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## ORIGINAL ARTICLE

# Knowledge, attitudes, beliefs, and barriers associated with the uptake of influenza vaccine among pregnant women

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## KEYWORDS

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**Abstract** *Objective:* The purpose of the study was to assess the knowledge, attitudes, beliefs, and factors associated with the uptake of the influenza (flu) vaccination in women within Saudi Arabia during their pregnancy period. *Methods:* A cross-sectional prospective survey was conducted on 1085 pregnant women at the antenatal clinic over a period of 6 weeks with the provision of influenza vaccination. The questionnaire collected demographic and other data; it included 12 questions on their general knowledge and assessed their attitude toward influenza vaccination, and their awareness of vaccine risk and the potential benefits during pregnancy. The knowledge score obtained was then calculated and compared. *Results:* A total of 998 patients took part in the questionnaire with a response rate of 92%. There was poor awareness that the flu vaccine is safe to administer during pregnancy (130, 13.1%) and that all pregnant women should receive the flu vaccine (190, 19.1%). Pregnant women with flu vaccine knowledge score of  $\leq 5$  (range 0–12) were significantly less likely to take the vaccine (OR 3.78, 95% CI 2.68–5.26,  $p < 0.001$ ). There was a low uptake of the vaccine (178, 18.1%) and only 29 (3.0%) had previously been offered the flu vaccine by any doctor during their pregnancy. In addition, 255 (25.8%) were against taking the flu vaccine during pregnancy. *Conclusion:* The knowledge and uptake of the influenza vaccine among Saudi pregnant women are low. One quarter was against the vaccine during pregnancy. Very few

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believed the flu vaccine to be safe during pregnancy. Rarely, physicians advise their clients to take flu vaccine.

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## 1. Introduction

The influenza infection in pregnant women has been linked to an increased risk of serious illnesses, longer hospitalization periods, an increase in premature delivery, and a higher mortality rate (Anzic Influenza Investigators and Australasian Maternity Outcomes Surveillance System, 2010; Jamieson et al., 2009). Hospital admissions and respiratory illnesses among pregnant women during the influenza season are much higher compared to before their pregnancies (Cox et al., 2006; Dodds et al., 2007). The influenza infection not only carries the increased risk of serious illnesses for pregnant women, but can also cause an increase in morbidity and mortality in infants that are less than 6 months old (Bhat et al., 2005; Poehling et al., 2006). Influenza vaccination can reduce the risk of respiratory illnesses in pregnant women as well as in their newborn infants up to age of 6 months (Zaman et al., 2008). A double-blind, randomized placebo-controlled trial in Bangladesh showed that new-born infants of mothers who were immunized with the Inactivated Influenza Vaccine (IIV) during their third trimester had fewer respiratory illnesses with fever, fewer clinic visits for respiratory illness with fever, and fewer cases of laboratory-confirmed influenza during the first 6 months of their life than the control group. In the same study, vaccinated mothers also had a 36% reduction in respiratory illnesses with fever, as compared to women in the control group (Zaman et al., 2008). Moreover, several observational studies have demonstrated that newborns are protected from influenza illness when their mothers have been vaccinated during or just prior to pregnancy. Such protection from influenza illness among newborns is almost certainly due to passive acquisition of antibodies to newborns from maternal circulation via transplacental transmission (Poehling et al., 2011; Steinhoff et al., 2010).

Although the influenza vaccine is safe and effective to administer during pregnancy, the uptake of the flu vaccine among pregnant women varies. A systematic review of 21 studies assessed the coverage of the seasonal flu vaccination, which showed the uptake ranging between 1.7% and 88.4% (Yuen and Tarrant, 2014). The rate of vaccine uptake increases if women believe that they are at a higher risk of influenza-related complications while pregnant (Yuet Sheung Yuen et al., 2013a). Lack of awareness about the benefits of the influenza vaccine is an obstacle to vaccine receipt (Beigi et al., 2009; Yudin et al., 2009).

The Centers for Disease Control and Prevention's Advisory Committee on Immunization Practices (ACIP) and the American College of Obstetricians and Gynecologists recommend that all women who are or will be pregnant during the influenza season have an IIV as soon as possible. All current available data overwhelmingly support the safety of the influenza vaccination during pregnancy (Bednarczyk et al., 2012).

The researchers' aims were to determine the knowledge, attitudes, and beliefs toward the flu vaccine, and the barriers associated with the uptake in pregnant women in Saudi Arabia

during pregnancy. Currently, no such data are available within the Kingdom. This study should help the authors to identify opportunities for strategic initiatives to improve uptake of flu vaccine locally.

## 2. Materials and methods

This cross-sectional study was conducted in the outpatient antenatal clinic at King Khalid University hospital in Riyadh, Saudi Arabia, from July to August 2013. All pregnant women above the age of 16 years, who were attending the outpatient clinic for antenatal care follow-up treatment, were asked to participate in the study during a regular clinic visit. Prior to conducting the study, approval from the Institutional Review Board (IRB) was obtained. The study objective was explained prior to interview, and written consent was obtained if the patient verbally agreed to participate. The questionnaire was administered face-to-face by trained researchers, who were monitored to ensure quality of research.

The questionnaire comprised of two parts. The first part collected the patient demographic data including age, their educational level, occupation, income, and the number of pregnancies. The second part of the questionnaire measured general knowledge of the flu vaccine during pregnancy, attitude toward influenza vaccination, and awareness of vaccine risk and the potential benefits during pregnancy. Some questions from the previously validated survey by Yudin et al. were included with modifications (Yudin et al., 2009). The survey was administered in the Arabic language. It was tested on 50 patients who were currently attending the antenatal clinic for the clarity, content validity, internal consistency, and the ease of administration. The sample size was calculated assuming 5% vaccine uptake, at 95% level of confidence, and with a precision of  $\pm 1.5\%$ , 812 study subjects were required for the study. Assuming 15% non-responses, 934 patients were required for the study. The questionnaire consisted of 12 knowledge questions with the possibility of yes/no answers. Each correct answer was given one point with total of 12 points for all correct answers. A score above the median was considered as good knowledge and a score at or below the median was considered as poor knowledge of flu vaccine. Descriptive statistics (means, standard deviation, median, range, counts and percentages) were used to describe the quantitative and categorical study variables. A binary logistic regression model was used; variables included in the model were education level (high = undergraduates + post graduate, low = all others), age group (<mean age, >mean age), employment status (employed, unemployed), pregnancy (1, >1), and income level (<mean income, >mean income in Saudi Riyals). Pearson's Chi-square tests and Fisher's exact test were used to detect whether there were any associations between demographic characteristics, knowledge and attitude. Univariate odds ratios (OR) were calculated between the categorical study and the outcome variables were calculated to measure the strength of

**Table 1** Demographic characteristics of pregnant women participating in the survey.

Characteristics	N = 998
<i>Age (years)</i>	
<20 (%)	41 (4.1)
20–29 (%)	570 (57.1)
>30 (%)	387 (38.8)
Mean age ( $\pm$ SD)	28.4 (6.1)
<i>Educational level (%)</i>	
Illiterate	14 (1.4)
Middle school/high school	342 (34.3)
Bachelor degree	540 (54.1)
Postgraduate studies	102 (10.2)
<i>Employment status (%)</i>	
Yes	342 (34.3)
No	647 (64.8)
Missing data	9 (0.9)
<i>Monthly income (Saudi Riyals)</i>	
<4000 (%)	106 (10.6)
4000–7000 (%)	364 (36.5)
7001–10,000 (%)	321 (32.2)
>10,000 (%)	190 (19.0)
Missing data (%)	17 (1.7)
Mean income in SR ( $\pm$ SD)	7039 (1753)
<i>Number of pregnancies (%)</i>	
1	402 (40.3)
>1	580 (58.1)
Missing data	16 (1.6)

SR = Saudi Riyal.

the association. A multivariate logistic regression analysis was used to find out the independent associated variables among the demographic background relating to knowledge and attitude. A  $p$  value of  $<0.05$  and 95% confidence intervals of ORs was used to report the statistical significance and precision of the estimates. Statistical analyses were conducted using the Statistical Package for Social Science (SPSS) software (SPSS Inc., Chicago, IL), version 18.0.

### 3. Results

A total of 1085 pregnant women were invited to participate in the survey. Of those invited, 998 took part giving a response rate of 92%. The mean age of the pregnant women in the study was  $28.4 \pm 6.1$  years and their mean income was  $7039 \pm 1753$  SR. The demographic and other characteristics of the pregnant women are presented in Table 1.

Knowledge scores are presented in Table 2. Most (908, 91.3%) of the pregnant women surveyed correctly stated that influenza infection is highly contagious, although 459 (46.0%) were unaware that pregnant women are at a higher risk of flu complications than non-pregnant women are. There was poor awareness that the flu vaccine is safe to administer during pregnancy (130, 13.1%) and lactation (159, 16.0%), and that all pregnant women should get flu vaccine (190, 19.1%).

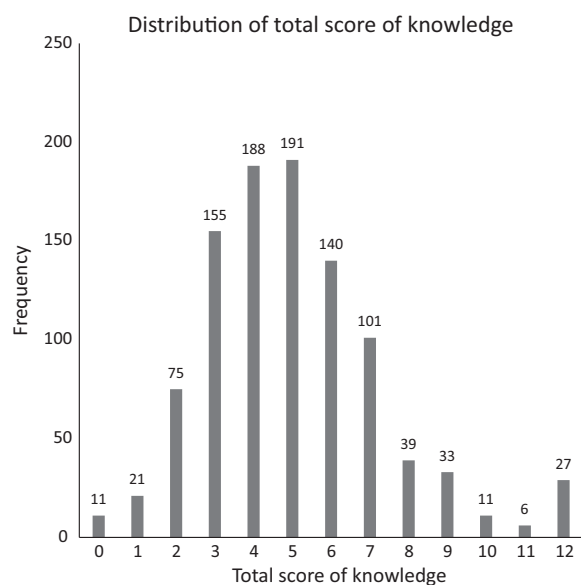
The median knowledge score of flu vaccine among pregnant women in the survey was 5 (range 0–12); 638 (63.9%) participants had poor knowledge of flu vaccine (score  $\leq 5$ ) and 360 (36.1%) had good knowledge ( $> 5$ ). The distribution of knowledge scores is shown in Fig. 1. Cronbach's alpha coefficient for the 12-item scale was 0.642.

**Table 2** Percentage of pregnant women who responded to questions on knowledge, attitude, and uptake of influenza vaccine.

Items	Patients response	
	Yes	No
<i>Knowledge questions</i>		
Flu infection is highly contagious ( $n = 994$ )	908 (91.3) <sup>a</sup>	86 (8.7)
Flu infection can sometimes be serious enough that a person needs to be admitted to the hospital ( $n = 969$ )	739 (76.2) <sup>a</sup>	230 (23.8)
Pregnant women have same risk of complications from the flu as women who are not pregnant ( $n = 997$ )	459 (46.0)	538 (54.0) <sup>a</sup>
Immunity decreases during pregnancy ( $n = 996$ )	669 (67.2) <sup>a</sup>	327 (32.8)
The flu vaccine is safe in pregnancy ( $n = 994$ )	130 (13.1) <sup>a</sup>	864 (86.1)
Flu vaccine is safe in lactation ( $n = 993$ )	159 (16.0) <sup>a</sup>	834 (84.0)
Flu vaccine can cause birth defects ( $n = 997$ )	161 (16.1)	836 (83.9) <sup>a</sup>
Flu vaccine could cause influenza ( $n = 995$ )	325 (32.7)	670 (67.3) <sup>a</sup>
Flu vaccine is expensive ( $n = 993$ )	373 (37.6)	620 (62.4) <sup>a</sup>
Influenza vaccine is given in winter ( $n = 972$ )	379 (40.1) <sup>a</sup>	593 (59.9)
Annual vaccination is the best way to protect from influenza ( $n = 995$ )	531 (51.3) <sup>a</sup>	464 (46.7)
All pregnant women should get flu vaccine ( $n = 995$ )	190 (19.1) <sup>a</sup>	805 (80.9)
<i>Uptake of flu vaccine</i>		
Did you take flu vaccine during pregnancy? ( $n = 986$ )	178 (18.1)	808 (81.9)
<i>Attitude toward flu vaccine</i>		
Are you against taking flu vaccine during pregnancy? ( $n = 988$ )	255 (25.8)	733 (74.2)
<i>Flu vaccine offered by physician</i>		
Have you ever been offered flu vaccine by any doctor in your pregnancy? ( $n = 983$ )	29 (3.0)	954 (97.0)

Flu = influenza, flu vaccine is offered free to all pregnant women at our hospital.

<sup>a</sup> Correct answers of knowledge questions.



**Figure 1** The distribution of knowledge scores of 998 pregnant women who took part in survey.

To identify potential associations between poor knowledge of the flu vaccine (knowledge scores  $\leq 5$ ) and socio-demographic characteristics, univariate and multivariate logistic regression analyses were conducted. In univariate analyses, pregnant women with below mean age ( $p < 0.004$ ), who were unemployed ( $p < 0.001$ ), had below mean income ( $p < 0.001$ ), and who were in their first pregnancy ( $p < 0.001$ ) were significantly associated with poor flu vaccine knowledge (Table 3). In multivariate analyses, pregnant women with unemployed status (OR 1.95, 95% CI 1.43–2.66,  $p \leq 0.001$ ), below mean income (OR 1.57, 95% CI 1.16–2.11,  $p \leq 0.003$ ) and first pregnancy (OR 1.44, 95% CI 1.07–1.94,  $p \leq 0.02$ ) were still significantly associated with poor flu vaccine knowledge after

adjusting for the other dependent variables (age, education level) (Table 3).

Overall, 178 (18.1%) pregnant women took the flu vaccine during pregnancy (Table 2). Pregnant women with poor knowledge of the flu vaccine were significantly less likely to take the flu vaccine than those with good knowledge (OR 3.78, CI 2.68–5.26,  $p < 0.001$ ). Poor uptake of the flu vaccine was also significantly associated with pregnant women below mean age (OR 1.54, 95% CI 1.05–2.25,  $p < 0.025$ ), below mean income (OR 1.90, 95% CI 1.35–2.66,  $p < 0.001$ ), and unemployed status (OR 2.77, 95% CI 1.98–3.87,  $p < 0.001$ ), and pregnant women with low education status (OR 2.29, 95% CI 1.55–3.36,  $p < 0.001$ ) (Table 4). The multivariate analyses showed that poor uptake of flu vaccine is only independently associated with unemployed status (OR 2.40, 95% CI 1.63–3.53,  $p \leq 0.001$ ) after adjusting for the other dependent variables (age, income, employment status, and education level, number of pregnancies) (Table 4). Only 29 (3.0%) of all participants were ever offered the flu vaccine by any doctors during their pregnancy.

One quarter (255, 25.8%) of the pregnant women who participated in the survey were against taking the flu vaccination during pregnancy (Table 2). Pregnant women with low education status (OR 1.66, 95% CI 1.24–2.22,  $p < 0.032$ ) and in their first pregnancy (OR 1.51, 95% CI 1.12–2.03,  $p < 0.007$ ) were more likely to be against the flu vaccine than those with high education status or more than one pregnancy, respectively (Table 4). Logistic regression analysis showed an independent association between women who were against the influenza vaccination in pregnancy and a low education status (OR 1.56, 95% CI 1.11–2.22,  $p \leq 0.01$ ), and women in their first pregnancy (OR 1.51, 95% CI 1.08–2.11,  $p \leq 0.015$ ) after adjusting for other dependent variables (age, income, employment status) (Table 4). The pregnant women who did not take the flu vaccine during pregnancy were more likely to be against it during pregnancy than those who were not against the vaccine (OR 2.52, 95% CI 1.60–3.98  $p < 0.001$ ). The participants were then asked, if they were to take the flu vaccine (even those

**Table 3** Association between socio-demographic variables and poor knowledge of vaccine (score  $\leq 5$ ) in pregnant women.

	Unadjusted odds ratio (95% CI)	<i>p</i> value	Adjusted odds ratio (95% CI)	<i>p</i> value
<i>Age groups (years)</i>				
Below mean age	1.55 (1.16, 2.07)	0.004	0.98 (0.70, 1.39)	0.939
Above mean age	1		1	
<i>Employment status</i>				
Unemployed	2.21 (1.68, 2.89)	0.001	1.95 (1.43, 2.66)	0.001
Employed	1		1	
<i>Income (in SR)</i>				
Below mean income	1.88 (1.44, 2.46)	0.001	1.57 (1.16, 2.11)	0.003
Above mean age	1		1	
<i>Educational level</i>				
Low	1.25 (0.95, 1.65)	0.110	0.86 (0.62, 1.19)	0.853
High	1		1	
<i>No. of pregnancies</i>				
1	1.73 (1.32, 2.27)	0.001	1.44 (1.07, 1.94)	0.018
> 1	1		1	

Education level: high = post graduate + undergraduate, low = all others, mean age = 28.4 years, mean income = 7,039 SR. Odds ratios (95% CI) adjusted for all variables in the table: mean age, employed, mean income, education level, and number of pregnancies.

**Table 4** Association between socio-demographic variables and uptake of flu vaccine, and against flu vaccine in pregnant women.

	Unadjusted odds ratio (95% CI)		Adjusted odds ratio (95% CI)	
	Vaccine uptake ( <i>n</i> = 178)	Against vaccine ( <i>n</i> = 255)	Vaccine uptake ( <i>n</i> = 178)	Against vaccine ( <i>n</i> = 255)
<i>Age groups (years)</i>				
Below mean age	1.54 (1.05, 2.25)*	1.17 (0.86, 1.61)	1.07 (0.68, 1.67)	0.92 (0.64, 1.32)
Above mean age	1	1	1	1
<i>Employment status</i>				
Unemployed	2.77 (1.98, 3.87)*	1.98 (0.76, 1.38)	2.40 (1.63, 3.53)*	1.24 (0.87, 1.75)
Employed	1	1	1	1
<i>Income (in SR)</i>				
Below mean income	1.90 (1.35, 2.66)*	0.75 (0.57, 1.07)	1.28 (0.87, 1.88)	1.32 (0.95, 1.82)
Above mean income	1	1	1	1
<i>Educational level</i>				
Low	2.29 (1.55, 3.36)*	1.66 (1.24, 2.22)*	1.31 (0.84, 2.05)	1.56 (1.11, 2.22)*
High	1	1	1	1
<i>No. of pregnancies</i>				
1	1.00 (0.72, 1.40)	1.51 (1.12, 2.03)*	0.86 (0.59, 1.25)	1.51 (1.08, 2.11)*
<1	1	1	1	1

Education level: high = post graduate + undergraduate, low = all others. Mean age = 28.4 years, mean income = 7039SR.

Odd ratios (95% CI) adjusted for all variables in the table: mean age, employed, mean income, education level, and number of pregnancies.

\* *p* values are <0.05.

against it), where they would prefer for it to be administered. The results showed that 23% would prefer to take the vaccine at the doctor's office and 14% post-delivery in the hospital, and the remaining participants (53%) did not wish to take it.

#### 4. Discussion

The WHO in 2012, through the Strategic Advisory Group of Experts on Immunization recommended that all pregnant women should be immunized against influenza infection because they are the most important risk group for seasonal influenza compared to all risk groups, and that they will most likely benefit from the vaccination (World Health Organization, 2012, 2003). Three major findings in this study did not correlate with the WHO recommendations. These included a low uptake of the vaccine among pregnant women (18.1%) and only a meager 3% of all pregnant women ever being offered the flu vaccine by their doctors during their pregnancy. The third finding was that 25.5% of them were against taking the flu vaccination during pregnancy.

The present study suggests low knowledge of influenza vaccination among pregnant women with median score of 5 from a possible of 12 on the scale. Pregnant women with low knowledge of the flu vaccine were significantly less likely to take the flu vaccine as opposed to those with good knowledge. In addition, the pregnant women with low educational status were significantly less likely to take flu vaccine during pregnancy as well as generally being against the vaccination during pregnancy. Half of the pregnant women who were surveyed did not believe that they were at a higher risk of complication from influenza, and most (86%) of them stated that flu vaccine is not safe to administer during pregnancy. Results also showed that half of the participants did not believe that annual vaccinations are the best way to protect oneself from influenza.

Similarly, previous studies have confirmed that the lack of awareness about the benefits of the influenza vaccine is an obstacle to vaccine receipt (Beigi et al., 2009; Yudin et al., 2009). In this study, women who are in their first pregnancy and have a low education status are identified as being the major group for having poor knowledge of the influence vaccination within the Saudi Arabian population.

Overall, 178 (18.1%) of the 998 pregnant women took the flu vaccine during pregnancy. From a study done in Hong Kong, the uptake during the seasonal influenza vaccine period among pregnant women was only 1.7% (Yuet Sheung Yuen et al., 2013b). Another study from Australia showed that the uptake of antenatal seasonal influenza vaccine increased from 30% in 2010 to 40% in 2011 after the implementation of an educational program for maternity staff and pregnant women (McCarthy et al., 2012). Similar results were observed in a Canadian study, showing that the influenza vaccination uptake increased from 19% in 2006 to 56% in 2007, after distributing educational pamphlets on influenza in antenatal clinics (Naleway et al., 2006; Yudin et al., 2010). In Saudi Arabia, improvements in awareness of the flu vaccine could be accomplished by providing individual counseling, posters, booklets, pamphlets, information sheets, web tools and audio/visual materials on the safety, efficacy and potential benefits of the influenza vaccine. During patient counseling, healthcare providers must emphasize one of the greatest vaccine benefits, which is that it can reduce the risk of respiratory illnesses and hospital admissions for them as well as for their newborn infants up to the age of 6 months. Educational materials on the flu vaccine should be made available to encourage them to be vaccinated during their clinic visits. Audiovisual presentations containing safety, efficacy, and potential benefits of the influenza vaccine should be presented to them while they are waiting at the antenatal clinic for their appointment. Furthermore, in depth qualitative description research should be

conducted to understand why pregnant women within Saudi Arabia are against taking the flu vaccine during pregnancy and why they are not advised to take it.

Only 3% of all pregnant women were ever offered the flu vaccine by any doctors during their pregnancy in our survey. Most healthcare providers are hesitant to provide a strong opinion or a recommendation to their patients on the flu vaccine, often due to their own lack of confidence in the safety of the vaccine and their fear of the consequences of liability if anything goes wrong. They prefer pregnant women to take their own responsibility and decide for themselves (Marteau et al., 2001). However, studies consistently show that when the recommendation and availability of influenza vaccination during pregnancy come directly from their antenatal care providers, the likelihood of vaccine acceptance and receipt is much higher (Ahluwalia et al., 2010; Shavell et al., 2012). Even women who have safety concerns about the vaccine still indicate that they would accept it if the provider recommended it (Wiley et al., 2013). Healthcare providers' attitudes and beliefs around influenza vaccination clearly influence vaccine uptake; a study showed vaccination awareness campaigns aimed at obstetricians, primary care physicians, and midwives had yielded large increases in coverage rates (Lam et al., 2010). Another viable tactic is to encourage antenatal care providers to offer the influenza vaccination to their clients at the clinic.

The study sample size was adequate given that it was calculated on assumption with 5% of the vaccine uptakes, at 95% level of confidence. The survey response rate was excellent at 92%.

The study researchers are aware of the limitations of this study, including the use of a closed ended questionnaire rather than focus group interviews or an open ended questionnaire, which would have given an in depth review about the participants' opinions and knowledge. In addition, the study is limited to a single center.

In conclusion, overall, the knowledge and uptake of the influenza vaccine among Saudi pregnant women are low. One quarter of the participants were against the vaccine during pregnancy. Very few believed the flu vaccine to be safe during pregnancy, which may be associated with poor knowledge. Rarely, physicians advise their clients to take flu vaccine. Educational material aimed at pregnant women and support for the antenatal healthcare providers is needed to increase awareness and recommendations made to increase the uptake of the vaccine.

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### References

- Ahluwalia, I.B., Jamieson, D.J., Rasmussen, S.A., D'Angelo, D., Goodman, D., Kim, H., 2010. Correlates of seasonal influenza vaccine coverage among pregnant women in Georgia and Rhode Island. *Obstet. Gynecol.* 116, 949–955.
- Anzic Influenza Investigators, Australasian Maternity Outcomes Surveillance System, 2010. Critical illness due to 2009 A/H1N1 influenza in pregnant and postpartum women: population based cohort study. *BMJ* 340, c1279.
- Bednarczyk, R.A., Adjaye-Gbewonyo, D., Omer, S.B., 2012. Safety of influenza immunization during pregnancy for the fetus and the neonate. *Am. J. Obstet. Gynecol.* 207, S38–S46.
- Beigi, R.H., Switzer, G.E., Meyn, L.A., 2009. Acceptance of a pandemic avian influenza vaccine in pregnancy. *J. Reprod. Med.* 54, 341–346.
- Bhat, N., Wright, J.G., Broder, K.R., Murray, E.L., Greenberg, M.E., Glover, M.J., et al, 2005. Influenza-associated deaths among children in the United States, 2003–2004. *N. Engl. J. Med.* 353, 2559–2567.
- Cox, S., Posner, S.F., McPheeters, M., Jamieson, D.J., Kourtis, A.P., Meikle, S., 2006. Hospitalizations with respiratory illness among pregnant women during influenza season. *Obstet. Gynecol.* 107, 1315–1322.
- Dodds, L., McNeil, S.A., Fell, D.B., Allen, V.M., Coombs, A., Scott, J., et al, 2007. Impact of influenza exposure on rates of hospital admissions and physician visits because of respiratory illness among pregnant women. *CMAJ* 176, 463–468.
- Jamieson, D.J., Honein, M.A., Rasmussen, S.A., Williams, J.L., Swerdlow, D.L., Biggerstaff, M.S., et al, 2009. H1N1 2009 influenza virus infection during pregnancy in the USA. *Lancet* 374, 451–458.
- Lam, P.P., Chambers, L.W., MacDougall, D.M., McCarthy, A.E., 2010. Seasonal influenza vaccination campaigns for health care personnel: systematic review. *CMAJ* 182, E542–E548.
- Marteau, T.M., Dormandy, E., Michie, S., 2001. A measure of informed choice. *Health Expect.* 4, 99–108.
- McCarthy, E.A., Pollock, W.E., Nolan, T., Hay, S., McDonald, S., 2012. Improving influenza vaccination coverage in pregnancy in Melbourne 2010–2011. *Aust. N. Z. J. Obstet. Gynaecol.* 52, 334–341.
- Naleway, A.L., Smith, W.J., Mullooly, J.P., 2006. Delivering influenza vaccine to pregnant women. *Epidemiol. Rev.* 28, 47–53.
- Poehling, K.A., Edwards, K.M., Weinberg, G.A., Szilagyi, P., Staat, M.A., Iwane, M.K., et al, 2006. The underrecognized burden of influenza in young children. *N. Engl. J. Med.* 355, 31–40.
- Poehling, K.A., Szilagyi, P.G., Staat, M.A., Snively, B.M., Payne, D. C., Bridges, C.B., et al, 2011. Impact of maternal immunization on influenza hospitalizations in infants. *Am. J. Obstet. Gynecol.* 204, S141–S148.
- Shavell, V.I., Moniz, M.H., Gonik, B., Beigi, R.H., 2012. Influenza immunization in pregnancy: overcoming patient and health care provider barriers. *Am. J. Obstet. Gynecol.* 207, S67–S74.
- Steinhoff, M.C., Omer, S.B., Roy, E., Arifeen, S.E., Raqib, R., Altaye, M., et al, 2010. Influenza immunization in pregnancy—antibody responses in mothers and infants. *N. Engl. J. Med.* 362, 1644–1646.
- Wiley, K.E., Massey, P.D., Cooper, S.C., Wood, N.J., Ho, J., Quinn, H.E., et al, 2013. Uptake of influenza vaccine by pregnant women: a cross-sectional survey. *Med. J. Aust.* 198, 373–375.
- World Health Organization, 2012. SAGE Meetings – Information Related to Influenza Immunization. <[http://www.who.int/influenza/vaccines/SAGE\\_information/en/](http://www.who.int/influenza/vaccines/SAGE_information/en/)> (Accessed 20 March 2013).
- World Health Organization, 2003. Prevention and control of influenza pandemics and annual epidemics. The Fifty-Sixth World Health Assembly, WHA56.19. <[http://www.who.int/immunization/sage/I\\_WHA56\\_19\\_Prevention\\_and\\_control\\_of\\_influenza\\_pandemics.pdf](http://www.who.int/immunization/sage/I_WHA56_19_Prevention_and_control_of_influenza_pandemics.pdf)>.
- Yudin, M.H., Salaripour, M., Sgro, M.D., 2009. Pregnant women's knowledge of influenza and the use and safety of the influenza vaccine during pregnancy. *J. Obstet. Gynaecol. Can.* 31, 120–125.
- Yudin, M.H., Salaripour, M., Sgro, M.D., 2010. Impact of patient education on knowledge of influenza and vaccine recommendations among pregnant women. *J. Obstet. Gynaecol. Can.* 32, 232–237.
- Yuen, C.Y., Tarrant, M., 2014. Determinants of uptake of influenza vaccination among pregnant women – a systematic review. *Vaccine* 32, 4602–4613.

Yuet Sheung Yuen, C., Yee Tak Fong, D., Lai Yin Lee, I., Chu, S., Sau-mei Siu, E., Tarrant, M., 2013a. Prevalence and predictors of maternal seasonal influenza vaccination in Hong Kong. *Vaccine* 31, 5281–5288.

Yuet Sheung Yuen, C., Yee Tak Fong, D., Lai Yin Lee, I., Chu, S., Sau-mei Siu, E., Tarrant, M., 2013b. Prevalence and predictors of

maternal seasonal influenza vaccination in Hong Kong. *Vaccine* 31, 5281–5288.

Zaman, K., Roy, E., Arifeen, S.E., Rahman, M., Raqib, R., Wilson, E., et al, 2008. Effectiveness of maternal influenza immunization in mothers and infants. *N. Engl. J. Med.* 359, 1555–1564.