



Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study

Title	Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study
Author(s)	Flanagan, Paula;Dowling, Maura;Gethin, Georgina
Publication Date	2020-03-23
Publisher	Wiley
Repository DOI	10.1111/jan.14360

Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study

Paula Flanagan¹, Maura Dowling², Georgina Gethin^{3,4,5}

¹HSE-Health Protection Surveillance Centre, Dublin, Ireland.

²School of Nursing and Midwifery, NUI Galway, Galway, Ireland.

³School of Nursing and Midwifery, NUI Galway, Galway, Ireland.

⁴School of Nursing, Monash University, Clayton, Victoria, Australia.

⁵Alliance for Research and Innovation in Wounds, NUI Galway, Galway, Ireland.

Flanagan P, Dowling M, Gethin G. Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study. *Journal of Advanced Nursing*. 2020 Jul;76(7):1746-1764. DOI: 10.1111/jan.14360.

Abstract

Aim: To identify the barriers and facilitators to seasonal influenza vaccination uptake among nurses.

Background: Seasonal influenza causes significant mortality and morbidity among older people and high risk groups. Vaccinating nurses against influenza is an essential public health measure to reduce the burden of disease. Yet despite annual recommendations, nurses' influenza vaccine uptake rates remain low.

Design: An explanatory sequential mixed methods study design.

Data Sources: Qualified nurses attending mandatory training in two large acute hospitals in Ireland.

Methods: A paper-based questionnaire assessing nurses' knowledge, risk perception, health beliefs and influenza vaccination practices was distributed to a convenience sample of qualified nurses (n=462) between September 2017 - February 2018. A self-selected sample of thirty five nurses who completed the questionnaire participated in five focus groups to explore in depth the barriers and facilitating factors associated with their vaccination practices between September 2018 - October 2018. The questionnaire data were analysed statistically and thematic analysis was applied to the qualitative data. The quantitative and qualitative findings were integrated using the Pillar Integration Process.

Results: Seven themes emerged; (1) the influence of nurses' knowledge on vaccine uptake, (2) dissemination of information, (3) vaccine fears and concerns, (4) protection, risk and vulnerability: self and others, (5) influencers, (6) accessibility and (7) organisational pressure.

Conclusion: Achieving high vaccine uptake rates among nurses through voluntary vaccination programmes remains a challenge. Multi-faceted influenza campaigns based on the HBM should be prioritised to address dissemination of evidence based information, accessibility and external cues to action.

Impact: Low influenza vaccine uptake among nurses compromises patient safety and contributes to a significant burden on health services. This study identified factors associated with vaccine practices among nurses and will inform the development of specific tailored interventions for nurses.

Keywords: Seasonal influenza, nurses, mixed methods, vaccination behaviours, health belief model.

Introduction

Seasonal influenza is an acute, respiratory infection that remains a public health concern (World Health Organization, 2019). Although the illness is often self-limiting, it can contribute to significant mortality and morbidity among elderly and high risk patients (Rothberg, Haessler, & Brown, 2008). Globally, annual epidemics cause approximately 3-5 million cases, resulting in 250,000-600,000 deaths (Nair et al., 2011). In the European Union (EU)/ European Economic Area (EEA) an estimated 40,000 people die prematurely due to influenza infection (Nicoll et al., 2012).

Influenza is a vaccine-preventable disease and annual vaccination is the most effective preventative measure (Nicoll & Sprenger, 2013) to protect vulnerable patients either directly through vaccination, or indirectly by vaccinating health care workers (HCWs) (European Centre for Disease Prevention and Control, 2018). HCWs are a potential source of infection (Magill et al., 2011) as health care facilities provide an environment consisting of frequent contact between patients, visitors and staff. The effect of influenza on vulnerable patients is due to lower vaccine efficacy particularly in elderly and immunocompromised individuals (Gross, Hermogenes, Sacks, Lau, & Levandowski, 1995). Vaccinating HCWs can reduce influenza transmission within health care settings; reduce employee illness and absenteeism between 43% and 53% (Nichol et al., 1995; Wilde et al., 1999) and decreases influenza-related morbidity and mortality among high risk individuals by up to 20% (Hayward et al., 2006; Lemaitre et al., 2009; Potter et al., 1997). Therefore, international and national agencies recommend annual vaccination of HCWs (Centers for Disease Prevention and Control, 2015; European Council, 2009; Immunisation Guidelines for Ireland, 2013; World Health Organization, 2012).

Background

Most studies investigating vaccination practices in healthcare settings have done so within the context of the wider healthcare workforce therefore failing to adequately explore the specific issues related to nurses as a professional group (Smith, Sim, & Halcomb, 2016a, 2016b).

Misconceptions or insufficient information about influenza and the vaccine, negative attitudes towards vaccination, level of knowledge and level of perceived risk (Livni, Chodik, Yaari, Tirosh, & Ashkenazi, 2008; Raftopoulos, 2008; Smith et al., 2016a, 2016b; Zhang, While, & Norman, 2010, 2012b) have been identified as influencing their vaccination practices. Nurses represent the largest group of health professionals internationally (World Health Organization,

2016) and have different attitudes about influenza and its prevention compared to physicians (Hollmeyer, Hayden, Poland, & Buchholz, 2009). Internationally and nationally nurses vaccine uptake rates are lower compared to other HCWs (Christini, Shutt, & Byers, 2007; De Juanes et al., 2007; Leitmeyer et al., 2006; O'Lorcain, Cotter, & Kelleher, 2019; Riphagen-Dalhuisen, Gefenaite, & Hak, 2012). Nurses are at higher risk of influenza (Chen et al., 2010) due to their close interaction with patients infected with influenza, who are not clinically ill or diagnosed with the virus (Bernard, Fischer, Mikolajczyk, Kretzschmar, & Wildner, 2009).

Although some vaccination campaigns have increased vaccine uptake rates among HCWs, studies have suggested that programmes are less effective in promoting an increase in nurses compared to physicians (Zhang et al., 2010). Evidence supports the need to develop occupation-specific interventions and campaigns instead of generic campaigns (Bouadma et al., 2012). Therefore it is essential to identify the reasons why nurses accept or reject the influenza vaccine. Health-related behaviours are influenced by individuals perception of a threat posed by a health problem as well as by the value associated with actions aimed at reducing the threat (Becker & Maiman, 1975). Psychological theories of behaviour change are effective in guiding the development of interventions to improve vaccine uptake (Corace et al., 2016). The Health Belief Model (HBM) (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988) has been used extensively to determine relationships between health beliefs and behaviours (Glanz, Rimer, & Viswanath, 2008) and has been found to be the most frequently employed theory to predict influenza vaccination among HCW (Corace et al., 2016). On review of the HBM's constructs, it was identified as the most suitable underpinning theory for the study. According to the model, the constructs of perceived seriousness, susceptibility, benefits, barriers, cues to actions and self-efficacy can be used to explain whether a person takes action to prevent, or improve health behaviours (Luquis & Kensinger, 2019) (figure 1). To date, no known mixed methods studies have investigated the factors associated with nurses' vaccination practices incorporating the HBM. This research is essential in order to inform policy and increase nurses' vaccination uptake rates to reduce the burden of the disease.

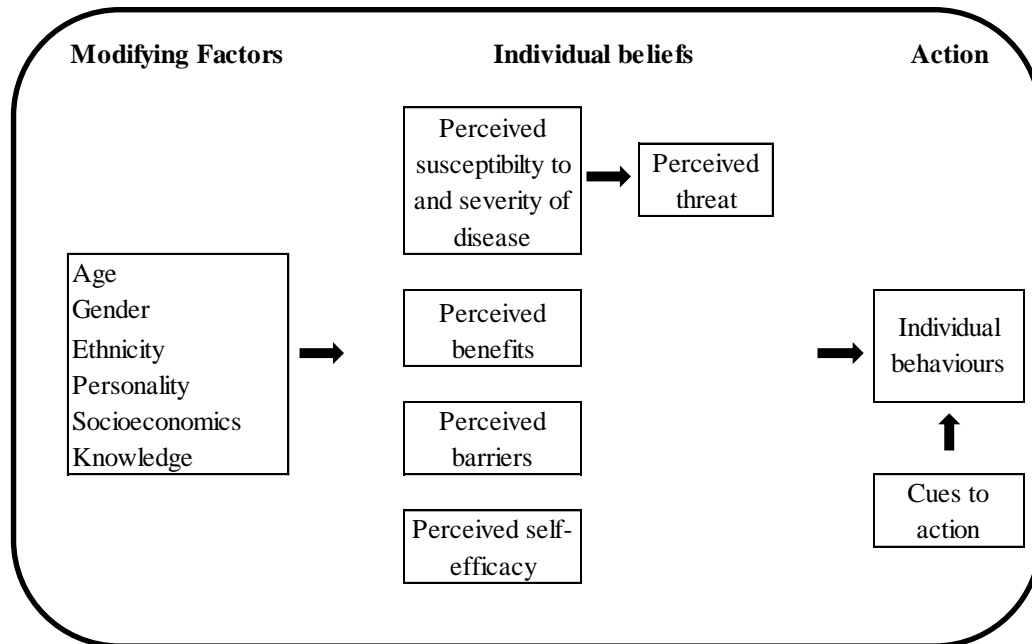


Figure 1 Health belief Model (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988)

The study

Aim and objectives

This study aimed to identify the barriers and facilitators of seasonal influenza vaccination uptake among nurses. The objectives were to (1) to examine nurses' knowledge, risk perceptions, health beliefs and seasonal influenza vaccination practices and (2) to explore in depth the barriers and facilitating factors influencing their vaccination practices.

Design

A sequential explanatory mixed methods design (Creswell, 2009) was used. The quantitative and qualitative data were collected in sequence with the purpose of using the follow-up qualitative data to elaborate and explain the quantitative results.

Quantitative study

Sample

A convenience sample of qualified nurses, attending mandatory on-site training was invited to participate between September 2017- February 2018. A paper-based questionnaire was distributed to qualified nurses attending moving and handling and cardiopulmonary resuscitation (CPR) training in site A and moving and handling in site B.

Data Collection

Permission was granted to use the King's Nurses Influenza Vaccination Questionnaire (KNIVQ) (Zhang, While, & Norman, 2012a). This consisted of six parts which assessed nurses' knowledge, risk perception, health beliefs and vaccination practices. Twenty two questions relating to nurses' knowledge about influenza and the vaccine requiring true, false or unsure responses were summed to give an overall knowledge score (1=correct response, 0=incorrect and 2=unsure). Eight questions measured nurses risk perception using a five point Likert scale (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree, 0=undecided) and views on Health Locus of Control were measured using the Multidimensional Health Locus of Control (MHLC) scales (Wallston, Wallston, & DeVellis, 1978). Three subscales (chance, internal and powerful others) consisted of 18 questions and were rated on a six point Likert scale (1=strongly disagree, 2=moderately disagree, 3 slightly disagree, 4=slightly agree, 5=moderately agree, 6=strongly agree) which quantified the extent to which nurses believed their health was controlled internally, by chance and/or by powerful others. The vaccination practices of nurses were assessed using questions to explore whether they were vaccinated against influenza in the previous 12 months and their future vaccine intentions. Factors associated with vaccine practices were collected using two open-ended questions identifying reasons for and against vaccination. The final section collected demographic characteristics of each nurse.

Validity and reliability

Cronbach's alpha for each subscale ranged from 0.701 to 0.763 demonstrating internal validity (Zhang et al., 2012b). The survey was piloted among 15 nurses in Ireland to assess acceptability and usability. Minor changes were made to the demographic section.

Data Analysis

The data from the questionnaires were doubled-entered into EpiData version 3.0 by two members of the research team working independently. Statistical analysis was completed in Stata version 14.0. The Chi-Square or Fisher's exact tests were used to examine the statistical difference between categorical variables, as appropriate. The independent sample *t* test was used to compare the differences between continuous variables in two groups (vaccinated and unvaccinated nurses and future vaccine intentions) ANOVA was used to compare the differences in more than two groups.

Univariate analysis using logistic regression analysis was used to identify factors associated with nurses' vaccination uptake in the previous 12 months and also to identify factors associated with future vaccine intentions. Odds ratios (ORs) were calculated with 95% confidence intervals (CIs) and significance set at $p < 0.05$. Factors with a *p* value of < 0.2 (two tailed) in univariate logistic regression analysis were included in multivariable logistic regression analyses (stepwise backward model). Adjusted ORs with 95% CIs were calculated to identify the independent variables that remained associated with vaccination uptake. A *p* value < 0.05 was considered statistically significant.

Qualitative study

Sample

A self-selection sampling strategy was used until data saturation was achieved. Participants who completed the questionnaire were invited to consent to participate in the focus group discussions between September 2018 and October 2018.

Data collection

Each focus group was conducted face to face in a quiet training room in both hospitals. A topic guide, informed by the results of the questionnaire guided the focus group discussions. A semi-structured format was used to provide rich data and achieve a better understanding of nurses' vaccination practices (Creswell, 2014). An assistant moderator attended each focus group to help clarify and add contextual details (Mack, Woodsong, Mac Queen, Guest, & Namey, 2005).

All focus groups were audio recorded with permission and transcribed verbatim by the first author. Pseudonyms were assigned to ensure confidentiality.

Validity and reliability

All focus group transcripts were coded by the first author. Peer de-briefing was subsequently undertaken by the second author whereby the analysis process was reviewed and the data checked for representation within the generated themes.

Data analysis

The qualitative data were analysed using thematic analysis (Braun & Clarke, 2006) by the first author in NVIVO (version 12). During the process of transcribing, initial thoughts and ideas were documented. The transcripts were read several times ensuring familiarisation with the data. This was followed by generating initial codes. Themes were identified where the codes had similar patterns or meaning and were further refined and checked to ensure they accurately represented the data. Using an iterative approach, the analysis moved to the stage of naming and defining themes. The final stage of producing the report provided sufficient content from the transcripts supporting the themes. The codebook and transcripts were provided to the second author and assessed for agreement.

Ethical considerations

Ethical approval was granted by the research ethics committee from the two hospitals. The questionnaire was anonymised and completed voluntarily. Nurses provided written consent to participate in the focus group discussions. Consent forms were collected separately to the questionnaires.

Data integration

The Pillar Integration Process (PIP) (Johnson, Grove, & Clarke, 2017) was used to display the findings from the questionnaire and focus groups in a meaningful and transparent way using a visual joint matrix. The PIP displays the findings from the outside column first, working towards the central column (Johnson et al., 2017). Figure 2 illustrates a generic visual representation of the PIP and the four stages; listing, matching, checking and pillar building.

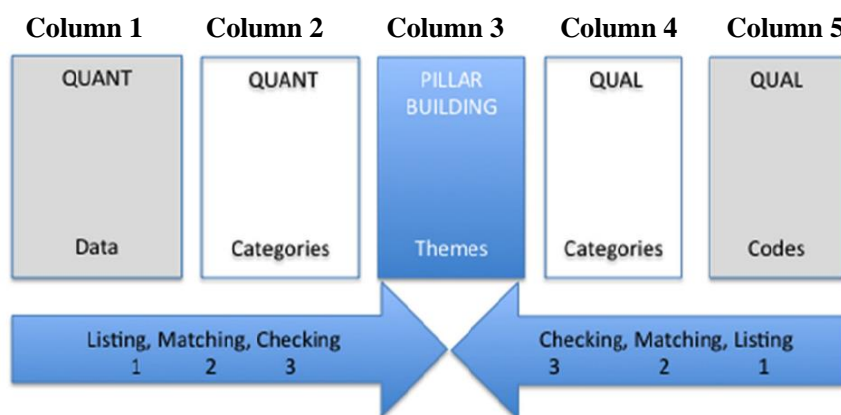


Figure 1 A generic diagrammatic representation of the Pillar Integration Process to demonstrate column headings and direction of Integration (Johnson et al., 2017)

In this study, column one described the different sections of the questionnaire explored. The results from the questionnaire were listed in column two (stage 1, listing). This was followed by the process of matching in columns four and five where the qualitative content and codes were matched with the quantitative data in column two (stage 2, matching). The data were cross checked and verified for completeness to ensure the rows were appropriately matched with raw data (stage 3, checking). Where no match was found, this was left blank. The data in columns two, four and five were then compared to ensure all data reflected patterns of similarities. To ensure rigour in the process, the first and second authors checked the data for completeness and to identify emerging patterns. Inferences arising from the integrated findings were agreed and entered in the pillar column (column three, stage 4, pillar building).

Results

Quantitative findings

Characteristics of respondents

A response rate of 79.4% (n= 462/582) was achieved. The characteristics are presented in table 1. The majority of respondents were females (92.2%, n=426), staff nurses (77.1%, n=356) and qualified for an average of 16.2 years (SD=10.34). Almost 80% (n=368) worked full-time with the majority specialising in general medicine (43.9%, n=203) (Table 1).

Table 1 Characteristics of survey participants

Characteristic		n*	%
Age group	20-29 yrs	108	23.4
	30-39 yrs	142	30.7
	40-49 yrs	136	29.4
	50+ yrs	74	16.0
Staff grade	Staff nurse	356	77.1
	CNM 1	14	3.0
	CNM 2/CNS	72	15.6
	CNM 3/Senior Management	14	3.0
Sex	Female	426	92.2
	Male	33	7.1
Education qualification	DipHE	81	17.5
	Bachelor Degree	209	45.2
	PGDip/Masters	149	32.3
	Other	17	3.7
Specialty	Medicine	203	43.9
	Surgery	147	31.8
	Other	97	21.0
Years qualified	0-10 yrs	167	36.2
	11-20 yrs	141	30.5
	21+ yrs	147	31.8
Hospital	Site A	313	67.8
	Site B	147	31.8
Employment status	Full time employment	368	79.7
	Part time employment	87	18.8

*Number of participants who provided an answer to this question

CNM, Clinical Nurse Manager; CNS, Clinical Nurse Specialist; DipHE, Diploma in Higher Education; PGDip, Post Graduate Diploma

Influenza vaccination uptake and future vaccine intentions

A total of 40.3% (n=186) were vaccinated against influenza in the previous 12 months and 59.9% (n=277) intended to get vaccinated in the future. On univariate analysis there was a statistically significant difference between nurses vaccinated in the past 12 months and future vaccine intentions ($p < 0.0001$). Vaccine uptake in the previous 12 months did not significantly differ by age group, specialty or the number of years qualified. However, vaccination uptake significantly increased among senior nurses with nurses employed as Clinical Nurse Managers 2 (CNM) grade more likely to be vaccinated compared to staff nurses. CNM 2's were also more likely to intend to get vaccine in the future (Table 2). Similarly, nurses with a level 8 (Bachelor

Degree) or level 9 (Post Graduate Diploma/Masters) qualification were more likely to have been vaccinated. Those employed in hospital site B were more likely to have been vaccinated in the past and have future vaccine intentions. Employment status was reported by 98.5% (n=455) of nurses (Table 1) with nurses employed part time less likely to be vaccinated compared to nurses working full time (Table 2).

Knowledge

The mean (SD) knowledge score of vaccinated and unvaccinated nurses was 18.3 (2.76) and 17.2 (2.36) respectively (range 0-22). Higher knowledge about influenza and the vaccine was found among nurses vaccinated in the previous 12 months and among nurses with future vaccine intentions (Table 2).

Risk perception (perceived susceptibility and severity)

The overall mean (SD) risk perception score was 2.46 (range 1-4; SD=0.45). A higher risk perception score was found among nurses vaccinated in the previous 12 months and also among nurses with future vaccine intentions (Table 2). Figure 3 illustrates the risk perception responses of nurses.

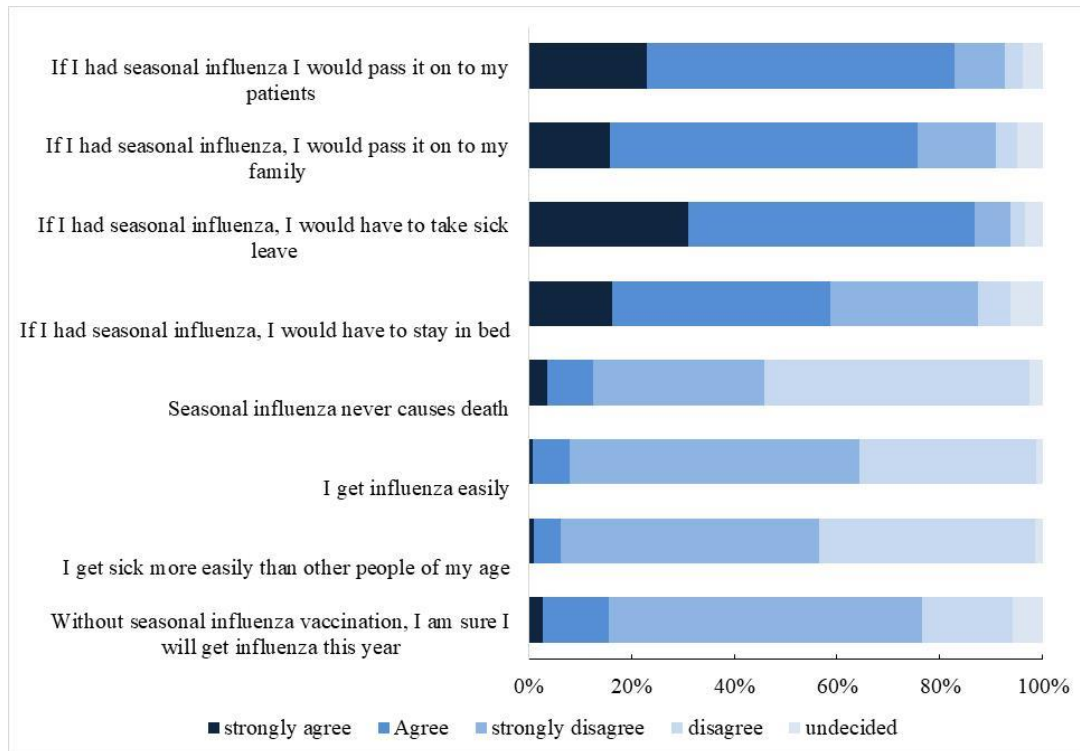


Figure 3 Nurses perception of influenza risk

Multi-dimensional health locus of control (MHLC)

Overall, the mean (SD) of the subscales chance, internal and powerful others were 15.9 (5.15), 25.9 (4.41) and (16.27) respectively. Nurses who believe they are in control of their health (i.e. internal subscale) were more likely to be vaccinated in the previous 12 months. The subscale “powerful others” was found to be associated with future vaccine intentions (Table 2).

Factors associated with vaccination uptake and future vaccine intentions

The results of multivariable logistic regression analysis showed that male nurses (OR: 2.67; 95%CI: 1.23-5.78), being employed in site B (OR: 2.68; 95%CI: 1.74-4.12), having higher knowledge about influenza and the vaccine (OR: 1.24; 95%CI: 1.13-1.37) and higher perceived risk (OR: 1.84; 95%CI: 1.14-2.99) were associated with nurses vaccination uptake in the previous 12 months. Nurses who believe they are in control of their own health (internal

subscale) (OR: 1.05; 95%CI: 1.00-1.11) were also more likely to have been vaccinated (Table 2).

Similarly, nurses employed in site B (OR2.69; 95%CI: 1.69-4.30), higher knowledge about influenza and the vaccine (OR: 1.24; 95%CI: 1.13-1.37), higher perceived risk (OR: 2.37; 95%CI: 2.37 (1.44-3.89) and powerful others subscale (OR: 1.06; 95%CI: 1.01-1.11) were associated with nurses future vaccine intentions.

Table 2 Factors associated with influenza vaccine uptake in the previous 12 months and future vaccine intentions^a

Characteristics		Vaccinated in the previous 12 months [†]				Future vaccine intentions							
Variables	Categories			Univariate analysis		Multivariable analysis [‡]				Univariate analysis		Multivariable analysis [§]	
		n	%	OR (95% CI)	P value	OR (95% CI)	P value	n	%	OR (95% CI)	P value	OR (95% CI)	P value
Age group	20-29 yrs	45	41.7	Ref	-			67	62.0	Ref	-		
	30-39 yrs	61	43.0	1.08 (0.65-1.79)	0.764			89	62.7	1.07 (0.64-1.79)	0.804		
	40-49 yrs	44	32.4	0.69 (0.41-1.17)	0.170			72	52.9	0.722 (0.43-1.21)	0.218		
	50+ yrs	35	47.3	1.32 (0.72-2.41)	0.359			47	63.5	1.25 (0.66-2.35)	0.488		
Staff grade	Staff nurse	133	37.4	Ref	-			200	56.2	Ref	-		
	CNM 1	9	64.3	2.96 (0.97-9.03)	0.056			11	78.6	2.75 (0.75-10.0)	0.125		
	CNM 2/CNS	36	50.0	1.74 (1.04-2.92)	0.035			53	73.6	2.20 (1.24-3.92)	0.007		
	CNM 3/Senior Management	6	42.9	1.23 (0.41-3.64)	0.702			10	71.4	1.88 (0.57-6.09)	0.296		
Sex	Female	166	39.0	Ref	-	Ref	-	253	59.4	Ref	-		
	Male	19	57.6	2.07 (1.01-4.24)	0.047	2.67 (1.23-5.78)	0.013	22	66.7	1.29 (0.61-2.74)	0.497		
Education qualification	DipHE	22	27.2	Ref	-			41	50.6	Ref	-		
	Bachelor Degree	88	42.1	1.9 (1.08-3.33)	0.026			133	63.6	1.67 (0.98-2.81)	0.057		
	PGDip/Masters	69	46.3	2.29 (1.27-4.13)	0.006			93	62.4	1.62 (0.93-2.83)	0.086		
	Other	5	29.4	1.17 (0.36-3.77)	0.783			7	41.2	0.72 (0.24-2.12)	0.553		
Specialty	Medicine	83	41.1	Ref	-			121	59.6	Ref	-		
	Surgery	64	43.5	1.13 (0.74-1.74)	0.571			88	59.9	1.00 (0.65-1.56)	0.972		
	Other	35	36.1	0.86 (0.52-1.43)	0.574			59	60.8	1.13 (0.68-1.88)	0.630		
Years qualified	0-10 yrs	74	44.3	Ref	-			102	61.1	Ref	-		
	11-20 yrs	53	37.6	0.77 (0.48-1.22)	0.275			86	61.0	0.99 (0.62-1.58)	0.998		
	21+ yrs	57	38.8	0.84 (0.53-1.32)	0.460			86	58.5	0.98 (0.62-1.56)	0.935		
Hospital	Site A	105	33.6	Ref	-	Ref	-	168	53.7	Ref	-	Ref	-
	Site B	80	54.4	2.43 (1.62-3.64)	<0.0001	2.68 (1.74-4.12)	<0.0001	107	72.8	2.39 (1.54-3.70)	<0.0001	2.69 (1.69-4.30)	<0.001
Employment status	FT employment	158	42.9	Ref	-			226	61.4	Ref	-		
	PT employment	26	29.9	0.59 (0.35-0.97)	0.040			47	54.0	0.77 (0.47-1.25)	0.286		

Table 2 continued

	mean	SD	OR (95% CI)	P value	OR (95% CI)	P value	mean	SD	OR (95% CI)	P value	OR (95% CI)	P value
Knowledge	18.25	2.76	1.23 (1.13-1.35)	<0.0001	1.24 (1.13-1.37)	<0.0001	18	2.22	1.22 (1.12-1.33)	<0.0001	1.24 (1.13-1.37)	<0.0001
Risk perceptions	2.35	0.38	2.28 (1.44-3.60)	<0.0001	1.84 (1.14-2.99)	0.013	2.3	0.43	3.14 (1.96-5.04)	<0.0001	2.37 (1.44-3.89)	<0.0001
Internal	26.5	3.95	1.05 (1.00-1.10)	0.019	1.05 (1.00-1.11)	0.041	26.3	4.06	1.04 (0.99-1.08)	0.106		
Chance	16.16	5.09	1.01 (0.98-1.05)	0.364			15.7	5.05	0.98 (0.94-1.01)	0.032		
Powerful others	16.81	4.73	1.03 (0.99-1.07)	0.071			17	5.11	1.05 (1.01-1.09)	0.006	1.06 (1.01-1.11)	0.005

*Number of participants who provided an answer to this question

† Vaccination in the previous 12 months was missing for 7 respondents

‡ Hosmer-Lemeshow goodness of fit test: p=0.335 (no evidence of lack of fit)

§ Hosmer-Lemeshow goodness of fit test: p=0.352 (no evidence of lack of fit)

Statistically significant results are indicated in bold font

CNM, Clinical Nurse Manager; CNS, Clinical Nurse Specialist; DipHE=Diploma in higher education, PGDip=postgraduate diploma; FT employment=full time employment; PT employment=part-time employment; SD=standard deviation

Qualitative findings

Thirty five qualified nurses participated in five focus group discussions. Six themes were identified; accessibility, influencers, information, organisational pressure, risk perception and vaccine fears and concerns. The majority of nurses participating in the focus groups were female (91.4%, n=32) and vaccinated against influenza 57.1% (n=20).

Integrated findings

Seven main themes emerged from the integrated findings; these include (1) the influence of nurses' knowledge on vaccine uptake, (2) dissemination of information, (3) vaccine fears and concerns, (4) protection, risk and vulnerability: self and others, (5) influencers, (6) accessibility and (7) organisational pressure. Table 3 illustrates the integrated findings.

Table 3 Pillar Integration Process

Survey findings		Pillar	Focus group findings	
1	2	3	2	1
	➔		←	
<p>Knowledge: This data represents nurses' knowledge in relation to the influenza virus and the influenza vaccine.</p>	<p>Mean knowledge score of vaccinated and unvaccinated was 18.25 (2.76) and 17.19 (2.36) respectively (OR: 1.24; 95%CI: 1.13-1.37, p<0.0001*)</p>	<p>The influence of knowledge on vaccine uptake</p>	<p>Knowledge is core</p>	<p>"I think nurses ...maybe lack of knowledge and we feel it's not that serious " [#4, FGD 5]</p>
	<p>Mean knowledge score of nurses with future vaccine intentions was 18.05 (2.22) and 16.96 (2.49) respectively (OR: 1.23; 95%CI: 1.13-1.37, p<0.0001*)</p>		<p>"I think its knowledge" [P6, FGD 3]</p>	
	<p>There was a statistical difference in the mean knowledge score of nurses who have recommended the vaccine to patients in the past, p<0.001[†] and among nurses who intend to recommend the vaccine to patients in the future, p<0.001[‡]</p>		<p>"Like I work in dialysis and we have to vaccinate all our patients... for flu and that...patients ask you "have you taken the vaccine" so I think we are all like you know ...we are inclined to take it because you know you can't tell your patient that you won't take it but I'll give it to you so we all encourage ourselves, we can't tell our patients that we will vaccinate you but I don't want to take it so we all take it" [P7, FGD 4]</p>	
	<p>Staff nurses had lower mean knowledge scores compared to CNM/CNS grades, p<0.05[§]. Nurses aged 20-29 years had lower mean knowledge score compared to all other age groups, p<0.05[§].</p>		<p>Reinforce the knowledge</p>	<p>To be honest I [CNM 2] wouldn't have known a huge amount only we were sent off on a 4 day course there myself and the CNM 1 because we are going to be the flu ward in the hospitalwe got a huge amount of information about the flu vaccine and even though in the back of your head you knew you couldn't get the flu from the vaccine it was actually hearing it from the experts and now it's us giving that knowledge back" [P2, FGD 3]</p>
<p>This data represents the type and source of information nurses receive regarding</p>		<p>Dissemination of information</p>	<p>Ineffective communication systems</p>	<p>"Like you've so many notices on the wall and if you really look at all of those how many of those do we read..em" [P3, FGD 3]</p>

influenza and the vaccine. The results illustrated here are from the focus group discussions only				<p><i>"Yeah, it just flashes on the computer screen across the hospital ...like, you might see it and you mightn't" [P3, FGD 4]</i></p>
				<p><i>"It's not informed to everybody, maybe people who have access to emails; they get the emails, what about the other nurses? So somebody...we don't check our mail every day, it doesn't come to our personal mail it comes to our official mail lady and most of us don't access the official mail so it's uninformed when the vaccine is going around" [P4, FGD 5]</i></p>
			Rely on self	<p><i>"Yeah it's not, we are encourage to get it, like you said, you're encouraged to get it...to get it but ...probably, there's not the education as such unless you go looking for it ...it's absolutely there but you know it's not really brought to you" [P3, FGD 4]</i></p>
				<p><i>"Yeah, I know somebody last year referred me to the HSE land there was something done on flu and that and I watched that, yeah" [P5, FGD 2]</i></p> <p><i>"I didn't know about the HSE land" [P3, FGD 2]</i></p>
This data represents fears and concerns regarding the influenza vaccine	24.2% (n=112) of all participants believe the influenza vaccine may cause serious adverse effects, of these 35.7% (n=40) were vaccinated and 64.3% (n=72) were unvaccinated against influenza.	Vaccine fears and concerns	Is it safe?	<p><i>"There might be long term complications that there might be a long term effect" [P4, FGD 2]</i></p>
	43.9% (n=203) of all participants were unsure if the vaccine causes Guillain-Barre syndrome, of these, 35.5% (n=72) were vaccinated and 61.1% (n=124) were unvaccinated against influenza.			<p><i>"We've had a few in with Guillain Barre over the years and they've had the flu jab and within three weeks, is that coincidental? So that's for me is a lot of the ...cause I've seen that more even though it's a small percentage... [P3, FGD 2]</i></p>

	38.3% (n=70) of unvaccinated nurses cited fear of vaccine side effects as a reason for vaccine refusal			<i>"Well I ...I know that I would chose not to get the vaccine if I was getting it when I was on duty for the fear of coming back with eh it's not a fear, it's a know.... but like you can get a throbbing arm, I've seen a colleague nearly flat out on a computer [...]and that's what scare mongered me...when I actually seen someone having a reaction to it" (P 3, FGD 2]</i>
	32.2% (n=59) of unvaccinated nurses cited concerns about vaccine effectiveness and safety as a reason for vaccine refusal			<i>"Em, I still have a concern about how safe is it" [P2, FGD 5]</i>
				<i>"Yeah it is a trust thing ...and you know, and you're wondering is it from the em... you know, the pharmaceutical companies, they....suddenly there was swine flu and they had a vaccine...just like that...and since that vaccine has come out there has been a lot of... narcolepsy..." [P6, FGD 2]</i>
	21.3% (n=39) of unvaccinated nurses cited fear of illness post vaccination as a reason for vaccine refusal		It doesn't work	<i>"And I think that's a factor when it comes to the nurses who have less knowledge that, if they have a work colleague or someone who says "I got it [vaccine] last year had the worst flu, sher..... I was off work for a week" and all of a sudden.... the whole ward or the whole area was like, you know what...she was awfully sick and there's that misconception there that is transmitted throughout the department you know so..." [P3, FGD 1]</i>
This data represents nurses' perceived level of risk in relation to influenza infection	84% (n=140) of vaccinated nurses cited self-protection as a reason for accepting the vaccine	Protection, risk and vulnerability: self and others	Mind yourself	<i>"Oh I think you have to protect yourself" [P8, FGD 3]</i>
	Risk perception scores were higher among vaccinated nurses (OR: 1.84; 95%CI: 1.14-2.99, p=0.013*) and also among nurses with future vaccine intentions (OR: 2.37; 95%CI: 1.44-3.89, p<0.0001*)		Perceived susceptibility to influenza infection	<i>"I suppose if they [nurses] have a chronic illness themselves like asthma or diabetes or something no matter how minor, you're more aware of your health and your mortality, aren't you more likely to protect yourself" [#5, FGD 3]</i>

	<p>0.7% (n=3) strongly agreed and 7.2% (n=33) agreed that they get flu easily. 2.8% (n=13) strongly agreed and 12.8% (n=59) agreed without seasonal influenza vaccination, they will get influenza this year</p>		<p><i>"I mean I work in health care and I've never had a flu, so I think well, you know...I personally wouldn't want to take it without giving it some thought but I suppose I'm having faith in the fact that I've never had or have never been sick, thank God, that I don't have to say, give it much consideration I just think, look I'm on the so far so good so I kind of shy away from it and think..." [P7, FGD 2]</i></p>
	<p>26.8% (n=49) of unvaccinated nurses cited they are fit and healthy and 23.5% (n=43) believe they are not at risk of influenza infection</p>	<p>I'm fit and healthy</p>	<p><i>"I don't think I should be you know [at risk], I'm fit I'm healthy I haven't been ill medically that way, do you know what I mean, respiratory wise" [P1, FGD 5]</i></p>
	<p>0.9% (n=4) strongly agreed and 5.4% (n=25) agreed that they get sick more easily than other people of their age</p>	<p>Older age</p>	<p><i>"I know I would've said, I don't need it a few years back where as now I'll give it a bit of thought....as you get older" [P2, FGD 5]</i></p>
	<p>17.0% (n=28) of vaccinated nurses cited being a HCW as a reason for accepting the vaccine</p>	<p>Personal responsibility</p>	<p><i>"I'm talking as an advocate of my patients, our patients are our frequent visitors or current visitors they're very high risk of infections and flu could you know, actually potentially kill them very very quickly so if I don't protect myself and I come in with early stages of flu and I give it to someone whose just literally just out of HDU or transplant and they're on my ward the flu could potentially kill them so yeah I think that you know I have to take responsibility to protect myself and them" [P5, FGD 3]</i></p>
	<p>87.2% (n=389) of all participants either disagreed or strongly disagreed that influenza never causes death.</p>	<p>Don't put patients at risk</p>	<p><i>"You know I work here I have to think of them" [P5, FGD 3]</i></p>
	<p>82.8% (n=381) of all participants either strongly agreed or agreed if they had seasonal influenza they would pass it on to their patients.</p>		<p><i>"Oh sher, I know.... it's.... the patients, the other staff nurses, everyone in the house living with me as well. I know I would be putting them all at risk as well, em but it's just yeah, you just don't go into work, call in sick, take your few days you know if the other half gets it, lessons will be learnt... what can we do, you know" [P3, FGD 5]</i></p>

	<p>31% (n=142) of all participants strongly agreed and 55.9% (n=256) agreed if they had seasonal influenza, they would have to take sick leave.</p> <p>15.7% (n=72) of all participants strongly agreed and 60% (n=276) agreed that they would transmit seasonal influenza to their family.</p> <p>32.7% (n=54) of vaccinated nurses cited protection of family or friends as a reason for vaccination.</p>			
	<p>15.2% (n=25) of vaccinated nurses cited protection of patient or colleagues as a reason for accepting the vaccine.</p>			<p>"They're still in an age bracket that they are still more at risk cause that's where I... even more outside of work think, God I'm going into Mam and Dad you know" [P3, FGD 2]</p> <p>"On a personal level to me, I feel I am protecting myself and my family, yes [...] but sometimes I think if you make it more personal then, you're not bringing something out of the hospital to your family" [P8, FGD 3]</p> <p>"Because, I took it last year, not in that I feel like I am at risk, but because its supposedly the right thing to do em, and so that I am not a source of infection for others, colleagues or patients em" [P2, FGD 5]</p>
			High risk patient care	<p>"I feel in ICU you're at greater risk, we deal with a lot of influenza...very close to your patients in the isolation room, and you're kind of the only one with the patient for the day and they can be very sick and they can have a lot of secretions and that ...we deal with.....a lot of flu in the winter" [P5, FGD 2]</p>
This information represents the Multi-Dimensional Health Locus of Control (Chance, Internal and Powerful others subscales)	<p>There was a statistically significant difference between the internal subscale and vaccinated nurses (OR:1.05; 95% CI: 1.00-1.11, p=0.041*)</p>	Influencers	Personal control	<p>"Yeah, I think we are in control of our health" [P5, FGD 2]</p>
	<p>There was a significant difference in the subscale "powerful others" and future vaccine intentions of nurses (OR: 1.06; 95% CI: 1.01-1.11, p=0.005*)</p>		Experts	<p>"I know last year I heard [consultants name] you knowfrom the lab speaking and for me, the way he phrased it and the way heI can't remember the exact wording now but definitely triggered something in me last year you know because before that you know I probably wouldn't have...you know thought about it to be honest" [P5, FGD 1]</p>

			Ward managers	<i>"The CNM on the ward probably is quite a good role model in relation to getting the vaccination and being there and being proactive in relation to it, like so even though people are turning up for the peer to peer the fact that the CNM on the ward is facilitating it and educating her staff about it that sort of a grass roots thing, so that works I think, so if you had a CNM that wasn't pro the vaccination I think the staff might see it as something that, you know they would have more of a choice of whether or not they would take it or not. They still have their choice but if the people, the person on the ward is you know, leading out on it I think it's a good idea and is a lot of forward thinking I think that influences the staff as well" [P7, FGD 3]</i>
			Other nurses	<i>" If there's a lot of more people on the ward getting it, well I know I'd personally be more inclined to get it but if there wasn't much people I would be more sheepish" [P4, FGD 4]</i>
	Male nurses were more likely to be vaccinated compared to female nurses (OR: 2.67; 95%CI: 1.23-5.78, p<0.05)		Compliance	<i>"I don't know it just comes down to ...the way I look at it is ...you come down with the senior staff....and what are they doing?...and for us we have a CNM in every theatre and it's like okay we have our morning meeting Mondays and Wednesdays, it's.... today.... it's going to be this.... do the flu jab... you... theatre 1 ...you organise them to go out at this time...and you just do it...you do as your told" (P 1, FGD 2, male vaccinated nurse)</i>
This data represents the findings regarding accessing the influenza vaccine	13.7% (n=25) of unvaccinated nurses cited lack of time and access to the vaccine as a reason for not getting vaccinated	Accessibility	Challenge: leaving the unit	<i>"I know there were dates available last year but it was ...I was at work, too busy to go over on my break and I wasn't coming in on my day off...Sadly, I do think that if someone offered it to me on the ward I would take it but I wouldn't walk over to occ health for to get it" [P3, FGD 5]</i>
				<i>"Getting to occ health, it's a long way" [P10, FGD 3]</i>

			Challenge: shift work	<p><i>"If you do two weeks nights you're off for two weeks if the vaccination or the peer group vaccination is going on that week you'll definitely miss it" [P4, FGD 5]</i></p> <p><i>"We work nights it's not available at nights, you're trying to sleep in the day you're on a ward and you don't have time to go out and get it because they're doing a session from 11.30-1200 o'clock back over in the occ health department" [P1, FGD 2]</i></p>
			Facilitation: stay on the unit	<p><i>"Because getting off the ward can be very difficult so if you've somebody there, you could catch 5 or 6 staff in the treatment room and that's 5 done out of 25 so that has been very beneficial I have to say" [P2, FGD 3]</i></p> <p><i>"Yes, they [peer vaccinators] link in with CNMs on the wards, they're a familiar face and they ring up and say, [nurses name], if I come over at 2 o'clock on Wednesday would you be able to get a group together God, I will [peer vaccinators name] or I say I will of course [peer vaccinators name], and you know, I suppose you're kin of working in partnership with them as well, it's not like you sometimes think you have to go over to occupational health, and you have to make the appointment, or less you are going over there and you have to wait about an hour" [P2, FGD 1]</i></p>
This data represents findings relating to pressure experienced by nurses in the workplace	4.9% (n=9) of unvaccinated nurses cited organisational pressure as a barrier to vaccination.	Organisational pressure	Brute force	<p><i>"Like my staff is going down and we got a good result last year but that was by sheer brute force" [P3, FGD 4]</i></p> <p><i>"Why are we forced to get it? I don't think no one should be forced to take it" [P6, FGD 2]</i></p>
			Autonomy	<p><i>"I think you find the uptake will be higher if people have a choice, if you're forced to take it it's like the stick! You have to" [P4, FGD 3]</i></p>

	13.9% (n=23) of vaccinated nurses cited to prevent sick leave from work as a reason for vaccine acceptance		Bullying tactic	<i>"I'm one of the ones who give the flu injection and em, I found last year that people were nearly been bullied into itin some places...you know...if you don't get it then you're going to be signed off and if you go off sick you're not going to be paid because you didn't get the flu vaccine so that's....that's bullying...making people"</i> [P4, FGD 2]
			Guilt and Blame	<i>"If you don't get it and your patients get it well then it's your fault"</i> [P4, FGD 2]
				<i>"Someone had been out sick last year from one of the units before and the first thing my ADON said was "has she had the flu vaccination" and the way then that it was asked then that's not going to encourage any of the staff either do you know what I mean"</i> [P1, FGD 5]

* Multivariable logistic regression analysis

† Independent sample *t* test

‡ ANOVA test

§ Tukey's post-hoc test

Theme One - The influence of nurses' knowledge on vaccine uptake

The quantitative and qualitative findings converged in relation to the influence knowledge about influenza and the vaccine had on nurses' vaccine practices in the past and in the future. The importance of receiving accurate knowledge about influenza and the vaccine from reliable sources was expressed and it was recognised that a lack of knowledge can negatively impact on nurses' level of awareness about the seriousness of the influenza. There were significant variations in the mean knowledge scores among different nursing grades and among younger nurses. This finding was supported by the results from phase two where it was acknowledged senior nurses were more likely to be provided with formal training and education on influenza and the vaccine due to their senior positions as ward managers. This highlights the importance of receiving accurate evidence based knowledge about influenza and the vaccine through formal training on nurses' vaccine practices. Although 99.1% (n=458) of participants were aware that the vaccine was recommended for HCWs, vaccine uptake remained low indicating that knowledge of this recommendation alone was insufficient (Table 3).

Theme two – Dissemination of Information

The type and source of information nurses access in relation to influenza can impact on their knowledge, attitudes, beliefs and vaccination practices. This was explored in the focus groups only. The findings suggest nurse's access information from multiple sources and the quality of this information had an impact on their decisions about whether or not to accept the vaccine. It was apparent that some of the communication systems used within the workplace to disseminate information about influenza and the vaccine were ineffective. There was no standardised method of delivering accurate information and there were many challenges expressed in relation to accessing good quality information. Despite the presence of a variety of posters displayed in the workplace, nurses expressed a view that these were ineffective and were mostly ignored. Many acknowledged that although information encouraging vaccination is disseminated to them by email, they expressed that this information was not conveyed to all nurses. Although they are actively encouraged within their workplace to get vaccinated, they indicated they do not receive adequate information about influenza or the vaccine unless they source this information themselves. This clearly impacted on their decision to accept or reject the vaccine. Despite acknowledging that information was available electronically through the health service e-learning training site (www.HSEland.ie) they were not accessing this as it is not a mandatory requirement. Interestingly, some nurses did not know information was available through this online portal. They expressed a need for high quality evidence-based information about the influenza virus and the vaccine to be easily available to them. They believed this would give them the ability to make an informed decision regarding the vaccine (Table 3).

Theme three - Vaccine fears and concerns

Vaccine fears and concerns were found to be a major barrier. The results from both quantitative and qualitative findings converged and identified a broad range of misconceptions about the vaccine which appeared to be increased by poor vaccine knowledge. A lack of trust in the efficacy and safety of the vaccine was also expressed which was heightened by the experience of the 2009 influenza pandemic. Fears associated with vaccine side effects, adverse reactions and illness post vaccination were reported. Nurses acknowledged hearing about work colleagues who reported an illness post vaccination and having observed colleagues experience side effects apparently from the vaccine was a barrier to them accepting the vaccine (Table 3).

Theme four - Protection, risk and vulnerability: self and others

Susceptibility to influenza infection had a fundamental role in vaccination acceptance. The majority of vaccinated nurses cited self-protection as a reason for accepting the vaccine and this was also supported in the focus groups. Overall, nurses who perceived themselves at greater risk of acquiring influenza infection were more likely to accept the vaccine and this was influenced by having an underlying medical condition. In contrast, nurses who considered themselves not at risk were less likely to accept the vaccine. Reasons supporting this included the belief that they were 'fit and healthy' and therefore did not perceive influenza as a threat to their health. Despite the majority (82.8%; n=381) recognising the risk of transmitting influenza from HCWs to patients, only 15.2% (n=25) cited protecting patients and colleagues as a reason for accepting the vaccine. Protection of family and friends was identified as a motivating factor among nurses accepting the vaccine and this was supported in the focus groups once nurses recognised a family member to be at risk of infection. The negative impact influenza had on staff absenteeism was addressed in both the quantitative and qualitative phases. Over 85% (86.9%; n=398) of nurses acknowledged if they had influenza infection they would have to take sick leave. Specialty was found to influence nurses' perceived susceptibility of acquiring influenza. They believed their risk of being exposed to influenza was greater when caring for patients in high risk settings such as in critical care units due to prolonged contact with vulnerable patients (Table 3).

Theme five – Influencers

Nurses with an internal locus of control were more likely to have been vaccinated. This finding was supported in the focus groups with all nurses believing they were in control of their health suggesting vaccinated nurses take a more proactive approach to their health. The subscale "powerful others" was found to be associated with the future vaccine intentions of nurses. This highlights the important role of senior colleague's in influencing future vaccine intentions. The qualitative findings found that nurses were strongly influenced by the information disseminated by flu experts. They also expressed that nurse managers were influential in facilitating access to the vaccine. Male nurses were more likely to have been vaccinated against influenza compared to female nurses and the results from the focus groups revealed that male nurses were compliant and influenced by their senior staff colleagues and ward managers. Close colleagues and other nurses in the workplace were also

identified as influencing nurses' decisions regarding the vaccine. The importance of seeking reassurance from colleagues prior to accepting or declining the vaccine was highlighted, along with a need to conform to the actions of peers in the workplace (Table 3).

Theme six - Accessibility

Nurses reported they were too busy to leave the ward due to the unpredictability of their workload. Accessing the vaccine through occupational health was reported as an inconvenience for nurses. In addition, shift work was also identified as a barrier. Nurses said that working weekends and night duty prohibited access to peer vaccinators who were only available during the day shift or between 9-5pm. Despite this barrier, peer vaccinators were recognised as a facilitating factor to vaccination among nurses who could access the service. Knowing the peer vaccinators had a positive influence on vaccine acceptance (Table 3).

Theme seven - Organisational pressure

Organisational pressure was only cited as a reason for vaccine refusal by a minority of unvaccinated nurses in the questionnaire; however, this theme was very dominant in the focus groups. The strategy currently used during annual influenza campaigns was considered very dictatorial by the nurses who felt pressured into accepting the vaccine. Perception of choice appeared to play a vital role in terms of vaccine acceptance. Nurses expressed a need for autonomy when making an informed decision regarding the vaccine. They did not want to be forced to accept the vaccine and most believed that they should be allowed to make an informed decision for themselves. The threat of punitive action by management such as being made take unpaid sick leave was viewed as a bullying tactic (Table 3).

4.12 Discussion

The vaccination uptake rate in this study was 40.3% which is lower than the national rate (50.4%) reported for nurses in acute hospitals in Ireland (O'Lorcain et al., 2019). Similar to other studies, male nurses were more likely to be vaccinated (O'Reilly et al., 2005, Falomir-Pichastor, 2009). Prior vaccination was also found to be associated with future vaccine intentions (Falomir-Pichastor, Toscani, & Despointes, 2009; Godin, Vézina-Im, & Naccache, 2010; Smith et al., 2016a; Zhang et al., 2012b) suggesting that once the barrier associated with vaccination is overcome nurses are more than likely to avail of the vaccine in the future.

The HBM offers explanations to support the study's findings. In relation to the HBM, a positive predictor of vaccine uptake and future vaccine intentions was having a high level of knowledge which is consistent with other findings (Christini et al., 2007; Hollmeyer et al., 2009; Kadi, Atif, Brenet, Izoard, & Astagneau, 2016; Mehta, Pastor, & Shah, 2008; Smith et al., 2016a; Zhang et al., 2012b). Younger nurses were found to have lower knowledge. A recent study also found younger HCWs had lower influenza knowledge and reported nursing schools to be important to deliver this knowledge (Harrison et al., 2016). Targeting future educational programmes within these settings may be effective in increasing young nurses' knowledge and in turn their vaccine uptake.

The HBM constructs of perceived susceptibility to and severity of disease also offered explanations in this study. The combination of susceptibility and severity is known as a perceived threat (Champion & Skinner, 2008) and the higher the perceived threat, the more likely individuals engage in health-related behaviours. Similar to other findings (Leong, 2015; Smith et al., 2016a; Zhang et al., 2012b) this study showed that perceived threat was important in nurses' decision regarding the vaccine. In contrast, nurses who believed they were "fit and healthy" and "not at risk" did not perceive themselves susceptible to influenza. This indicates that there is a misunderstanding as to why the vaccine is recommended, as 99% of nurses were aware that the vaccine was recommended for all HCWs. Our findings also demonstrated vaccine acceptance is related to personal benefit. Personal protection and protection of family and friends was identified as the main benefit of vaccination. Therefore, future campaigns should focus more on personal benefit instead of focusing on reducing staff absenteeism.

Barriers to vaccination included misconceptions such as safety and efficacy concerns, fear of side effects and long term consequences. These can also be explained as perceived threats and are commonly reported (Albano, Matuozzo, Marinelli, & Di Giuseppe, 2014; Hollmeyer et al., 2009; Kimura, Nguyen, Higa, Hurwitz, & Vugia, 2007; Kraut, Graff, & McLean, 2011; Naleway et al., 2014). The influenza pandemic of 2009 increased fears associated with vaccines (Baron-Epel, Madjar, Grefat, & Rishpon, 2013), a finding also reflected in our study indicating a lack of trust in the health system and the vaccine since the 2009 pandemic. Although distrust in vaccines is not a new phenomenon, strategies to tackle this mistrust in the influenza vaccine needs to be developed and this should be a priority. Vaccine fears and

concerns also appear to be heightened by a paucity of information due to ineffective communication systems within the workplace. Delivering accurate information about vaccine efficacy and safety may reduce these fears and concerns and positively impact vaccine acceptance. Despite the positive influence of peer vaccinators, barriers were also identified including a lack of access for nurses working night duty, weekends or outside of 9-5pm.

Cues to action can take many forms however, being reminded or alerted about a potential health problem increases the likelihood of perceiving a threat and taking actions (Sarafino, 2008). Cues to action (as per the HBM) in our study were mainly external and arose from peers, experts and managers. Cues from hospital posters displayed and reminder emails from managers did not increase the likelihood of nurses' perceiving influenza to be a threat. Moreover, the external cues to action arising from organisational pressure had a negative effect on nurses' self-efficacy. Organisational pressure was perceived as focusing on increasing vaccination uptake rates and efficiency only. Similar to the demand for autonomy (Baron-Epel et al., 2013) nurses did not want to be forced to take the vaccine and felt they should be given the choice to make an informed decision. In addition, threats of unpaid sick leave were not perceived as encouraging vaccine acceptance. Nurses who perceived a higher level of professional responsibility to protect their patients were more likely to be vaccinated. Therefore recognising the importance of being a role model and the efficacy of them receiving the vaccine in improving the health of their patients' should be acknowledged and promoted in future campaigns.

Although vaccine coverage rates have been reported as high as 99.3% in some health systems in the United States (US) (Feemster et al., 2011; Karanfil, Bahner, Hovatter, & Thomas, 2011; Keller, 2010); these have been achieved as a result of mandatory vaccination programmes. Influenza vaccination remains voluntary in Ireland as well as in other European countries. The important role of HCWs in controlling and limiting the spread of influenza continues to be stressed by the European Council which encourages Member States to reach a target of 75% uptake (European Council, 2009). Despite aspiring to a target of 75%, results from twelve EU Member States found that HCWs' vaccine uptake rates ranged from 15.6% to 63.2% (European Centre for Disease Prevention and Control, 2018). In Ireland, nurses' vaccine uptake rates remain low at 50.4% for the most recent influenza season (2018-2019) compared to 39.8% for the 2017-2018 season (O'Lorcain et al., 2019). Despite the increase for the 2018-2019 season, uptake rates remain below the national target of 75% set by the

Irish Health Service Executive (Health Service Executive (HSE), 2018) with only 11.8% of hospitals exceeding this target among nursing staff (O'Lorcain et al., 2019). Challenges remain in reaching this target among nurses and developing interventions based on the HBM constructs should be considered.

4.12.1 Strengths and Limitations

To our knowledge this is the first mixed methods study to explore the barriers and facilitators of influenza vaccination uptake among nurses. Strengths of this study include the methodological approach and large sample size. The approach was suitable and novel for this topic. Trustworthiness was achieved through triangulation of data and peer debriefing of the qualitative data. However, study limitations are evident, such as selection bias due to the sampling strategy used in the focus groups and information bias due to self-reporting vaccine uptake. The generalizability of the results to other nurses is also limited as the findings relate to nurses at two hospitals only. In addition, a high proportion of nurses participating in the focus groups were vaccinated.

4.13 Conclusion

Encouraging vaccine uptake among nurses is a complex issue. Multi-faceted influenza campaigns based on the HBM should be adapted to address dissemination of information, accessibility and external cues to action. Annual education and training should be made mandatory to equip nurses with the knowledge to make informed decisions regarding vaccination. Increasing access to the vaccine among nurses who work weekends or night shifts is also required.

4.15 Acknowledgements

The authors would like to thank the two hospital sites that facilitated this study and the nurses who participated in both the survey and the focus group discussions. The authors would also like to thank Dr Diarmuid O'Donovan for his advice during the quantitative study, Dr Margaret Fitzgerald and Ms Gloria Alvos for providing statistical advice and Ms Maedhbh Hunt for assisting with data entry.

4.16 Conflict of Interest

No conflict of interest has been declared by the authors.

4.17 Author contribution

PF, MD, GG: made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; involved in drafting the manuscript or revising it critically for important intellectual content; given final approval of the version to be published; agreed to be accountable for all aspects of the work in ensuring that questions related to accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

- Albano, L., Matuozzo, A., Marinelli, P., & Di Giuseppe, G. (2014). Knowledge, attitudes and behaviour of hospital health-care workers regarding influenza A/H1N1: a cross sectional survey. *BMC Infect Dis*, *14*, 208. doi:10.1186/1471-2334-14-208
- Baron-Epel, O., Madjar, B., Grefat, R., & Rishpon, S. (2013). Trust and the demand for autonomy may explain the low rates of immunizations among nurses. *Hum Vaccin Immunother*, *9*(1), 100-107. doi:10.4161/hv.22503
- Becker, M. H., & Maiman, L. A. (1975). Sociobehavioral determinants of compliance with health and medical care recommendations. *Med Care*, *13*(1), 10-24.
- Bernard, H., Fischer, R., Mikolajczyk, R., Kretzschmar, M., & Wildner, M. (2009). Nurses' contacts and potential for infectious disease transmission. *Emerging Infectious Diseases*, *15*(9), 1438-1444. doi:10.3201/eid1509.081475
- Bouadma, L., Barbier, F., Biard, L., Esposito-Farese, M., Le Corre, B., Macrez, A., . . . Tubach, F. (2012). Personal decision-making criteria related to seasonal and pandemic A(H1N1) influenza-vaccination acceptance among French healthcare workers. *PLoS ONE*, *7*(7), e38646. doi:10.1371/journal.pone.0038646
- Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, *3*(77), 77-101. doi:DOI: 10.1191/1478088706qp0630a
- Centers for Disease Prevention and Control (CDC). (2015). Prevention and Control of Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*, *20*(64), 818-825.
- Champion, V., & Skinner, C. (2008). In Glanz, K, Rimer, B & Viswanath, K. *Health Behaviour and Health Education. Theory, Research and Practice. Fourth Edition*. CA: John Wiley and Sons.
- Chen, M. I. C., Lee, V. J. M., Barr, I., Lin, C., Goh, R., Lee, C., . . . Leo, Y. S. (2010). Risk Factors for Pandemic (H1N1) 2009 Virus Seroconversion among Hospital Staff, Singapore. *Emerg Infect Dis*, *16*(10), 1554-1561. doi:10.3201/eid1610.100516
- Christini, A. B., Shutt, K. A., & Byers, K. E. (2007). Influenza vaccination rates and motivators among healthcare worker groups. *Infect Control Hosp Epidemiol*, *28*(2), 171-177. doi:10.1086/511796
- Corace, K. M., Srigley, J. A., Hargadon, D. P., Yu, D., MacDonald, T. K., Fabrigar, L. R., & Garber, G. E. (2016). Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine*, *34*(28), 3235-3242. doi:10.1016/j.vaccine.2016.04.071
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches. 3rd Edition*. Thousand Oaks, CA, US: Sage publications.
- Creswell, J. W. (2014). *Research Design; Quantitative, Qualitative and Mixed Methods Approaches* (4th ed.). CA: Thousand Oaks, Sage publications.
- De Juanes, J. R., Garcia de Codes, A., Arrazola, M. P., Jaen, F., Sanz, M. I., & Gonzalez, A. (2007). Influenza vaccination coverage among hospital personnel over three consecutive vaccination campaigns (2001-2002 to 2003-2004). *Vaccine*, *25*(1), 201-204. doi:10.1016/j.vaccine.2005.10.057
- European Centre for Disease Prevention and Control (ECDC). (2018). *Seasonal Influenza Vaccination and Antiviral use in EU/EEA Member States - Overview of vaccine recommendations for 2017-2018 and vaccination coverage rates for 2015-2016 and 2016-2017 influenza season. Technical report*. Retrieved from Stockholm, Sweden:
- European Council. (2009). *Commission Recommendations on Seasonal Influenza Vaccination*. Brussels: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:348:0071:0072:EN:PDF>
- Falomir-Pichastor, J. M., Toscani, L., & Despointes, S. H. (2009). Determinants of Flu Vaccination among Nurses: The Effects of Group Identification and Professional Responsibility. *Applied Psychology*, *58*(1), 42-58. doi:10.1111/j.1464-0597.2008.00381.x

- Feemster, K. A., Prasad, P., Smith, M. J., Feudtner, C., Caplan, A., Offit, P., & Coffin, S. E. (2011). Employee designation and health care worker support of an influenza vaccine mandate at a large pediatric tertiary care hospital. *Vaccine*, *29*, 1762-1769. doi:10.1016/j.vaccine.2010.12.115
- Glanz, K., Rimer, B., & Viswanath, K. (2008). *Health Behaviour and Health Education. Theory, Research and Practice. Fourth Edition*. USA: Wiley and Sons Ltd.
- Godin, G., Vézina-Im, L.-A., & Naccache, H. (2010). Determinants of Influenza Vaccination among Healthcare Workers. *Infection Control & Hospital Epidemiology*, *31*(7), 689-693. doi:10.1086/653614
- Gross, P. A., Hermogenes, A., Sacks, H., Lau, J., & Levandowski, R. (1995). The Efficacy of Influenza Vaccine in Elderly Persons A Meta-analysis and Review of the Literature. *Annals of Internal Medicine*, *123*(7).
- Harrison, N., Brand, A., Forstner, C., Tobudic, S., Burgmann, H., & Burgmann, H. (2016). Knowledge, Risk Perception and Attitudes towards vaccination among Austrian health care workers: A cross sectional study. *Hum Vaccin Immunother*, *12*(9), 2459-2463. doi:DOI: 10.1080/21645515.2016.1168959
- Hayward, A. C., Harling, R., Wetten, S., Johnson, A. M., Munro, S., Smedley, J., . . . Watson, J. M. (2006). Effectiveness of an influenza vaccine programme for care home staff to prevent death, morbidity, and health service use among residents: cluster randomised controlled trial. *BMJ*, *333*(7581), 1241. doi:10.1136/bmj.39010.581354.55
- Health Service Executive (HSE). (2018). *(Former) Health & Wellbeing Division Key Performance Indicator Metadata 2018*. Retrieved from <https://www.hse.ie/eng/services/publications/kpis/-former-health-wellbeing-division-metadata-2018-final.pdf>
- Hollmeyer, H. G., Hayden, F., Poland, G., & Buchholz, U. (2009). Influenza vaccination of health care workers in hospitals--a review of studies on attitudes and predictors. *Vaccine*, *27*(30), 3935-3944. doi:10.1016/j.vaccine.2009.03.056
- Immunisation Guidelines for Ireland. (2013). Immunisation Guidelines for Ireland, 2013. 07/01/2016. Retrieved from <http://www.hse.ie/eng/health/Immunisation/hcpinfo/guidelines/>
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: a decade later. *Health Educ Q*, *11*(1), 1-47. doi:10.1177/109019818401100101
- Johnson, R. E., Grove, A. L., & Clarke, A. (2017). Pillar Integration Process: A Joint Display Technique to Integrate Data in Mixed Methods Research. *Journal of Mixed Methods Research*, *13*(3), 301-320. doi:10.1177/1558689817743108
- Kadi, Z., Atif, M. L., Brenet, A., Izoard, S., & Astagneau, P. (2016). Barriers of influenza vaccination in health care personnel in France. *Am J Infect Control*, *44*(3), 361-362. doi:10.1016/j.ajic.2015.09.027
- Karanfil, L. V., Bahner, J., Hovatter, J., & Thomas, W. L. (2011). Championing patient safety through mandatory influenza vaccination for all healthcare personnel and affiliated physicians. *Infection Control and Hospital Epidemiology*, *32*, 375-379.
- Keller, D. (2010, November 2010). Hospital Reaches Near 100% Flu Vaccination Rate of Staff With Mandate. *Medscape*. Retrieved from <https://www.medscape.com/viewarticle/732085>
- Kimura, A. C., Nguyen, C. N., Higa, J. I., Hurwitz, E. L., & Vugia, D. J. (2007). The effectiveness of vaccine day and educational interventions on influenza vaccine coverage among health care workers at long-term care facilities. *American journal of public health*, *97*(4), 684-690. doi:10.2105/AJPH.2005.082073
- Kraut, A., Graff, L., & McLean, D. (2011). Behavioral change with influenza vaccination: Factors influencing increased uptake of the pandemic H1N1 versus seasonal influenza vaccine in health care personnel. *Vaccine*, *29*(46), 8357-8363. doi:10.1016/j.vaccine.2011.08.084
- Leitmeyer, K., Buchholz, U., Kramer, M., Schenkel, K., Stahlhut, H., Kollstadt, M., . . . Meyer, C. (2006). Influenza vaccination in German health care workers: effects and

- findings after two rounds of a nationwide awareness campaign. *Vaccine*, 24(47-48), 7003-7008. doi:10.1016/j.vaccine.2006.04.040
- Lemaitre, M., Meret, T., Rothan-Tondeur, M., Belmin, J., Lejonec, J. L., Luquel, L., . . . Carrat, F. (2009). Effect of influenza vaccination of nursing home staff on mortality of residents: A cluster-randomized trial. *Journal of the American Geriatrics Society*, 57(9), 1580-1586.
- Leong, R. (2015). Knowledge, attitudes, risk perception of influenza and influenza vaccination among final year nursing students in Singapore: an exploratory study. *Antimicrobial Resistance and Infection Control*, 4(SUPPL 1). doi:doi:10.1186/2047-2994-4-S1-P19
- Livni, G., Chodik, G., Yaari, A., Tirosh, N., & Ashkenazi, S. (2008). Attitudes, knowledge and factors related to acceptance of influenza vaccine by pediatric healthcare workers. *Journal of Pediatric Infectious Diseases*, 3(2), 111-117.
- Luquis, R., & Kensinger, W. (2019). Applying the Health Belief Model to assess prevention services among young adults. *International Journal of Health Promotion and Education*, 57(1), 37-47. doi:doi: 10.1080/14635240.2018.1549958
- Mack, N., Woodsong, C., Mac Queen, K., Guest, G., & Namey, E. (2005). *Qualitative Research Methods: A data collector's field guide*. USA: by Family Health International.
- Magill, S. S., Black, S. R., Wise, M. E., Kallen, A. J., Lee, S. J., Gardner, T., . . . Jung, M. (2011). Investigation of an outbreak of 2009 pandemic influenza A virus (H1N1) infections among healthcare personnel in a Chicago hospital. *Infect Control Hosp Epidemiol*, 32(6), 611-615. doi:10.1086/660097
- Mehta, M., Pastor, C. A., & Shah, B. (2008). Achieving optimal influenza vaccination rates: a survey-based study of healthcare workers in an urban hospital. *Journal of Hospital Infection*, 70(1), 76-79. doi: <https://doi.org/10.1016/j.jhin.2008.04.028>
- Nair, H., Brooks, W. A., Katz, M., Roca, A., Berkley, J. A., Madhi, S. A., . . . Campbell, H. (2011). Global burden of respiratory infections due to seasonal influenza in young children: a systematic review and meta-analysis. *Lancet*, 378(9807), 1917-1930. doi:10.1016/s0140-6736(11)61051-9
- Naleway, A. L., Henkle, E. M., Ball, S., Bozeman, S., Gaglani, M. J., Kennedy, E. D., & Thompson, M. G. (2014). Barriers and facilitators to influenza vaccination and vaccine coverage in a cohort of health care personnel. *Am J Infect Control*, 42(4), 371-375. doi:10.1016/j.ajic.2013.11.003
- Nichol, K. L., Lind, A., Margolis, K. L., Murdoch, M., McFadden, R., Hauge, M., . . . Drake, M. (1995). The effectiveness of vaccination against influenza in healthy, working adults. *N Engl J Med*, 333(14), 889-893. doi:10.1056/nejm199510053331401
- Nicoll, A., Ciancio, B. C., Lopez Chavarrias, V., Molbak, K., Pebody, R., Pedzinski, B., . . . Van Kerkhove, M. D. (2012). Influenza-related deaths--available methods for estimating numbers and detecting patterns for seasonal and pandemic influenza in Europe. *Euro Surveill*, 17(18).
- Nicoll, A., & Sprenger, M. (2013). Low effectiveness undermines promotion of seasonal influenza vaccine. *Lancet Infect Dis*, 13(1), 7-9. doi:10.1016/s1473-3099(12)70313-4
- O'Lorcain, P., Cotter, S., & Kelleher, K. (2019). *HSE Health Protection Surveillance Centre. Uptake of the Seasonal Influenza Vaccine in Acute Hospitals and Long Term/Residential Care Facilities in Ireland in 2018-2019*. Dublin
- Retrieved from <https://www.hpsc.ie/a-z/respiratory/influenza/seasonalinfluenza/influenzaandhealthcareworkers/>
- Potter, J., Stott, D. J., Roberts, M. A., Elder, A. G., O'Donnell, B., Knight, P. V., & Carman, W. F. (1997). Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis*, 175(1), 1-6. doi:10.1093/infdis/175.1.1

- Raftopoulos, V. (2008). Attitudes of nurses in Greece towards influenza vaccination. *Nursing Standard*, 23(4), 35-42. doi:10.7748/ns2008.10.23.4.35.c6675
- Riphagen-Dalhuisen, J., Gefenaite, G., & Hak, E. (2012). Predictors of seasonal influenza vaccination among healthcare workers in hospitals: a descriptive meta-analysis. *Occup Environ Med*, 69(4), 230-235. doi:10.1136/oemed-2011-100134
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the health belief model. *Health Educ Behav*, 15(175). doi:10.1177/109019818801500203
- Rothberg, M. B., Haessler, S. D., & Brown, R. B. (2008). Complications of Viral Influenza. *Am J Med*, 121(4), 258-264. doi:10.1016/j.amjmed.2007.10.040
- Sarafino, E. (2008). *Health Psychology, Biopsychosocial Interactions. Sixth edition*. USA: John Wiley and Sons.
- Smith, S., Sim, J., & Halcomb, E. (2016a). Australian general practice nurse's knowledge, attitudes and practices regarding influenza vaccination: a cross-sectional survey. *Journal of Clinical Nursing*, 25(17-18), 2502-2510. doi:10.1111/jocn.13287
- Smith, S., Sim, J., & Halcomb, E. (2016b). Nurses' knowledge, attitudes and practices regarding influenza vaccination: an integrative review. *J Clin Nurs*, 25(19-20), 2730-2744. doi:10.1111/jocn.13243
- Wallston, K. A., Wallston, B. S., & DeVellis, R. (1978). Development of the Multidimensional Health Locus of Control (MHLC) Scales. *Health Educ Monogr*, 6(2), 160-170. doi:10.1177/109019817800600107
- WHO. (2012). Strategic Advisory Group of Experts on Immunization. Background Paper on Influenza Vaccines and Immunization. Geneva: World Health Organization; 2012.
- Wilde, J. A., McMillan, J. A., Serwint, J., Butta, J., O'Riordan, M. A., & Steinhoff, M. C. (1999). Effectiveness of influenza vaccine in health care professionals: a randomized trial. *Jama*, 281(10), 908-913. doi:10.1001/jama.281.10.908
- World Health Organization. (2019, March, 11). Global Influenza Strategy 2019-2030 Retrieved from <http://www.who.int/topics/influenza/en/>
- World Health Organization (WHO). (2016). Global strategic directions for strengthening nursing and midwifery 2016-2020; Geneva, Switzerland.
- Zhang, J., While, A. E., & Norman, I. J. (2010). Knowledge and attitudes regarding influenza vaccination among nurses: a research review. *Vaccine*, 28(44), 7207-7214. doi:10.1016/j.vaccine.2010.08.065
- Zhang, J., While, A. E., & Norman, I. J. (2012a). Development and testing of an instrument to assess nurses' knowledge, risk perception, health beliefs and behaviours related to influenza vaccination. *Journal of Clinical Nursing*, 21(17-18), 2636-2646. doi:10.1111/j.1365-2702.2011.03794.x
- Zhang, J., While, A. E., & Norman, I. J. (2012b). Seasonal influenza vaccination knowledge, risk perception, health beliefs and vaccination behaviours of nurses. *Epidemiology and Infection*, 140(10), 1569-1577. doi:10.1017/S0950268811002214