)	0.503
Lung disease or asthma	22 (48.9)	7 (31.8)	15 (68.2)	
Chronic neurological condition (including multiple sclerosis and seizure disorders)	4 (8.9)	1 (25.0)	3 (75.0)	
Immune-compromising condition (including HIV infection)	4 (8.9)	0 (0)	4 (100.0)	
Heart disease	1 (2.2)	0 (0)	1 (100.0)	
Multiple underlying medical conditions	3 (6.7)	2 (66.7)	1 (33.3)	
<b>First pregnancy? (<i>N</i> = 491)</b>				
No	248 (50.5)	72 (29.0)	176 (71.0)	0.040
Yes	243 (49.5)	51 (21.0)	192 (79.0)	
<b>Maternity care provider recommendation for vaccination (<i>N</i> = 470)</b>				
No	101 (21.5)	52 (51.5)	49 (48.5)	<0.001
Yes	369 (78.5)	63 (17.1)	306 (82.9)	
<b>Recommendation against influenza vaccination by anyone (<i>N</i> = 464)</b>				
No	412 (88.8)	91 (22.1)	321 (77.9)	<0.001
Yes	52 (11.2)	23 (44.2)	29 (55.8)	
<b>Read information about influenza vaccination (<i>N</i> = 470)</b>				
No	66 (14.1)	31 (47.0)	35 (53.0)	<0.001
Yes	404 (86.0)	86 (21.3)	318 (78.7)	
<b>Vaccinated for influenza before this pregnancy (ever) (<i>N</i> = 487)</b>				
No	199 (40.9)	69 (34.7)	130 (65.3)	<0.001
Yes	288 (59.1)	54 (18.8)	234 (81.3)	
<b>Vaccinated for influenza in a previous pregnancy (<i>N</i> = 279)</b>				
No	191 (68.5)	41 (21.5)	150 (78.5)	0.123
Yes	88 (31.5)	11 (12.5)	77 (87.5)	
<b>Vaccinated for pertussis in their third trimester (<i>N</i> = 326)</b>				
No	91 (27.9)	38 (41.8)	53 (58.2)	<0.001
Yes	235 (72.1)	40 (17.0)	195 (83.0)	

**Table 2.** Perceptions of influenza and vaccination among women who declined vaccination or were vaccinated for influenza in their pregnancy (*N* = 492)<sup>a</sup>

Perceptions	Total <i>n</i> (%)	Declined <i>n</i> (%)	Vaccinated <i>n</i> (%)	OR (95% CI)
<b>“I know what to do if my baby gets the flu” (<i>N</i> = 462)</b>				
No, I don't agree ( <i>n</i> = 75)/Neither agree or disagree ( <i>n</i> = 80)	155 (33.6)	35 (22.6)	120 (77.4)	referent
Yes, I agree	307 (66.5)	83 (27.0)	224 (73.0)	1.27 (0.81, 2.00)
<b>“The flu vaccine is safe for pregnant women to have” (<i>N</i> = 469)</b>				
No, I don't agree ( <i>n</i> = 23)/Neither agree or disagree ( <i>n</i> = 68)	91 (19.4)	63 (69.2)	28 (30.8)	13.21 (7.78, 22.43)
Yes, I agree	378 (80.6)	55 (14.6)	323 (85.5)	referent
<b>“I know the symptoms of the flu” (<i>N</i> = 454)</b>				
No, I don't agree ( <i>n</i> = 22)/Neither agree or disagree ( <i>n</i> = 29)	51 (11.2)	12 (23.5)	39 (76.5)	referent
Yes, I agree	403 (88.8)	103 (25.6)	300 (74.4)	1.12 (0.56, 2.21)
<b>“The flu vaccine in pregnancy is dangerous for the baby” (<i>N</i> = 463)</b>				
No, I don't agree	309 (66.7)	45 (14.6)	264 (85.4)	referent
Yes, I agree ( <i>n</i> = 49)/Neither agree or disagree ( <i>n</i> = 105)	154 (33.3)	72 (46.8)	82 (53.3)	5.15 (3.29, 8.06)
<b>“Having the flu vaccine in my pregnancy will protect me from the flu” (<i>N</i> = 468)</b>				
No, I don't agree ( <i>n</i> = 56)/Neither agree or disagree ( <i>n</i> = 104)	160 (34.2)	78 (48.8)	82 (51.3)	6.37 (4.05, 10.04)
Yes, I agree	308 (65.8)	40 (13.0)	268 (87.0)	referent
<b>“Having the flu vaccine in my pregnancy won't protect my baby once he/she is born” (<i>N</i> = 465)</b>				
No, I don't agree	162 (34.8)	18 (11.1)	144 (88.9)	referent
Yes, I agree ( <i>n</i> = 101)/Neither agree or disagree ( <i>n</i> = 202)	303 (65.2)	99 (32.7)	204 (67.3)	3.88 (2.25, 6.70)
<b>“Having the flu vaccine in my pregnancy will protect my baby during my pregnancy” (<i>N</i> = 465)</b>				
No, I don't agree ( <i>n</i> = 31)/Neither agree or disagree ( <i>n</i> = 146)	177 (38.1)	85 (48.0)	92 (52.0)	7.95 (4.92, 12.83)
Yes, I agree	288 (61.9)	30 (10.4)	258 (89.6)	referent
<b>“Having the flu in pregnancy is not severe” (<i>N</i> = 459)</b>				
No, I don't agree	253 (55.1)	50 (19.8)	203 (80.2)	referent
Yes, I agree ( <i>n</i> = 75)/Neither agree or disagree ( <i>n</i> = 131)	206 (44.9)	62 (30.1)	144 (69.9)	1.75 (1.14, 2.69)

<sup>a</sup> Not all women answered each question, as demonstrated by the different '*N*' values shown for each category.  
 CI = confidence interval; OR = odds ratio

Further, vaccination was declined by 51.5% of women who did not receive a recommendation from a maternity care provider to have an influenza vaccination, 44.2% of women who received a recommendation from anyone not to have the vaccine, 47.0% of women who had not read information on influenza vaccination in pregnancy, 34.7% of women who had not been previously vaccinated for influenza and 41.8% of women in their third trimester who had not yet received the pertussis vaccine in their pregnancy (Table 1).

Among the 52 women who reported that they were recommended against vaccination by anyone, four (7.7%) reported the recommendations were from a healthcare provider: two from general practitioners (GPs), one from a midwife and one from an obstetrician. Three of those participants declined vaccination. One woman who received a recommendation against vaccination by her obstetrician reported it was due to a “previous bad reaction to the influenza vaccine”. There were no reasons specified as to why the two GPs recommended against vaccination and both women declined vaccination in those cases, although one reported also receiving a recommendation against vaccination from family and friends. The woman who received a recommendation against vaccination from a midwife went on to get vaccinated. In addition, there were 37 women who reported that family or friends provided a recommendation against vaccination and a further 11 women reported the source of a recommendation against vaccination as either “other” ( $n = 6$ ) or “I can’t remember/no answer” ( $n = 5$ ).

Responses to questions around vaccine safety revealed that 69.2% of women who disagreed or neither agreed/disagreed that “the flu vaccine is safe for pregnant women to have” and 46.8% of women who agreed or neither agreed/disagreed “the flu vaccine in pregnancy is dangerous for the baby” had declined vaccination (Table 2). Responses to questions around vaccine effectiveness revealed that vaccination was declined by 48.8% of women who disagreed or neither

agreed/disagreed that “having the flu vaccine in my pregnancy will protect me from the flu”, 32.7% of women who agreed or neither agreed/disagreed that “having the flu vaccine in my pregnancy won’t protect my baby once he/she is born” and 48.0% of women who disagreed or neither agreed/disagreed that “having the flu vaccine in my pregnancy will protect my baby during my pregnancy” (Table 2). Because of high collinearity among perception variables, and of perception variables with a maternity care provider recommendation, perception variables were not included in subsequent multivariable modelling. Odds ratios from univariate analyses are shown in Table 2.

Among the 45 women who reported an underlying medical condition, 12 (26.7%) declined vaccination, of whom five (41.7%) had received a recommendation to have the vaccine from a maternity care provider (Table 3). Seven women with an underlying medical condition received conflicting recommendations, of whom three (42.9%) declined vaccination (Table 3).

Table 4 outlines factors analysed using multivariable analysis for their association with a pregnant woman’s decision to decline vaccination. After adjustment, significant factors included lack of a maternity care provider recommendation for vaccination; having been recommended against vaccination by anyone; not ever having been previously vaccinated for influenza; and, among third-trimester women, not having received the pertussis vaccine in their pregnancy. There was no significant difference between hospitals in the adjusted model (Table 4). Trimester of pregnancy was not included in the model on the basis that the proportion of women who declined was similar for each trimester group and was not a significant factor. Having read information on influenza vaccination was also highly collinear with having received a maternity care provider recommendation and was excluded from the model.

Among women who declined vaccination and who had received a maternity care provider recommendation, 83.3% (50/60) acknowledged having read information on influenza vaccination in pregnancy. Of these, 38/50

**Table 3.** Vaccine recommendations among pregnant women with an underlying medical condition ( $N = 45$ )<sup>a</sup>

Recommendations	Total <i>n</i> (%)	Declined <i>n</i> (%)	Vaccinated <i>n</i> (%)	<i>p</i> value
Total women	45 (100)	12 (26.7)	33 (73.3)	
MCP recommendation for vaccination	28 (62.2)	2 (7.1)	26 (92.9)	
MCP recommendation for vaccination and recommendation against vaccination by anyone	7 (15.6)	3 (42.9)	4 (57.1)	<0.001
Recommendation against vaccination by anyone	2 (4.4)	1 (50.0)	1 (50.0)	
No recommendations for or against vaccination	8 (17.8)	6 (75.0)	2 (25.0)	

MCP = maternity care provider

<sup>a</sup> Categories are mutually exclusive



**Table 4.** Multivariable logistic regression analysis of factors associated with a woman's decision to decline influenza vaccination (*N* = 492)

Study factor	Univariate analysis: OR (95% CI)	Multivariable analysis: aOR (95% CI) <i>N</i> = 451 <sup>a</sup>
<b>Site (<i>N</i> = 492)</b>		
Royal North Shore Hospital	referent	referent
Westmead Hospital	1.52 (1.00, 2.29)	1.18 (0.72, 1.97)
<b>Age, years (<i>N</i> = 491)</b>		
18–24	referent	referent
25–34	0.31 (0.15, 0.63)	0.35 (0.15, 0.83)
35 and older	0.72 (0.34, 1.49)	1.01 (0.41, 2.51)
<b>Education (<i>N</i> = 490)</b>		
Primary or secondary school to year 12	1.69 (0.91, 3.14)	–
Trade, apprenticeship, certificate or diploma	1.76 (1.09, 2.84)	–
Tertiary graduate or postgraduate degree	referent	–
<b>Language other than English at home (not exclusive of English) (<i>N</i> = 492)</b>		
No	referent	–
Yes	0.71 (0.47, 1.06)	–
<b>First pregnancy (<i>N</i> = 491)</b>		
No	1.54 (1.02, 2.33)	–
Yes	referent	–
<b>MCP recommendation <i>N</i> = 470)</b>		
No	5.15 (3.20, 8.29)	6.06 (3.50, 10.50)
Yes	referent	referent
<b>Recommended against influenza vaccination by anyone (<i>N</i> = 464)</b>		
No	referent	referent
Yes	2.80 (1.54, 5.07)	4.17 (2.07, 8.38)
<b>Vaccinated for influenza before this pregnancy (ever) (<i>N</i> = 487)</b>		
No	2.30 (1.52, 3.49)	2.75 (1.64, 4.59)
Yes	referent	referent
<b>Vaccinated for pertussis (third-trimester women) (<i>N</i> = 492)</b>		
No	3.50 (2.04, 5.99)	2.55 (1.32, 4.89)
Yes	referent	referent
Missing ( <i>n</i> = 166, not third trimester)	1.81 (1.12, 2.94)	1.78 (1.00, 3.16)

<sup>a</sup> *N* = 451 due to several covariates having some missing data in the final model.

– = variable not included in final model where *p* > 0.2 (*p* value not shown), except for site; aOR = adjusted odds ratio; CI = confidence interval; MCP = maternity care provider; aOR = adjusted odds ratio

(76.0%) had read a brochure and 28/50 (56.0%) referred to the internet (responses were not mutually exclusive).

## Discussion

This study identified multiple factors potentially contributing to a woman's decision to decline influenza

vaccination in pregnancy. We demonstrated that the absence of a maternity care provider recommendation increased the odds of declining vaccination in pregnancy by more than six times. These findings are consistent with other Australian studies in which maternity care provider recommendations have consistently been shown to improve influenza vaccine uptake among

pregnant women.<sup>10–12,17</sup> Reading information on influenza vaccination in pregnancy, such as supplementary brochures, social media and mobile phone apps, may also be successful in increasing exposure to messaging about the benefits of vaccination in pregnancy.<sup>9</sup> Women who declined vaccination were strongly influenced not to be vaccinated, primarily by family or friends. When a woman openly declines a vaccination in her pregnancy, it may be beneficial for a maternity care provider to ask if the woman has received a personal recommendation against vaccination and attempt to address any myths or misconceptions she may have been exposed to.

On unadjusted univariate analysis, strong concerns about vaccine safety in pregnancy for both mother and baby were evident; women who declined vaccination were 13 times more likely to disagree or neither agree or disagree that influenza vaccination was safe for pregnant women than those who were vaccinated. Further, 62% of women who declined vaccination agreed, or neither agreed or disagreed, that influenza vaccination in pregnancy was dangerous for the baby, compared with only 24% of women who were vaccinated. Concerns about vaccine safety have frequently been reported in other studies as one of the main reasons for hesitancy or not vaccinating for influenza during pregnancy.<sup>9,10,18–20</sup>

Poor perceptions of vaccine effectiveness were also evident among pregnant women who declined vaccination. Women were 6–8 times more likely to decline vaccination if they did not agree that the influenza vaccine would protect either themselves or their baby during pregnancy. Also, 85% of women who declined vaccination and 59% of women who were vaccinated agreed, or neither agreed or disagreed, that the flu vaccine would not protect their baby once born. Although women who declined vaccination were more likely to hold this view, it is also apparent that there is a substantial lack of confidence in vaccine effectiveness among all women regarding the protection of newborns. A lack of confidence in the effectiveness of the influenza vaccine among pregnant women, in general, was also reported from the earlier NSW pilot study<sup>9</sup>, and from a study in the UK.<sup>21</sup> Therefore, clearer, evidence-based messaging of the risks versus benefits of vaccination in pregnancy during antenatal visits is likely to increase the effectiveness of vaccine recommendations.

Among pregnant women in their third trimester, women who had not yet received antenatal pertussis vaccination were 2.5 times more likely to decline influenza vaccination than those who had received pertussis vaccination. Communicating about pertussis and influenza vaccinations in pregnancy simultaneously and as part of routine antenatal care may help to improve acceptance of both vaccinations. The opportunity may arise more frequently in future because the recommendation for timing of pertussis vaccination in Australia has been revised down from 28 weeks to 20 weeks gestation.<sup>6</sup> An approach using standing orders for maternal vaccination, whereby a midwife is able to administer an antenatal

vaccine after obtaining informed consent, and without the need of a medical order<sup>22</sup>, can also support the needs of a maternity care provider who may have different priorities for antenatal care.<sup>23</sup> In Australia, use of standing orders during midwifery-led antenatal clinic appointments has seen pertussis vaccine uptake in pregnancy improve to 90%, and influenza vaccine uptake increase to 83–91%.<sup>11,22</sup>

Among women with an underlying medical condition who either declined to be vaccinated or were vaccinated, we found that 22% did not receive a recommendation to receive the influenza vaccine from their maternity care provider. Pregnant women are already an identified group at high risk of serious complications from influenza illness and are therefore potentially at greater risk when they have underlying comorbidities.<sup>6</sup> These women are likely to require more antenatal care appointments; however, despite an increased number of consultations, time to discuss vaccination may still be limited as attention is focused primarily on the care of the mother and her pregnancy under complex circumstances. Therefore, it remains especially important for the maternity care provider to discuss vaccination in the context of her heightened risks.

## Strengths and limitations

Our study is one of few to highlight issues of vaccine uptake specifically among women who declined vaccination during their pregnancy and to report on women with underlying medical conditions. There are, however, several limitations to this study. We were not able to consistently validate receipt of influenza vaccination by checking patient- or provider-held records, although prior research has indicated vaccine recall during pregnancy to be highly reliable.<sup>24</sup> Also, as the survey was conducted while women were pregnant, it is possible that some women who declined vaccination may have subsequently decided to get vaccinated. Women surveyed later in the influenza season may be more likely to feel that it is too late for vaccination; however, less than 1% of women surveyed later in the season were in their first trimester, indicating ample opportunity for women surveyed in their second or third trimester to have already been vaccinated.

Although we surveyed women from two geographically distinct areas within Sydney, women surveyed may not be truly representative of the broader population in NSW. For instance, in NSW, 24.7% of women who gave birth in 2017 were aged older than 35 years<sup>15</sup>, compared with 28.5% in our study. The 1.2% of respondents in our study who were Aboriginal or Torres Strait Islander was substantially lower than the reported 4.4% of Indigenous births reported in NSW for 2017.<sup>15</sup> Both hospitals had a significant proportion of women who spoke at least one language other than English at home, but resources did not permit interview of women not fluent in English, limiting our ability to assess data from women of culturally



and linguistically diverse backgrounds. Many women receiving care through a private obstetrician would also not have been captured and thus would not be well represented in this study.

## Conclusion

Multiple factors can influence a pregnant woman's decision to decline influenza vaccination. The absence of a recommendation for vaccination from a maternity care provider is central to this decision. Time should be allocated for discussions around both influenza and pertussis vaccination, ideally early in pregnancy, and these discussions should be integrated as part of routine antenatal care. Particular attention should be paid to women with underlying medical conditions during vaccine discussions. Finally, continued effort is needed to improve messaging on the benefits, safety and effectiveness of influenza vaccination, for protection of the pregnant woman, developing baby and newborn.

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Externally peer reviewed, not commissioned.

## Competing interests

None declared.

## Author contributions

The study was planned and designed by AD, FB, KM, SC, JS, NW and JM. Data analysis was performed by JM, and AD, FB, KM, PM and NW assisted with data interpretation. JM prepared the first draft of the manuscript under guidance from NW. All authors read and contributed to subsequent drafts and approved the final manuscript.

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