

RESEARCH PAPER



Vaccination in pregnancy: Attitudes of nurses, midwives and health visitors in England

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ABSTRACT

Objective: To examine amongst healthcare professionals in England; knowledge of vaccinations in pregnancy, their perceived roles in these programmes and whether they recommend scheduled vaccines to pregnant women.

Design: Cross sectional survey (online questionnaire)

Setting: Healthcare workers in contact with pregnant women in England.

Participants: The survey analysis included 3441 healthcare workers who had been surveyed during May to August 2015. The participants were midwives, practice nurses and health visitors, working in England who were members of the Royal College of Midwives, Royal College of Nursing and the Institute of Health Visiting.

Results: We found that knowledge of vaccination in pregnancy was high in all professional groups. Seventy three percent of all respondents would recommend the influenza vaccine and 74% would recommend the pertussis vaccine to pregnant women. They were more likely to recommend vaccination in pregnancy if they would personally have the influenza and pertussis vaccines themselves and/or if they had the influenza vaccine as a healthcare worker. Practice nurses were significantly more likely to recommend the pertussis and influenza vaccines to pregnant women than midwives and health visitors. Health professionals who had received immunisation training were more confident in giving advice to pregnant women.

Conclusion: Immunisation training is essential if healthcare workers are to be informed and confident in effectively delivering the maternal immunisation programme and thus improving uptake of vaccines in pregnancy. These findings are important in tailoring educational programmes and addressing the training needs of different healthcare professional groups.

ARTICLE HISTORY

Received 11 July 2017
Revised 25 August 2017
Accepted 17 September 2017

KEYWORDS

attitudes; health visitors;
midwives; nurses; pregnant;
vaccination

Introduction

Vaccination during pregnancy, using inactivated influenza, pertussis and tetanus containing vaccines, is a safe and effective way to protect pregnant women and their infants when either one or both are at risk of these vaccine preventable diseases. In the UK, there are currently maternal vaccination programmes protecting both pregnant women and their young babies against seasonal influenza and protecting babies from birth against pertussis.^{1–3}

Since 2010, UK guidelines recommend that women who are pregnant during the influenza (flu) season, regardless of gestation, should be offered inactivated influenza vaccine.⁴ Pregnant women, particularly in the last trimester, and young infants, are at increased risk of severe disease and death from influenza.⁵ Pregnant women can be safely vaccinated against flu^{6–8} and vaccination is effective in preventing disease in pregnant women and their infants.^{1,9} Despite recommendations and strong support from professional bodies, flu vaccination coverage during pregnancy in England was 42.3% in the 2015/16 winter season compared to 71% in those aged 65 years and over, in whom vaccination is also recommended.¹⁰

In 2012, the UK reported the highest pertussis activity in over two decades, with rates of morbidity and mortality greatest in infants under three months of age. Pertussis-containing vaccines are scheduled at 8, 12 and 16 weeks in infancy. Most cases and all deaths in 2012 occurred in infants before they commenced their primary course of pertussis-containing vaccines.¹¹ As an outbreak control strategy, Public Health England (PHE) introduced a temporary vaccination programme in 2012 offering all pregnant women pertussis-containing vaccine between 28 and 38 weeks of pregnancy to passively protect their infants from birth.¹²

In 2016, following research into the optimal timing of pertussis vaccination in pregnancy,¹³ the UK's Joint Committee on Vaccination and Immunisation (JCVI) recommended vaccinating from 16 weeks gestation.¹⁴ The vaccine is ideally offered around the fetal anomaly scan at about 20 weeks and up to 32 weeks (though it can be given later) to capture early deliveries.¹⁵ Vaccinating in pregnancy is highly effective in protecting infants against pertussis.^{2,3,11,16} Data on the uptake, effectiveness³ and safety⁷ of the programme and its impact on disease led to the extension of the UK programme until at least 2019.¹⁷

Box One: Healthcare workers in contact with pregnant women

Practice nurse – is a registered nurse who is employed by a general practice, or whose services are otherwise retained by a general practice. Practice nurses play a key role in the administration of many routine vaccinations.

Health visitor – is a nurse or midwife who has an additional qualification in Specialist Community Public Health Nursing – Health Visiting (SCPHN-HV). This includes extra training in all aspects of family and public health. They work at a child, family and community level. They provide support and advice for parents from the ante natal period until the child is 5 years old. A health visitor may meet a pregnant woman for the first time during the latter stages of the pregnancy and usually in the first few weeks after.

Midwife – is usually the first (alternatively women may first go to their GP and then be referred to antenatal care) and main contact for the woman during her pregnancy, throughout labour and the early postnatal period. They are responsible for providing care and supporting women to make informed choices about their care.

It is important that all pregnant women are fully informed and have the opportunity to be immunised with easy access to immunisation services.¹⁸ There is evidence that most women recognise the benefits of vaccination during pregnancy and would be likely to accept vaccination to protect their baby or themselves in pregnancy against a potentially life-threatening disease.¹⁹

Health professionals play a key role in informing women and recommending vaccination.¹⁹⁻²⁶ The strong links between healthcare workers' (HCWs) perceptions of vaccination and vaccine uptake has been documented in studies in several countries.^{18,27-34}

Public Health England (PHE) in collaboration with the associated Royal College of Midwives (RCM), Royal College of Nursing (RCN), and the Institute of Health Visiting (iHV) conducted a survey to assess the knowledge, attitudes and practice of HCWs involved in antenatal care and/or vaccination, towards immunisation in pregnancy. We targeted midwives, practice nurses and health visitors (Box One).

Our key questions to better understand and support HCWs in delivering the programme were;

- 1) Do HCWs recommend vaccines to pregnant women?
- 2) Do HCWs have sufficient knowledge to advise pregnant women?
- 3) Are HCWs confident in communicating information on vaccines?

Results

Demographic characteristics

The overall response rate was 10% (3493/34,037): midwives (2393/21714, 11%); practice nurses (751/5323, 14%); and health visitors (297/7000, 4%). We excluded 52 responses as we could not assign them a professional category and therefore 3441

responses were included in the analysis. 3415 (99%) were female, 2849 were white (93%) and 1327 were aged 45–54 (43%). The largest professional group was midwives (2393, 70%) followed by practice nurses (751, 22%) and health visitors (297, 9%). The demographic characteristics are summarised in Table 1. We were able to compare the demographic data with registered members from the RCM and RCN. RCM registered members were; 99.6% females, 88% of white ethnicity and 34% aged 45–54. The RCN had 97% females, 83% of white ethnicity and 35% aged 45–54.

Knowledge of vaccination in pregnancy

Most HCWs (84%, n = 3379) were aware that pertussis and influenza vaccines were recommended during pregnancy. Most practice nurses (91%) correctly answered this question, followed by 85% of midwives and 59% of health visitors.

Overall there was good knowledge of both maternal immunisation programmes, although there were aspects of each programme where respondents were less clear as highlighted in Table 2. These five highlighted questions were analysed further using a model to look at whether a correct response to the question was associated with occupation, training or age. Whilst Question A was poorly answered, Health visitors were more likely to answer this correctly. Practice nurses and midwives were more likely to answer the other four questions correctly with the exception of question R which practice nurses were significantly more likely to answer correctly. For each of the five questions those who answered correctly were significantly more likely to have received training.

Attitudes towards vaccines and their intentions to vaccinate

Eighty-four percent of respondents would accept pertussis vaccine if they were pregnant; fewer would accept the influenza vaccine (73%). Practice nurses were most likely to report that they would accept pertussis and influenza vaccines (92% and 81% respectively), midwives (82%, 71%) and health visitors (78%, 71%).

Seventy-three percent and 74% of respondents indicated they routinely recommend influenza vaccine and pertussis vaccine respectively to pregnant women. There was an association between HCWs who indicated they would accept pertussis vaccine themselves if pregnant and who recommended pertussis vaccine (OR 6.3, CI 4.4–9.0) and influenza (OR 3.4, CI 2.4–4.7) vaccines to pregnant women (Table 3). Training and confidence were excluded as variables from the model due to collinearity.

Those who reported 'This isn't relevant to my role' as a response to 'Do you recommend flu or whooping cough vaccination to pregnant women?' were first excluded from the above analysis as there are certain roles that may not involve advising on vaccination, such as bereavement counselling. In total 431 and 430 reported that it was not part of their role to recommend influenza and pertussis vaccines respectively including; 25% of health visitors (n = 73), 14% of midwives (n = 333) and 4% practice nurses (n = 29). When the analysis was rerun with these respondents categorised as not recommending the

Table 1. Characteristics of respondents to the survey.

Respondents		Health Visitor	%	Midwife	%	Practice nurse	%	TOTAL
Sex	Female	295	99	2376	99	744	99	3415
	Male	2	1	17	1	7	1	26
	Total	297		2393		751		3441
Age	18–24	2	1	75	3	3	0	80
	25–34	21	9	394	18	21	3	436
	35–44	59	25	433	20	83	12	575
	45–54	103	43	803	37	421	62	1327
	55–64	52	22	434	20	141	21	627
	Aged 65 & over	2	1	21	1	11	2	34
	Total	239		2160		680		3079
Area of Practice	East Midlands	13	5	169	8	76	11	258
	London	38	16	334	15	68	10	440
	North East	18	8	93	4	21	3	132
	North West	23	10	281	13	62	9	366
	South East	52	22	375	17	147	22	574
	South West	30	13	277	13	102	15	409
	West midlands	20	8	225	10	67	10	312
	Yorkshire &Humber	24	10	194	9	81	12	299
	Total	239		2160		680		3079
	Years in role	0–3 years	99	41	510	24	90	13
4–9 years		61	26	528	25	272	40	861
20 years & above		29	12	521	24	131	19	681
Total		239		2155		679		3073
Ethnicity	White	209	87	1990	93	650	97	2849
	Bangladesh	0	0	2	0	0	0	2
	Black African	14	6	44	2	3	0	61
	Chinese	2	1	9	0	3	0	14
	Indian	3	1	7	0	3	0	13
	Pakistani	1	0	2	0	3	0	6
	Mixed	4	2	32	1	4	1	40
	Other Asian	2	1	3	0	1	0	6
	Other Black	1	0	2	0	1	0	4
	Other ethnicity	0	0	25	1	4	1	29
	Total	239		2149		673		3061

vaccines the only difference was that midwives became significantly more likely to recommend pertussis (Adjusted OR 1.7 CI 1.3 – 2.4, $P < 0.001$) and influenza vaccine (Adjusted OR 1.7 CI 1.3 – 2.5 < 0.001) than health visitors.

Overall, 1938 of 3088 (63%) respondents indicated they had received influenza vaccination as a HCW during the 2014/15 season. Practice nurses reported the highest uptake at 79% with health visitors at 61% and midwives 58%. HCWs who had received influenza vaccine were significantly more likely to recommend both vaccines to pregnant women (Table 3). Practice nurses were more likely to recommend the vaccines than other professional groups.

Concerns about side effects or personal illness/ allergy were most commonly cited as the reason for not accepting influenza vaccination (472/1091, 43%). The main motivators for being vaccinated were helping colleagues by not being sick at busy times (1224/1861, 66%) protecting themselves (1200/1861, 64%) and protecting patients (1161/1861, 62%).

Role with pregnant women

The most commonly cited involvement with pregnant women was answering questions (70%), followed by discussing vaccinations (66%), advising where women could be vaccinated (60%), checking whether pregnant women had received the right vaccinations (55%) and providing information (52%).

Table 4 shows roles with pregnant women and vaccination as reported by the individual professional groups.

The majority (92%) of practice nurses indicated that they vaccinate pregnant women compared to 9% of midwives and 1% of health visitors. Of the 91% of midwives who did not currently vaccinate pregnant women, 67% would be happy to do so. Ninety-nine percent of health visitors did not currently vaccinate and 41% would be happy to do so. Of the 8% of practice nurses that do not administer vaccinations, 55% would be happy to vaccinate (Fig. 1).

All groups indicated that midwives have the main responsibility for advising pregnant women on vaccination (86%). Thirty percent of practice nurses felt they themselves should have the main role in advising pregnant women.

Of 3304 professionals surveyed, 1853 (56%) said they had not received training on vaccinations in pregnancy: 83% of health visitors, 62% of midwives, and 27% of practice nurses. Trained HCWs were generally more confident about giving advice in pregnancy (Fig. 2). Of those who had received training, 84% (95% CI 81%–86%) were confident advising pregnant women compared to 46% (95% CI 44%–48%) who had not received training.

Discussion

It is important to understand the views of HCWs involved in advising and/or offering vaccines to pregnant women, to bridge

Table 2. Influenza and pertussis knowledge questions and responses by healthcare worker group.

Influenza and pertussis knowledge questions	Occupation	Correctly answered	%	Incorrectly answered	%	Unsure	%	Total
A. Flu vaccination in pregnancy can protect a baby against flu disease from birth. Correct answer = True	Health visitor	128	54*	55	23	56	23	239
	Midwife	827	38	972	45	365	17	2164
	Practice nurse	313	46	250	37	112	17	675
B. Flu is not dangerous for babies. Correct answer = False	Total	1268	41	1277	41	533	17	3078
	Health visitor	208	89	19	8	6	3	233
	Midwife	1887	88	134	6	117	5	2138
C. Flu vaccine in pregnancy protects the mother. Correct answer = True	Practice nurse	588	88	54	8	28	4	670
	Total	2683	88	207	7	151	5	3041
	Health visitor	223	94	3	1	12	5	238
D. There is good evidence that flu vaccination in pregnancy is safe. Correct answer = True	Midwife	2089	97	31	1	43	2	2163
	Practice nurse	671	99	4	1	6	1	681
	Total	2983	97	38	1	61	2	3082
E. Pregnant women are at increased risk of serious complications from flu. Correct answer = True	Health visitor	213	90	1	0	23	10	237
	Midwife	1968	91	37	2	157	7	2162
	Practice nurse	664	97	3	0	16	2	683
F. Flu vaccination can be given at any stage of pregnancy. Correct answer = True	Total	2845	92	41	1	196	6	3082
	Health visitor	206	87	10	4	22	9	238
	Midwife	2101	97	25	1	40	2	2166
G. The vaccine can cause flu in pregnant women. Correct answer = False	Practice nurse	652	96	13	2	16	2	681
	Total	2959	96	48	2	78	3	3085
	Health visitor	124	52	41	17	72	30	237
H. Once a woman has received flu vaccine in pregnancy she will not need a further dose of vaccine in subsequent pregnancies. Correct answer = False	Midwife	1769	82	197	9	194	9	2160
	Practice nurse	631	93	25	4	24	4	680
	Total	2524	82	263	9	290	9	3077
I. The flu and pertussis vaccine cannot be given at the same time. Correct answer = False	Health visitor	182	78	20	9	31	13	233
	Midwife	1853	86	137	6	171	8	2161
	Practice nurse	658	97	4	1	19	3	681
J. The pertussis programme for pregnant women in pregnant women has stopped. Correct answer = False	Total	2693	88	161	5	221	7	3075
	Health visitor	200	84	11	5	27	11	238
	Midwife	1956	90	105	5	102	5	2163
K. The pertussis programme for pregnant women in pregnant women has stopped. Correct answer = False	Practice nurse	643	94	24	4	17	2	684
	Total	2799	91	140	5	146	5	3085
	Health visitor	102	43	27	11	107	45	236
L. Whooping cough vaccination in pregnancy is safe for mother and baby. Correct answer = True	Midwife	1303	60*	264	12	600	28	2167
	Practice nurse	623	91*	23	3	36	5	682
	Total	2028	66	314	10	743	24	3085
M. Whooping cough vaccination in pregnancy can protect a baby against whooping cough from birth. Correct answer = True	Health visitor	211	85	1	0	37	15	249
	Midwife	2047	93	10	0	136	6	2193
	Practice nurse	675	97	2	0	16	2	693
N. In England babies can still die from whooping cough. Correct answer = True	Total	2933	94	13	0	189	6	3135
	Health visitor	212	86	6	2	28	11	246
	Midwife	2001	91	30	1	160	7	2191
O. Pregnant women are at increased risk of serious complications from whooping cough. Correct answer = False	Practice nurse	676	97	3	0	16	2	695
	Total	2889	92	39	1	204	7	3132
	Health visitor	203	82	13	5	33	13	249
P. Young babies with whooping cough are likely to need hospitalisation. Correct answer = True	Midwife	1963	89	84	4	148	7	2195
	Practice nurse	676	97	7	1	12	2	695
	Total	2842	91	104	3	193	6	3139
Q. Pregnant women are at increased risk of serious complications from whooping cough. Correct answer = False	Health visitor	235	95	2	1	10	4	247
	Midwife	2110	97	14	1	56	3	2180
	Practice nurse	684	99	3	0	7	1	694
R. Young babies with whooping cough are likely to need hospitalisation. Correct answer = True	Total	3029	97	19	1	73	2	3121
	Health visitor	52	20	151	60	48	19	251
	Midwife	714	33*	998	46	476	22	2188
S. Young babies with whooping cough are likely to need hospitalisation. Correct answer = True	Practice nurse	308	45*	241	35	138	20	687
	Total	1074	34	1390	44	662	21	3126
	Health visitor	232	93	4	2	13	5	249
T. Young babies with whooping cough are likely to need hospitalisation. Correct answer = True	Midwife	2034	93	53	2	97	4	2184
	Practice nurse	666	96	15	2	12	2	693
	Total	2932	94	72	2	122	4	3126
U. Young babies with whooping cough are likely to need hospitalisation. Correct answer = True	Health visitor	134	54	38	15	75	30	247

(Continued on next page)

Table 2. (Continued).

Influenza and pertussis knowledge questions	Occupation	Correctly answered	%	Incorrectly answered	%	Unsure	%	Total
Q.Whooping cough vaccine should be given in every pregnancy. Correct answer = True	Midwife	1586	73*	262	12	337	15	2185
	Practice nurse	571	82*	73	11	49	7	693
	Total	2291	73	373	12	461	15	3125
R.Whooping cough vaccine is a combination vaccine with diphtheria, tetanus and polio. Correct answer = True	Health visitor	84	34	119	48	47	19	250
	Midwife	688	31	1069	49	430	20	2187
	Practice nurse	635	92*	40	6	15	2	690
	Total	1407	45	1228	39	492	16	3127

A model was created on the highlighted questions looking at whether answering the question was associated with occupation, training and age.

*Indicates the professional group that were significantly more likely to answer the questions correctly. For the 5 questions highlighted, training was significantly associated with a correct response.

the gap between vaccine recommendation and implementation. We found that a high proportion (74%) of practice nurses, midwives and health visitors recommend pertussis vaccine to pregnant women and 73% recommend influenza vaccine. At the time of the survey, coverage of the prenatal pertussis vaccines was 57.7%³⁵ and coverage of the influenza vaccine was 41.3% in 2014/2015.³⁶ National coverage in pregnant women has recently improved with earlier timing of pertussis vaccination and was 72.6% in March 2017.³⁷ However influenza vaccine uptake was still only 44.8% in January 2017.³⁸

This survey showed that practice nurses were well informed about maternal immunisation programmes and were more likely to recommend the influenza and pertussis vaccines to pregnant women than other professional groups. Administering immunisations is core to the practice nurse role and may underpin their positive attitudes to immunisations in pregnancy. Practice nurses were more likely to have received training and were more confident advising pregnant women. Health visitors on the other hand, usually have more contact postnatally and were less likely to have received vaccination training. In a relatively recent change, as part of the 5 key contacts³⁹ the role of health visitors now includes a mandated contact at 28 weeks of pregnancy. Together with the advice to offer vaccination earlier, from around 20 weeks gestation,¹⁵ this visit offers an important opportunity to ensure that pregnant women have been vaccinated, provide additional information and advice about immunisation in pregnancy and to signpost women to vaccination.

In an uncomplicated pregnancy, midwives can provide all the antenatal care for a pregnant woman and play an important role in promoting vaccines. Pregnant women who receive a positive recommendation for vaccination from a healthcare provider are more likely to receive the vaccine.^{18,20} A UK survey of pregnant women and women with young children found these women were willing to be vaccinated and citing midwives in particular as their preferred source of information.¹⁹

Respondents in our survey also identified midwives as the professionals who should have the main responsibility for advising pregnant women on vaccination. However only 60% of midwives were confident giving advice compared to 82% of practice nurses; influenced by immunisation training they had received. Around 10% of midwives were vaccinating pregnant women; nearly 70% not currently vaccinating would be happy to do so with appropriate training. Whilst midwives may be willing to vaccinate, there are certain constraints which could currently hinder their ability to do so including; short

appointment slots, lack of reimbursement, ensuring safe storage of vaccines in settings without storage facilities available. There are, however, an increasing number of areas in England where vaccination in pregnancy is locally commissioned from maternity services.

In the UK, the National Institute for Health and Care Excellence (NICE) has published draft guidelines to improve uptake of the flu vaccination.⁴⁰ These emphasise the need to educate HCWs about flu vaccination, highlighting specifically; eligibility, transmission, safety and effectiveness and benefits of vaccination for people at high risk, including pregnant women. The draft guidelines outline that HCWs in contact with pregnant women should receive this training, raise awareness of the importance of flu vaccination and maximise opportunistic appointments such as antenatal visits. There are specific recommendations on improving occupational flu vaccination uptake including challenging misconceptions such as the vaccine can cause flu.

National estimated annual coverage of influenza vaccine among HCWs was 54.9% in 2014/15 *at the time of the survey*.⁴¹ GP practice nurses achieved highest uptake (64.4%). The uptake of influenza vaccine reported in our study was comparatively high with practice nurses reporting 79%. This may reflect that the 10% of members who completed our survey had generally more positive views about vaccination than non-responders.

The most common reason for accepting influenza vaccination was that this could help colleagues by not being sick at busy times; to our knowledge this has not previously been reported as a main motivation for influenza vaccination among HCWs. This is important because HCWs who received influenza vaccine were more likely to recommend vaccines to pregnant women.²² This highlights the importance of addressing potential barriers and beliefs in HCWs themselves regarding vaccination. It is therefore encouraging that uptake in HCWs has improved, reaching 63.4% in 2016/17.⁴²

This study provided a valuable insight into respondents' views. However, the limitations of cross-sectional studies apply, providing only a snapshot view. It is not possible to assess changes in opinions over time and the impact of programme changes, such as earlier pertussis immunisation in pregnancy in the UK. Due to the outbreak situation there was a rapid introduction of this programme with limited opportunities for tailored training pre-implementation.⁴³ Efforts have since been

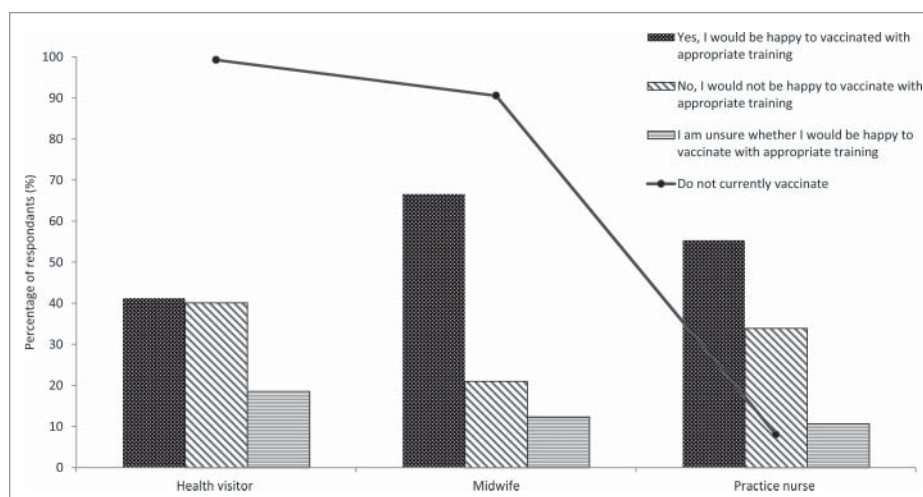
Table 3. Logistic regression of factors associated to recommending pertussis and influenza vaccines in pregnancy.

	Model 1: Recommend pertussis vaccine				Model 2: Recommend the influenza vaccine			
	Responses (%)	Univariable Odds ratio (95% CI)	P value	Multivariable Odds ratio (95% CI)	Responses (%)	Univariable Odds ratio (95% CI)	P value	Multivariable Odds ratio (95% CI)
Did they have the healthcare worker flu vaccine in the 2014/15 season?	n = 2665				n = 2684			
No	1707 (64)	1	<0.001	1	962 (36)	1	<0.001	1
Yes	958 (36)	3.7	<0.001	1.7	1722 (64)	3.9	<0.001	1.7
Occupation	n = 2814				n = 2684			
Health visitors	192 (7)	1		1	192 (7)	1		1
Midwife	1940 (69)	1.1	0.564	1.2	1940 (69)	1.2	0.374	1.3
Practice Nurses	682 (24)	3.3	<0.001	2.7	682 (24)	2.9	<0.001	2.3
Would they personally have the whooping cough vaccine in pregnancy?*	n = 2545				n = 2684			
Would not have the vaccines in pregnancy	335 (13)	1		1	347 (14)	1		1
Would have the vaccines in pregnancy	2210 (87)	9.3	<0.001	6.3	2250 (86)	7.1	<0.001	3.4
Would they personally have the flu vaccine in pregnancy?*	n = 2553				n = 2577			
Would not have the vaccines in pregnancy	646 (25)	1		1	652 (25)	1		1
Would have the vaccines in pregnancy	1907 (75)	4.5	<0.001	1.3	1925 (75)	5.2	<0.001	2.2
Age	n = 2657				n = 2676			
18-24	70 (3)	1		1	71 (3)	1		1
25-34	380 (14)	1.2	0.642	1.1	375 (14)	1.2	0.770	1.4
35-44	487 (18)	1.3	0.384	1.5	489 (18)	1.6	0.293	2.2
45-54	1149 (43)	1.6	0.121	1.2	1156 (43)	1.9	0.687	1.6
55-64	543 (20)	1.4	0.330	1.0	554 (21)	1.7	0.957	1.4
>65	28 (1)	3.0	0.172	2.4	31 (1)	4.2	0.321	3.8

*These questions were asked as theoretical questions.

Table 4. HCWs role with pregnant women and vaccination.

	Health Visitor (%)	Midwife (%)	Practice Nurse (%)
I provide them with written information (%)	53 (19)	1300 (57)	356 (50)
I discuss vaccination with them (%)	86 (32)	1485 (65)	598 (84)
I answer any questions they may have (%)	134 (49)	1576 (69)	602 (84)
I advise women where they can be vaccinated (%)	102 (37)	1579 (69)	302 (42)
I check whether pregnant women have had the right vaccinations (%)	65 (24)	1300 (57)	442 (62)
None of the above (%)	75 (27)	386 (17)	51 (7)
Total	273	2295	714

**Figure 1.** Respondents who do not currently vaccinate pregnant women and the proportions of these that would be happy to vaccinate with appropriate training, by professional group.

made to improve training in healthcare professionals, particularly midwives, in the years after completion of the survey and this is likely to have affected views.

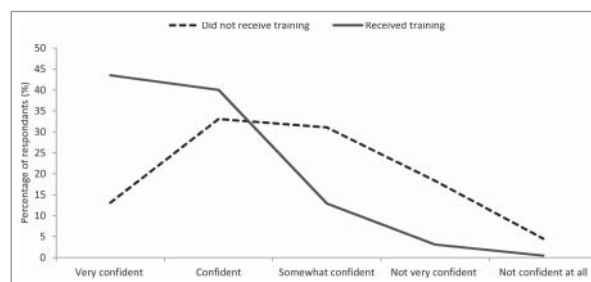
The survey is subject to selection and representation bias, for example the respondents might be largely those involved in or particularly interested in immunisation with polarised views. The main limitation was a relatively low response rate (10%). The survey was sent to all HCWs who were registered with the professional bodies and, for some, immunisation may not have been a key part of their role. To improve our response rate we could have further targeted HCWs through methods such as newsletters and websites. However it is difficult to control denominators through these more open channels of communication. We did not have demographic details from the iHV and therefore cannot determine the representativeness for health visitors. Demographic data from the RCN and RCM, suggest those of white ethnicity and practice nurses aged between 45–54 were over-represented in our survey.

Although the low response rate does not affect the internal validity of the study findings, it may limit the generalisability of the results. This was a large study and similar UK studies investigating health professionals' views of vaccines have been much smaller. The only other comparable study,²⁷ included 3059 respondents and looked at influenza vaccination uptake among HCWs and their attitudes and beliefs towards vaccination.

PHE is engaging with professional groups to raise awareness of the programmes through professional magazines,

oral and poster presentations at midwifery forums/conferences and development of online training resources for immunisation in pregnancy. PHE is producing; Patient Group Directions⁴⁴ for vaccination of pregnant women, an updated patient information leaflet⁴⁵ and updated antenatal and newborn screening resource cards for midwives that cover vaccination in pregnancy.⁴⁶ These initiatives aim to improve knowledge of maternal vaccination programmes in midwives in particular and, with mandated contact at 28 weeks gestation for health visitors, it is important that resources are similarly developed to target this professional group. To fully assess the impact of these resources another survey could be undertaken.

The recent improvements in maternal pertussis vaccine uptake suggest efforts to engage with midwives in particular,

**Figure 2.** The confidence of respondents in giving advice to pregnant women according to whether they had or had not received training.

together with programme changes, have had a positive impact. Since this survey was conducted, more training has taken place and therefore knowledge (see Table 2) and understanding of the programmes is likely to have improved consistent with increasing vaccine uptake.

Conclusions

- A large proportion of HCWs recommended vaccination to pregnant women with practice nurses significantly more likely to do so;
- Having influenza vaccine in their role as HCWs and their theoretical acceptance of pertussis vaccine were also significant factors in the likelihood of HCWs recommending vaccination to pregnant women.
- The correlation between receipt of immunisation training and HCWs' knowledge and confidence in recommending immunisation in pregnancy is important for both commissioners and providers of immunisation services and future public health strategies to improve maternal and infant health.

Method

Study design

Using an online questionnaire, we surveyed health visitors, midwives, and practice nurses working in England and members of one of three different professional bodies; 21,714 members of the RCM, 7000 members of the iHV and 5323 Practice nurses registered with the RCN. The survey ran from May to August 2015.

The survey was an anonymous self-administered, web-based questionnaire on the *SelectSurvey* platform (<https://selectsurvey.net/>). It was piloted amongst a small sample of each professional group prior to administering the main survey. The survey questions were re-ordered after the pilot study.

An invitation email (containing the link to the web based questionnaire) was sent to the iHV and RCN who forwarded the email to their registered members. PHE emailed RCM members directly to invite them to participate via a link to the survey. One subsequent reminder was emailed to the members of the three professional bodies. The questions were developed based on a literature review,^{19,47} similar previous surveys^{48,49} for parents and current vaccination guidelines. The questionnaire consisted of 35 close ended questions on five topics 1) knowledge of vaccines recommended in pregnancy 2) perceptions of their role in advising and administering immunisations in pregnant women 3) motivating factors for accepting and rejecting seasonal influenza vaccine for HCWs 4) comfort levels with advising on and administration of influenza and pertussis vaccines and 5) demographics.

Data analysis

The outcome variable selected for multiple logistic regression was whether the respondent recommended pertussis and/or influenza vaccine to pregnant women based on the question 'do you recommend flu or whooping cough vaccination to

pregnant women?'. The response options were 'Yes I routinely recommend the vaccine', 'I recommend the vaccine if a woman asks my opinion', 'I do not give my opinion as it is the woman's choice' 'I routinely advise against receiving the vaccine' and 'I advise against having the vaccine if the woman asks my opinion'. The first two options were grouped as recommending the vaccines and the last 3 were grouped as not recommending the vaccine. Respondents who indicated 'This isn't relevant to my role' were excluded from the analysis and the model was then rerun including these respondents as not recommending the vaccines, to look for any differences.

Chi-square test was used to identify significant associations between recommending the vaccine and different explanatory variables, such as age and whether they had received flu vaccination for HCWs. The variables with $P < 0.001$ in univariate analyses were entered into a multiple logistic regression analysis to identify factors associated with recommending the vaccines to pregnant women. Data were analysed using STATA software.

This study was not classified as a research study as defined by National Research Ethics Service (NRES) (<http://www.hra.nhs.uk/>) and therefore did not require ethics approval.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

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