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Facilitators and barriers to the seasonal influenza vaccination among nurses: A sequential explanatory mixed methods study

A thesis submitted to the College of Medicine, Nursing and Health Sciences, National University of Ireland Galway in fulfilment of the requirements for the degree of Doctor of Philosophy

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School of Nursing and Midwifery

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Abstract

Introduction

Seasonal influenza is a public health concern that contributes to a significant increase in mortality and morbidity among high-risk patients annually. Influenza is a vaccine preventable disease with international and national recommendations supporting annual vaccination for high-risk patients and healthcare workers (HCWs).

Despite recommendation, variations in vaccine uptake rates are evident among the different categories of HCWs, with nurses having one of the lowest vaccine uptake rates. HCWs constitute a large heterogeneous workforce and the reasons why they accept or reject the influenza vaccine is complex. Nurses in particular, are known to have different attitudes about influenza compared to physicians and it is also known that the various categories of HCWs respond to vaccination campaigns in different ways. It is therefore essential to identify and understand the reasons why nurses working in the acute hospital sector are not availing of a freely accessible, safe and effective vaccine in order to inform and develop future influenza campaigns to target the vaccination gap.

Aim

The overall aim of this study is to understand the facilitators of, and the barriers to, the uptake of seasonal influenza vaccination among nurses.

Objectives

1. To examine nurses' knowledge, risk perceptions, health beliefs and seasonal influenza vaccination behaviours.
2. To explore in depth the barriers and facilitating factors associated with vaccinated and unvaccinated nurses.
3. To identify nurses' views in relation to mandatory vaccination policy for seasonal influenza.
4. To conduct a systematic review of the literature on interventions to improve seasonal influenza vaccination rates among nurses.

5. To provide information for the planning and implementation of interventions and campaigns to promote the uptake of the influenza vaccine among nurses.

Methods

The Health Belief Model (HBM) was the theoretical framework underpinning this research. A sequential explanatory mixed methods study was undertaken to identify the barriers and facilitators to seasonal influenza vaccination among nurses (chapter 4). Phase one of this sequential explanatory mixed method study consisted of a cross sectional survey using the King's Nurses Influenza Vaccination Questionnaire (KNIVQ), to examine the relationship between nurses' knowledge, risk perception, health belief and influenza vaccination practices. This was followed by focus group discussions (phase two) which was informed by the findings from the survey in phase one. The aim of phase two was to elaborate, and further explain in depth the findings from the survey, and also explore the barriers and facilitating factors associated with vaccinated and unvaccinated nurses. The quantitative data were analysed statistically and thematic analysis was used to analyse the qualitative data. The results from phase one and phase two were integrated using the pillar integration process (PIP). A systematic review was also undertaken to review the evidence on the effectiveness of interventions to improve the seasonal influenza vaccination among nurses (chapter 6).

Results

The results found that in the absence of mandatory vaccination policy for seasonal influenza, there are multiple factors that act as facilitators of, and barriers to nurses' vaccination practices. Male nurses, those with higher knowledge about influenza and the vaccine and higher perceived risk were associated with vaccination uptake in the previous 12 months and future vaccine intentions. Nurses who believed they were in control of their own health (internal subscale) were also more likely to have been vaccinated while the subscale powerful others was associated with nurses' future vaccine intentions. Nurses were also strongly influenced by the information they receive from flu experts within the hospital.

Conclusions

Although vaccinating nurses against seasonal influenza is an important public health initiative, achieving high vaccine uptake rates among nurses remains a challenge annually. It is important to recognise the needs of the different categories of HCWs when developing and tailoring influenza intervention programmes. Multi-faceted influenza campaigns targeting nurses based on the Health Belief Model should be prioritised.

The current study makes an original contribution to knowledge by advancing understanding about the barriers of, and facilitating factors to nurses' vaccination practices. Recommendations include to improve knowledge and awareness through mandatory training. There is a need for a more targeted approach to influenza campaigns with the personal benefits of vaccination incorporated into future campaigns.

Declaration

I, Paula Flanagan declare that this work is submitted to fulfil the requirement of the degree of Doctor of Philosophy, at the National University of Ireland Galway. I have not obtained a degree in the National University of Ireland Galway, or elsewhere, on the basis of the work completed in this thesis. I am the author of this thesis and the principal author of the three included manuscripts. Contributions by others are included under 'Contributions to Research'

Signature: Paula Flanagan.

Date: 11th February 2021

List of publications from this thesis

Published papers

Flanagan, P., Dowling, M., & Gethin, G. (2020). Barriers and facilitators to seasonal influenza vaccination uptake among nurses: A mixed methods study. *Journal of Advanced Nursing*, **76**(7), 1746-1764. Doi: 10:1111/jan.14360

Flanagan, P., Dowling, M., & Gethin, G. (2020). Mandatory vaccination for seasonal influenza: what are nurses' views? *British Journal of Nursing*. *29*(20), 1188-1191.

Flanagan, P., Dowling, M., & Gethin, G. (2020). The effectiveness of interventions to improve seasonal influenza vaccination rates among nurses, Systematic review protocol, registered in *PROSPERO-CRD42020169735 Available from:* https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020169735.

Under review

Flanagan, P., Dowling, M., Sezgin, D., Mereckiene, J., Murphy L., Giltenane, M., Carr P., & Gethin G. (2020). The effectiveness of interventions to improve the seasonal influenza vaccination uptake among nurses: A systematic review. Submitted to the *Journal of infection Prevention* (Sage).

Oral conference presentations

National University of Ireland Galway, College of Medicine, Nursing and Health Sciences. Postgraduate research day, 21st May 2019. "Influenza Knowledge, risk perceptions and health beliefs among nurses working in two large acute hospital settings in Ireland".

The Ninth Annual Safe Patient Care Course, Royal College of Surgeons, Ireland/Health Protection Surveillance Centre (HPSC), 11th September 2018. "Influenza Knowledge, risk perception, health beliefs and vaccination behaviours among nurses".

Contribution to Research

This thesis comprises of three manuscripts, two of which have been published in peer reviewed journals, and one study which is currently under review in the *Journal of Infection Prevention*. As principal investigator for all three manuscripts, ethical approval was obtained from the relevant research ethics committees under the supervision of Dr Georgina Gethin. I was responsible for leading all three studies and maintaining communication and collaboration with the researchers involved.

The first paper in this thesis is presented in chapter four and consists of a sequential explanatory mixed methods study. Dr Gethin and I conceptualised and designed this research study. I was responsible for the overall data collection, data validation, data entry, statistical analysis and writing the initial manuscript. As this was a mixed methods research study, there were two phases. The first phase consisted of a quantitative research study and the second phase consisted of a qualitative research study. The quantitative data (phase one) were collected using a questionnaire which was developed by a team in King's College London. Permission was granted from the team in King's College London to use their questionnaire in this thesis. Through collaborating with two large academic hospital sites in Ireland, I recruited participants, developed and distributed the study information leaflets, letter of invitation, consent forms and the questionnaire. I was responsible for co-ordinating and liaising with the training facilitators at the two hospital sites in recruiting participants and collecting the data. I developed the database for data entry in epidata, and I entered the data manually. These data were double entered by a research assistant who at the time was employed at the HSE-Health Protection Surveillance Centre (HPSC). I undertook the statistical analysis of the quantitative data (statistical advice was sought at the beginning of the analysis from Ms Gloria Avalos, statistician in NUI Galway) and drafted the final report. All authors read the final quantitative report. For the second phase (qualitative phase) of this study, I developed a topic guide from the results of phase one (quantitative study) in order to conduct qualitative focus group discussions. This topic guide was pre-approved by Dr Gethin and Dr Dowling. I arranged a suitable time to conduct the focus groups with nurses and was the moderator for all focus groups which were undertaken at

each hospital site. I transcribed all of the transcripts verbatim and analysed the data using NVivo v12 under the supervision of Dr Dowling. The codebook and transcripts were provided to Dr Dowling and assessed for agreement. All authors read the final report from the qualitative findings. I integrated the findings from both the quantitative and qualitative study under the supervision of Dr Dowling and prepared the manuscript for circulation to all authors. All authors approved the final version of the manuscript. Once the final version was approved, I submitted the manuscript for publication to the *Journal of Advanced Nursing*. All authors contributed to the editor and reviewers' comments, and also to the final proofing of the manuscript prior to resubmission for publication.

The second paper is presented in chapter five. This paper consists of qualitative findings from a subset of participants' data collected during the first study. This study explored nurses' views in relation to mandatory vaccination for seasonal influenza. I was responsible for transcribing the transcripts and analysing the data in NVivo version 12. All transcripts, codes and themes were validated by Dr Dowling. All authors reviewed the final paper and I was responsible for submitting the manuscript for publication to the *British Journal of Nursing*. All authors contributed to the editor and reviewers' comments and also the final proofing of the manuscript prior to resubmission for publication.

The third paper consists of both a protocol and a systematic review, both of which are presented in chapter six. The protocol directed and guided the systematic review and was developed under the supervision of Dr Gethin and circulated to Dr Dowling and Dr Gethin who were initial members of the review team. Overall supervision of this systematic review was provided by Dr Gethin. Once approved, I submitted the protocol for publication to Prospero. Due to the volume of studies identified in the search and the timing of this review in light of the novel coronavirus (COVID-19) pandemic, the review team was extended to involve other reviewers. This was a large review team which I was responsible for leading on. This systematic review followed guidelines from the Cochrane handbook (Higgins & Greene, 2011). I developed the search strategy (with guidance and library support from Ms Rosie Dunne, NUI Galway) and undertook the electronic search. I also searched the grey literature and the reference lists of relevant studies. I was responsible for importing

the files from the electronic databases into Endnote and removing duplicates, following which I imported the file into Covidence software. Although a minimum of two reviewers were involved in all stages of this review, I undertook title and abstract screening, full text review and data extraction for all studies. I also completed the risk of bias assessment for the included study and this was also undertaken independently by Dr Duygu Sezgin. I drafted the manuscript and circulated it to all members of the review team to check for accuracy in advance of submitting it for publication. Once approved by all reviewers, I prepared the final manuscript for submission for publication to the *Journal of Infection Prevention*. This systematic review is currently under review.

Acknowledgements

Countless people have helped me throughout this PhD project, many of whom did so unintentionally. Firstly, I would like to thank my supervisors, Dr Georgina Gethin and Dr Maura Dowling who not only provided academic supervision to me, but provided constant support, expertise and professional guidance throughout the entirety of this work. I would also like to thank Dr Diarmuid O'Donovan for his expertise and knowledge in this subject area.

I would like to thank all members of my Graduate Research Committee (GRC), Dr Helen McGloin, Dr Suzanne Cotter and Dr Patricia Healy who reviewed the progress of my work annually and provided insightful comments and recommendations.

This project would not have been possible without the time and support that was dedicated to me from the HSE-Health Protection Surveillance Centre (HPSC). I would like to thank Dr Kevin Kelleher, for supporting this work and for recognising and prioritising the need for research in this area. Dr Suzanne Cotter, your advice and support has been invaluable to me throughout this journey.

I would like to thank my colleagues in the HSE-HPSC who provided constant words of encouragement, support, and extensive training. Thank you all for responding to all my spontaneous questions and for encouraging me through periods of self-doubt. The recent coronavirus (COVID-19) pandemic has highlighted your unwavering commitment and dedication to health protection in Ireland, and I feel privileged to be a member of the team.

To the staff at the two hospital sites who supported and facilitated the data collection for this study and to the nurses who participated, thank you.

To my close friends who provided constant support and encouragement and for understanding why I was so preoccupied for the past number of years, thank you!

I want to thank my family, especially my parents who have constantly supported me throughout my life but especially in my career. You have always encouraged me to achieve my goals and for that I am truly grateful.

Lastly and most importantly I wish to thank and acknowledge my husband Donal and our two children Luke and Noah; thank you so much for giving me the time, support and patience to pursue this project from the beginning. Donal, you took over so much of the family roles and responsibilities which gave me the time to focus and complete this work, and for that I am so grateful.

Dedication

I would like to dedicate this thesis to Donal, Luke and Noah.

Funding

This PhD project was funded by the Health Service Executive (HSE), Ireland.

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List of Abbreviations

ACIP	Advisory Committee Immunization Practices
ANOVA	Analysis of variance
CDC	Centers for Disease Control and Prevention
CI	Confidence Intervals
CPR	Cardiopulmonary Resuscitation
ECDC	European Centre for Disease Prevention and Control
EPOC	Effective Practice and Organisation of Care
EU	European Union
HBM	Health Belief Model
HCWs	Healthcare Workers
HPSC	Health Protection Surveillance Centre
HSE	Health Service Executive
ICC	Intracluster Correlation Coefficient
ICU	Intensive Care Units
ILI	Influenza-Like Illness
I-MOVE	Influenza Monitoring Vaccine Effectiveness
KNIVQ	King's Nurses' Influenza Vaccination Questionnaire
LRT	Lower Respiratory Tract
LTCF	Long Term Care Facilities
MHLC	Multidimensional Health Locus of Control
NIAC	National Immunisation Advisory Committee
OR	Odds Ratio
PICO	Population, Intervention, Comparison, Outcome
PIP	Pillar Integration Process
QUAL	Qualitative
QUAN	Quantitative
RCPI	Royal College of Physicians in Ireland
RCTs	Randomised Controlled Trials

RNA	Ribonucleic acid
TPB	Theory of Planned Behaviour
URT	Upper Respiratory Tract
US	United States
VE	Vaccine Effectiveness
WHO	World Health Organization

Chapter 1: Introduction

1.1 Introduction

The purpose of this chapter is to provide an introduction and discuss the main issues underpinning the rationale for this study. This chapter will provide information on the clinical features, mode of transmission and the burden of influenza disease. This chapter will conclude with the research aims and objectives and a thorough outline of the thesis structure will be provided.

1.2 Overview of the influenza virus

Seasonal influenza is an acute, highly contagious viral respiratory infection occurring typically during winter months. Influenza is a single-stranded, helically shaped, ribonucleic acid (RNA) virus of the orthomyxovirus family and is classified into three basic antigen types of influenza viruses: A, B and C. Type A influenza has subtypes that are determined by the surface antigens haemagglutinin (H) and neuraminidase (N) (Atkinson *et al.*, 2009; Saunders-Hastings & Krewski 2016). The two main influenza viruses responsible for causing seasonal epidemics each year are influenza A and B (Atkinson *et al.*, 2009).

Influenza viruses are unique in their ability to cause both recurrent annual epidemics and more serious pandemics that spread rapidly and affect all age-groups, with the highest incidence reported in children and most hospitalisations and deaths reported among older persons (Hawker *et al.*, 2012; World Health Organization, 2018). Both influenza epidemics and pandemics have been occurring for centuries. Annual epidemics result in local increases in incidence driven by seasonal influenza strains, whereas pandemics are epidemics that spread globally (Saunders-Hastings & Krewski, 2016). The size of epidemics and pandemics, and their relative impact, reflects the interplay between the scale of antigenic variation of the influenza virus, the amount of protective immunity in populations, and the virulence of the virus (Cox & Subbarao, 1999). Therefore, the severity of influenza disease can vary considerably and is determined by multiple factors including the characteristics of the circulating virus, the timing of the season, how effective the vaccine is and the number of people vaccinated for the season (World Health Organization, 2018; Centers for Disease Control and Prevention, 2020b).

Although pandemic strains are not the subject of this study, influenza pandemics are typically characterized by a higher, and widely varying, number of deaths than those experienced during seasonal epidemics (Kasowski *et al.,* 2011). These new influenza strains that cause pandemics are sufficiently different antigenically from previously circulating influenza viruses and have the capacity for human-to-human transmission with little or no previously existing immunity identified among individuals (Cox & Subbarao, 1999).

Since the middle of the 18th century, major pandemics have occurred at intervals of 10-40 years. Of these, the 1918 pandemic of the "Spanish flu" was the most severe, resulting in an estimated 20-40 million deaths worldwide. Less severe pandemics occurred in 1957 ("Asian flu") and in 1968 ("Hong Kong flu"). More recently, in 2009, global outbreaks caused by the influenza A(H1N1) strain designated as A(H1N1)pdm09 attained pandemic proportions, although it gradually evolved into a seasonal pattern in 2010 (World Health Organization, 2012b). This pandemic was the first in over 40 years since the 1968 pandemic (Centers for Disease Control and Prevention, 2010).

1.3 Clinical features and routes of transmission

The incubation period for seasonal influenza is usually two days, but can vary from one to four days (World Health Organization, 2018). Influenza disease is characterised by the sudden onset of fever, myalgia, sore throat, cough, headache, nasal congestion, weakness and loss of appetite (Hawker *et al.,* 2012; Centers for Disease Control and Prevention, 2020a). Among healthy adults, viral shedding starts zero to two days prior to symptom onset and continues for four to 14 days afterwards (Loeb *et al.,* 2012; Suess *et al.,* 2012). Among severely immunocompromised persons, who in most cases have sub-optimal immune response, influenza viruses often persist for longer periods (Van Der Vries *et al.,* 2013).

Influenza is highly infectious and easily transmitted from person to person by droplets which are excreted when individuals who are infected cough or sneeze

(World Health Organization, 2019a). The modes of human-to-human influenza transmission are contact transmission, which includes both direct and indirect transmission, and airborne transmission via droplets and aerosols (Centers for Disease Prevention and Control, 2015). Droplet transmission occurs when contagious particles are deposited on mucous surfaces of the upper respiratory tract (URT) such as the conjunctiva, mouth and nose. Aerosol transmission involves the production of particles that are small enough to be inhaled and reach the lower respiratory tract (LRT). Contact transmission, on the other hand, occurs when particles are transferred to mucous membranes of the URT either directly or by a contaminated object or person, and is also referred to as indirect transmission (Killingley & Nguyen-Van-Tam, 2013).

1.4 Burden of influenza disease

Seasonal influenza contributes significantly to serious complications such as pneumonia and exacerbations of underlying pulmonary and cardiac disease, resulting in hospitalisation (Rothberg *et al.,* 2008). Globally, seasonal influenza is associated with considerable health consequences including an increase in mortality and morbidity among high-risk individuals, especially older persons (Rothberg *et al.,* 2008; Luliano *et al.,* 2018). Although all age groups can be affected, certain groups of individuals are identified as being at higher risk. They include pregnant women, children under 59 months, older persons, individuals with chronic medical conditions and those with immunosuppressive conditions (World Health Organization, 2018). HCWs are also identified as being at higher risk as they can acquire influenza infection from increased exposure to patients infected with influenza who are not clinically ill or diagnosed with the infection (World Health Organization, 2018).

Annually, seasonal influenza epidemics affect an estimated 5-10% of the world's population, causing three million to five million severe infections and 250,000 to 600,000 deaths (World Health Organization, 2018), with most deaths occurring in those aged over 65 years (Nair *et al.,* 2012). In the United States (US), it is estimated that as a result of annual influenza epidemics, approximately 30,000 to 49,000 influenza-related deaths have occurred from 1976 to 2007 (Kasowski *et al.,* 2011). An estimated 24.7 million influenza cases, 31.4 million outpatient visits and

220,000 to 334,000 hospitalisations are attributable to influenza in the US each year (Molinari *et al.,* 2007). The highest hospitalisation rates occur in children less than two years of age and those aged ≥ 65 years (Centers for Disease Control and Prevention, 2016).

In the European Union (EU), according to the European Centre for Disease Prevention and Control (ECDC), approximately 40,000 people die prematurely each year from influenza. Influenza infects approximately 10% to 30% of the population and causes hundreds of thousands of hospitalisations (Centers for Disease Control and Prevention, 2016). A recent study conducted in Europe between 1999 and 2015 estimated that 291,243 to 645,832 seasonal influenza-associated respiratory deaths (4·0–8·8 per 100,000 individuals) occur annually (Luliano *et al.,* 2018).

Seasonal influenza places a considerable burden every year on the Irish health system. Approximately 200 to 500 deaths occur here each year and it is estimated that up to 1,000 deaths occur during particularly severe influenza seasons (Health Protection Surveillance Centre, 2019). Between the 2014/2015 and 2017/2018 seasons, confirmed influenza cases hospitalised and confirmed cases requiring admission to intensive care units (ICUs) ranged from 1,009 to 4,713 and from 51 to 191, respectively (Health Protection Surveillance Centre, 2019). For the 2019/2020 season to date, 4,329 confirmed influenza hospitalised cases were notified to the Health Protection Surveillance Centre (HPSC) and 152 confirmed influenza cases were admitted to intensive care units (ICUs) (Health Protection Surveillance Centre, 2020b).

The burden of seasonal influenza outbreaks is a critical economic problem in many countries (Perera, 2017). The total estimated economic burden of annual influenza epidemics in the US is $87.1 billion (Molinari *et al.,* 2007). While hospitalisations costs are important contributors to this enormous economic burden, lost lives and loss of productivity from absent work days comprise the bulk of the economic burden of influenza in the US (Molinari *et al.,* 2007).

HCWs are known to be at greater risk of influenza (Lietz *et al.,* 2016) and are reported to be three times more likely to be infected with influenza compared to adults working outside the health service (Kuster *et al*., 2011). As a result of this, they are considered to be an important priority group for influenza vaccination, not only to protect themselves directly and maintain essential health services during annual epidemics, but also to offer indirect protection and prevent the spread of influenza to vulnerable patients and staff (Dolan *et al.,* 2012).

Influenza epidemics have been occurring for centuries, with the first vaccine developed in parallel by multiple researchers during the late 1930s and early 1940s (Saunders-Hastings & Krewski, 2016). Vaccination is one of the most cost-effective health investments and health success stories globally, with vaccines available to prevent more than twenty life-threatening diseases, including influenza (World Health Organization, 2013). Despite influenza being a vaccine-preventable disease, it remains a serious public health problem, with annual epidemics amounting to a significant burden on health services. Each year, seasonal influenza is associated with significant health consequences that result in an increase in mortality and morbidity among high-risk individuals (Rothberg *et al.,* 2008; Luliano *et al.,* 2018). It has also been associated with high rates of absenteeism (Pereira *et al.,* 2017) and presenteeism among Healthcare Workers (HCWs) in the workplace (Chiu *et al.,* 2017; Mossad *et al.,* 2017). Although there is an effective and safe vaccine available, that is recommended by international and national health agencies, HCWs' influenza vaccine uptake rates remains low (European Council, 2009; World Health Organization, 2012a; National Immunisation Advisory Committee, 2017; Centers for Disease Control and Prevention, 2019; Grohskopf *et al*., 2020). Variations in influenza vaccine uptake rates are also evident among the different categories of HCWs, with nurses having consistently lower vaccine uptake rates compared to their colleagues (Trivalle *et al.,* 2006; Christini, 2007; Esposito *et al.,* 2007; Bouadma *et al.,* 2012; Bonaccorsi *et al.,* 2013; Mytton *et al.,* 2013; Naleway *et al.,* 2014; O'Lorcain *et al.,* 2019). This is concerning as nurses represent the largest group of health professionals internationally (World Health Organization, 2016) and are known to have an additional risk of exposure compared

to all other HCWs due to the nature and duration of their work (Chen *et al.*, 2010; Kuster *et al.*, 2011).

Factors influencing vaccine uptake are heterogeneous and also vary across the different groups of HCWs (World Health Organization, 2019b). In order to effectively address the vaccination gap, it is necessary to understand the key barriers and facilitators associated with vaccine practices among each health professional group (Butler & MacDonald, 2015). Although the factors that contribute to HCWs' vaccine decision-making pathways are diverse, some strategies appear to be more effective than others and, with the exception of mandatory vaccination, no single intervention has been shown to rapidly and substantially increase and sustain HCWs' vaccine uptake rates (World Health Organization, 2019b). The effectiveness of some interventions has also been found to be less successful among nurses and other health professionals when compared to physicians (Bouadma *et al.*, 2012, Friedl *et al.*, 2012) which also suggest that different approaches to influenza vaccination are necessary among nurses (Bouadma *et al.*, 2012; Dominguez *et al.*, 2014).

Influenza vaccination programmes for HCWs remain voluntary in Ireland and in most European countries. However, the low vaccine uptake has fuelled debate as to whether mandatory influenza vaccination programmes for HCWs with direct patient care should be implemented (Royal College of Physicians in Ireland, 2018). Although mandatory vaccination has been reported to be the most effective intervention at increasing vaccination uptake (Hollmeyer *et al.*, 2013; Rashid *et al.*, 2016) evidence suggests that sustained efforts of voluntary vaccination programmes are also capable of reaching high vaccination uptake rates (Salgado *et al.*, 2004; Centers for Disease Control and Prevention, 2005), with better results obtained by combining interventions in different areas (Bechini *et al.*, 2020).

In the absence of a mandatory vaccination policy, better understanding of the factors influencing nurses' influenza vaccination uptake rates can lead to the development of more effective interventions (Prematunge *et al.*, 2012). Therefore, to inform the development of tailored interventions, the focus of this thesis is to

identify the barriers and facilitating factors associated with nurses' vaccination practices in the acute hospital setting in Ireland.

1.5 Study aims, objectives and research questions

This thesis has used a range of methodological approaches to answer the research question:

What are the facilitators of, and barriers to, the seasonal influenza vaccination uptake among nurses in acute hospital settings?

1.5.1 Aims and objectives

The overall aim of this study is to understand the barriers and facilitating factors associated with seasonal influenza vaccine uptake among nurses. The objectives and research questions are illustrated in table 1.1.

Table 1.1 Research objectives and research questions

	Objectives	**Research question**
1.	To examine nurses' knowledge, risk perceptions, health beliefs and vaccination behaviours in relation to seasonal influenza vaccination	How does nurses' level of knowledge, risk perception and health beliefs affect influenza vaccination practices?
2.	To explore in depth the barriers and facilitating factors associated with vaccinated and unvaccinated nurses	What are the barriers and facilitators to seasonal influenza vaccination among nurses?
3.	Identify nurses' views in relation to implementing mandatory vaccination policy for seasonal influenza	What are nurses' views in relation to mandatory vaccination policy for seasonal influenza?
4.	To conduct a systematic review of the literature on interventions to	What evidence exists regarding the effectiveness of interventions

	improve seasonal influenza vaccination rates among nurses	to improve seasonal influenza vaccination rates among nurses?
5.	To provide information for the planning and implementation of interventions and campaigns to promote the uptake of the influenza vaccine among nurses	What conclusions can be drawn from the findings to inform the development and implementation of influenza intervention programmes for nurses in Ireland?

1.6 Outline of thesis

This thesis consists of seven chapters, two of which consist of manuscripts published in peer-reviewed journals and one which is currently under review. As this thesis presents a number of manuscripts, repetition in some sections was unavoidable. The research questions are addressed in chapters 4, 5, 6 and 7.

Chapter 1 provides the introduction to this thesis and highlights the main issues underpinning this research study. The study's aims and objectives are provided and the outline of the thesis is introduced.

Chapter 2 presents a comprehensive review of the literature on influenza and the influenza vaccine. The rationale supporting vaccinating HCWs and the reasons for and against HCWs vaccination will be provided.

Chapter 3 introduces the methodological approaches used to answer the research questions. An outline of the theoretical framework, research design and methods underpinning each of the research studies is provided.

Chapter 4 presents the findings of the first study. This study employed a sequential explanatory mixed methods research design.

Chapter 5 presents the findings of the qualitative study that explored nurses' views on mandatory vaccination policy for seasonal influenza in Ireland.

Chapter 6 presents the registered protocol and systematic review undertaken to determine the effectiveness of interventions at improving seasonal influenza vaccine uptake among nurses.

Chapter 7 presents the overall discussion of findings from the thesis. Implications for policy, practice and further research are also outlined.

1.7 Chapter summary

This chapter provided the introduction and rationale for this research study. The following chapter will provide a comprehensive review of the literature concerning the influenza virus and influenza vaccine. The rationale supporting the vaccination of HCWs and the reasons for and against it will be provided.

Chapter 2: Literature Review

2.1 Introduction

This chapter explores the literature in relation to preventing seasonal influenza. Although the focus of this review is on nurses, most studies investigating nurses' vaccination practices in healthcare settings have done so within the context of the wider healthcare workforce. The aim of this literature review is to provide a descriptive and evaluative summary of the research relating to seasonal influenza prevention among HCWs, with a particular focus on nurses. A detailed discussion of the effectiveness of the seasonal influenza vaccine and the benefits associated with vaccinating HCWs will also be provided. This chapter will focus on the influenza vaccine uptake rates among HCWs and the rationale supporting HCWs' vaccination against influenza. The reasons for and against such vaccination will also be highlighted.

2.2. Literature search strategy

The Population, Intervention, Comparison, Outcome (PICO) framework was used to develop the search strategy for this literature review. This framework was used to ensure a transparent and comprehensive search was conducted. The following electronic databases were searched: MEDLINE Ovid (1946 to December 2020), EMBASE Ovid (1974 to December 2020), Cinahl (EBSCO Host, 1937 to December 2020) and Scopus. A search of the Cochrane Database of Systematic Reviews was also undertaken. Reference lists of journal articles and books were searched to identify additional literature. The initial search was performed in Medline using a combination of controlled vocabulary and free-text terms to ensure maximum retrieval. The search terms were then adapted for EMBASE, Cinahl and Scopus. Search terms used in the literature search were influenza, seasonal influenza, flu, definition, clinical manifest*, vaccination, vaccin*, immuni*, seasonal influenza vaccination, influenza vaccine*, flu vaccine*, healthcare personnel, healthcare personnel, healthcare worker*, health care worker*, attitude*, behaviour*, behavior*, health belief*. Search terms were combined with the 'and' and 'or' Boolean as appropriate. No limits were applied to publication date except those applied by the databases themselves. The literature search was limited to

English language only. The searches were saved in each of the electronic databases and filtered to automatically run every three months. This ensured that the literature was critically reviewed on an ongoing basis throughout the entirety of the work. Although this wasn't a systematic review, the "Preferred Reporting Item for Systematic Reviews and Meta-analyses" (PRISMA) flow diagram was used for the selection of studies (Moher *et al.*, 2009) (figure 2.1).

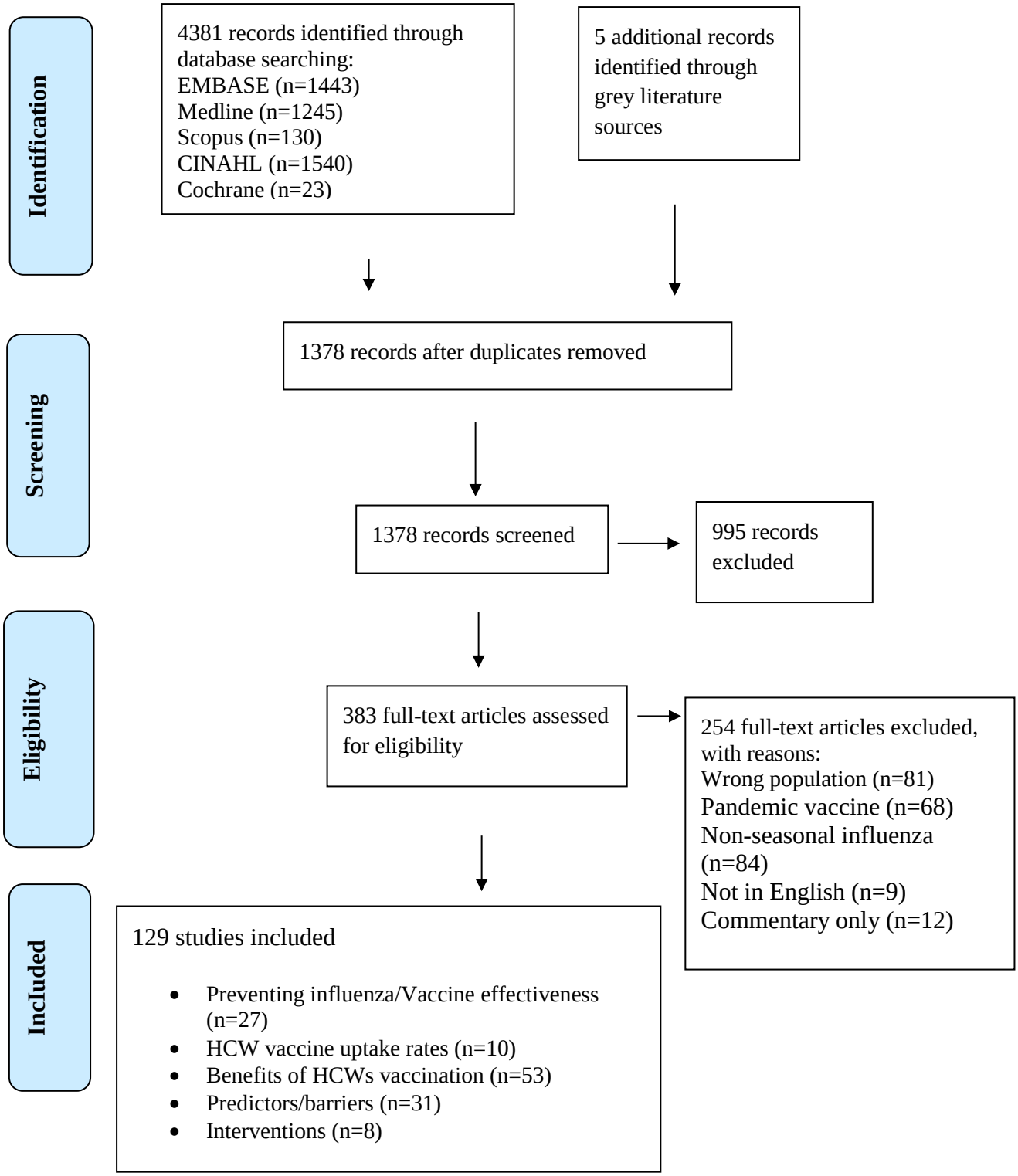

Figure 2.1. The "Preferred Reporting Item for Systematic Reviews and Meta-analyses" (PRISMA) flow diagram for the selection and inclusion of studies (Moher *et al.*, 2009)

2.3 Prevention of seasonal influenza

Seasonal influenza is a vaccine-preventable disease and annual vaccination is the most effective public health measure available to prevent the disease (Nicoll & Sprenger, 2013). Recognised high risk groups for seasonal influenza vaccination include pregnant women; elderly persons over a nationally defined age limit, irrespective of other risk factors; individuals older than six months with underlying health conditions; children aged six to 59 months; and HCWs, including those who work in homes that care for older persons or persons with disabilities (European Centre for Disease Prevention and Control, 2020).

Internationally, most recommendations favour influenza vaccination for HCWs, and in all developed countries, including Ireland, it is now standard practice to recommend influenza vaccination for HCWs. Organisations that favour such vaccination include the World Health Organization (WHO), the Advisory Committee Immunization Practices (ACIP) of the CDC, the council of the European Union (EU), and the National Immunisation Advisory Committee (NIAC) in Ireland. (European Council, 2009; World Health Organization, 2012a; National Immunisation Advisory Committee, 2017; Centers for Disease Control and Prevention, 2020c).

The influenza vaccination programme remains voluntary in Ireland and other European countries. An overview of vaccine recommendations and coverage rates in the EU Member States for the 2013/2014 and 2014/2015 influenza seasons revealed that, of the 30 Member States that participated, 29 recommend influenza vaccination for HCWs; 24 of these recommended vaccinating all HCWs; and four recommended vaccination for only certain groups of HCWs. In Northern Ireland and Scotland, the influenza vaccine is offered to all HCWs, while England and Wales recommend vaccinating only HCWs who have direct contact with patients (European Centre for Disease Prevention and Control, 2018).

In December 2009, the European Council recommended that EU countries adopt and implement national action plans to achieve 75% influenza vaccination coverage in all at-risk groups by the influenza season 2014/15 (European Council, 2009). The

recommendation encouraged countries to adopt and implement national, regional and local action plans or policies to improve influenza vaccination among HCWs and all those identified as high-risk population groups (Mereckiene *et al.,* 2014).

In 2013, the Health Service Executive (HSE) leadership team endorsed an action plan to improve the national influenza vaccine uptake among HCWs. Among the actions endorsed, an initial national target of 40% vaccine uptake was set in 2013 (Health Service Executive, 2016). This target was increased to 65% for the 2018/2019 season (Health Service Executive, 2018) and further increased to 75% for the 2019/2020 season (Health Service Executive, 2019).

Despite international recommendations, no country has made such vaccination mandatory. In the US, since 2004, some healthcare facilities and local health departments have requested that certain HCWs receive influenza vaccination as a condition of their employment or annually. Since then, many facilities in the US have developed and implemented similar policies (Stewart & Cox, 2013). These mandatory vaccination programmes have been more effective at increasing vaccine coverage rates than any voluntary strategy, with some health systems reporting coverage rates up to 99.3% (Keller, 2010; Feemster *et al.,* 2011; Karanfil *et al.,* 2011). However, multiple ethical issues have been raised in relation to mandatory vaccination policy (Stewart, 2009; Hollmeyer *et al.,* 2013; Wang *et al.,* 2017).

2.3.1 Vaccine effectiveness

Inactivated vaccines are efficacious and safe and are the cornerstone of influenza prevention in most countries. Vaccine effectiveness (VE) varies each year according to the seasonal variability of the influenza virus (Osterholm *et al.,* 2012). Since influenza viruses undergo frequent changes in their surface antigens, immunity from having being infected by one influenza virus does not protect fully against antigenic or genetic variants of the same subtype; i.e. influenza A viruses or type influenza B viruses. New influenza vaccines are developed every year to match the viruses that are expected to circulate during the subsequent influenza season. In the general population (as well as among HCWs) there are many factors that impact on the efficacy and effectiveness of influenza vaccines, and the vaccine's effectiveness can vary depending on who is being vaccinated. Other

factors that play an important role in determining whether the influenza vaccine will protect a person from influenza illness include the person's age and health, and the degree of match between the vaccine strain and the main circulating influenza virus (Centers for Disease Control and Prevention ,2020b; Centers for Disease Control and Prevention, 2020c).

Influenza vaccines are safe and effective, with 50%-90% effectiveness reported among healthy adults (including HCWs) (Michiels *et al.,* 2011). The influenza vaccine is also reported to be 50% effective when the circulating strain of influenza and the vaccine are poorly matched, and up to 90% effective when there is a good match (Michiels *et al.,* 2011, World Health Organization, 2012b). However, the vaccine is only 30%–40% effective in preventing illness among persons 65 years of age and older due to older person's difficulty in mounting and maintaining antibody responses (Gross *et al.,* 1995). However, although the vaccine is not very effective in preventing clinical influenza illness among older persons, it is effective in preventing complications and death in this population (World Health Organization, 2012b).

Since 2007, the ECDC has supported the influenza monitoring vaccine effectiveness (I-MOVE) network to monitor seasonal and pandemic influenza effectiveness (Valenciano *et al.,* 2012). During the 2015/2016 influenza season, the European I-MOVE multicentre case control study adjusted VE interim results against any influenza among all age groups were at 46.3% and 45.2% among 18-64-year olds (Kissling & Valenciano, 2016). More recently, interim results from six established VE studies across Europe for the 2018/2019 season indicate that the VE against laboratory confirmed influenza A ranged between 32% and 43% among all ages in primary care and hospital settings, and 59% in high-risk target groups (Kissling *et al.,* 2019). Although influenza vaccination has been criticised for such variable efficacy, it remains the primary method of preventing morbidity and mortality associated with influenza (Pitts *et al.,* 2014).

2.4 Vaccine uptake rates among healthcare workers

Although an effective and safe seasonal influenza vaccine is available, vaccine uptake rates among HCWs remains suboptimal. While some increases in vaccine uptake rates have been observed among HCWs, there are significant variations in these rates among various categories of HCWs, with nurses in particular having lower uptake rates than other HCWs (Leitmeyer *et al.*, 2006; Christini *et al.*, 2007; De Juanes *et al.*, 2007; Riphagen-Dalhuisen *et al*., 2012; O'Lorcain *et al.*, 2019).

In the United States, the CDC's data from an internet panel survey in November 2015 reported that influenza vaccination coverage among HCWs was 66.7%, which was similar to the previous season (2014/15) (64.3%). By occupational group, early season influenza vaccination coverage was highest among physicians (87.5%), nurse practitioner/physician assistants (81.8%), nurses (77.1%), pharmacists (76.8%), and other clinical professionals (72.6%) (Centers for Disease Prevention and Control, 2015). Uptakes rates in the US have increased over the years, largely due to intense promotion efforts and mandatory vaccination in some healthcare facilities (Galanakis *et al.*, 2013).

Vaccination uptake rates among HCWs also vary extensively across occupational groups in EU/EEA Member States. Data on influenza vaccine uptake rates provided by 12 Member States for the 2015/16, 2016/17 and 2017/18 seasons ranged from 15.6% to 63.2%. The median vaccine uptake rate in 2016/17 was 30.2%. The highest uptake of the vaccine was reported by Belgium, England and Wales (2016/17). When the two or three seasons mentioned above were compared, the vaccine uptake rate was seen to have increased in Greece, Ireland and the United Kingdom (European Centre for Disease Prevention and Control, 2018).

In Ireland since 2010, the HSE has monitored the uptake of seasonal influenza vaccination among HCWs. To date, this uptake has been monitored for nine consecutive influenza seasons (O'Lorcain *et al.*, 2020). For the most recent influenza season (2019/2020), vaccine uptake rates varied according to HSE staff category (48.4-76.4%), with the highest uptake reported among 'medical and dental' professionals and the lowest among 'general support' staff (figure 2.2) (O'Lorcain & Cotter, 2020). Although vaccine uptake varied by hospital group

(range 38.7%-74.6%) only two (4%) hospitals exceeded the 75% national uptake target (O'Lorcain & Cotter, 2020). This was the first year that any hospital reached the 75% target.

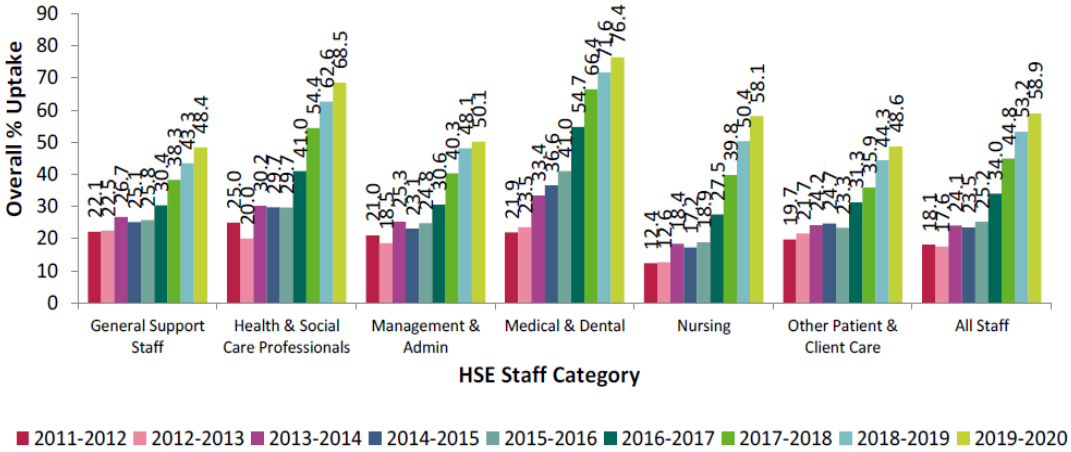

Figure 2.2 HCWs influenza vaccine uptake, public hospitals by HSE grade category and influenza season, Ireland (2011-2020) (Source: O'Lorcain, 2020).

Despite the increase in vaccine uptake among nurses, the rates of uptake remain concerning. The nursing profession is the largest workforce in the health service, and, according to O'Lorcain (2019), further increases in uptake among HCWs would be possible if vaccine uptake among nurses in public hospitals and long-term care facilities (LTCFs) was targeted, given that nurses accounted for 39.7% (n=26530/66857) of all HCWs in public hospitals and 37.7% (5082/13493.6) in public LTCFs in 2018-2019 (O'Lorcain *et al.,* 2019). Figure 2.3 illustrates the vaccine uptake among nurses in acute hospitals only and was developed from the data reported in O'Lorcain & Cotter (2020).

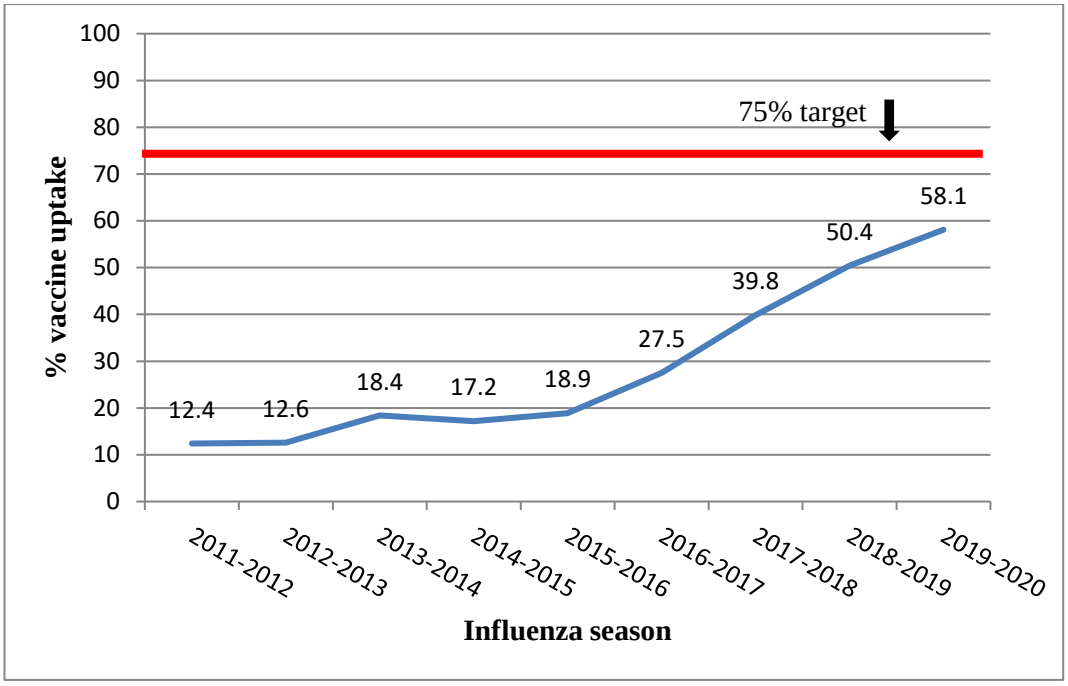

Figure 2.3 Nurses' vaccination uptake in public hospitals by influenza season (2011-2020)

2.5 The benefits of vaccinating HCWs

Vaccinating HCWs against seasonal influenza is likely to be cost-saving or, at the very least, highly cost-effective (Burls *et al.*, 2006). However, there has been some conflicting evidence regarding the rationale for vaccinating HCWs with regard to patient outcomes that may cause concern and confusion in relation to the benefits of such vaccination.

2.5.1 Benefits on morbidity and mortality

The benefits of vaccinating HCWs against seasonal influenza have been reported in many studies. A number of randomised controlled trials (RCTs) carried out in LTCFs for older people found that vaccinating HCWs causes a substantial reduction in mortality and morbidity among patients (Potter *et al.*, 1997; Wilde *et al.*, 1999; Carman *et al.*, 2000;; Hayward *et al.*, 2006; Lemaitre *et al.*, 2009). An observational study in Japan revealed that the risk of influenza-like illness (ILI) and influenza attack rates decreased significantly with an increase in HCW vaccine uptake rates (Oshitani *et al.*, 2000). A prospective cohort study conducted over two influenza seasons (1998/1999 and 1999/2000) found that a vaccination rate of 60% or greater for both residents and HCWs reduced the risk of ILI and could prevent outbreaks of influenza among nursing home residents (Saito *et al.*, 2002).

Although some systematic reviews support the benefits of vaccinating HCWs to reducing mortality and morbidity among patients (Dolan *et al.,* 2012; Ahmed *et al.,* 2014), the efficacy of HCWs' vaccination in preventing influenza among patients in LTCFs was not found in another systematic review by Thomas *et al.* (2016). Thomas *et al.* (2016) did not find conclusive evidence of the benefit of HCW vaccination programmes to specific outcomes of laboratory-confirmed influenza or to its complications (including LRI, hospitalisation or death due to lower respiratory tract illness) due to the very low quality of evidence included in the review. This review did not combine data on deaths from lower respiratory tract infections or all-cause mortality (Thomas *et al.,* 2016). Although Ahmed *et al.* (2014) acknowledges that the quality of the evidence available regarding HCWs influenza vaccination reduces mortality and cases of influenza in patients was moderate and low respectively, a 29% reduction in all-cause mortality among long-term care patients was reported (Ahmed *et al.,* 2014). In addition, a consistent direction of effect was observed across multiple outcome measures in the systematic review by Dolan *et al.* (2012) with virtually all studies noting a trend toward a protective effect of vaccination HCWs.

Despite these conflicting conclusions, several factors support the vaccination of HCWs to reduce influenza among patients. Evidence suggests that vaccinating HCWs has a protective effect (Benet *et al.,* 2012) and, in both acute and long-term care settings, HCW vaccination uptake rates have been found to be directly correlated with patient protection against influenza infection (Van Den Dool *et al.,* 2008a; Van den Dool *et al.,* 2009). According to Ahmed *et al.* (2014), the benefits of vaccinating HCWs outweigh its possible harms.

2.5.2 Benefits on nosocomial transmission

A nosocomial influenza outbreak is defined as "*an increase in influenza cases due to person-to-person transmission within hospitals"* (Voirin *et al.,* 2009: p7). Nosocomial influenza transmission can occur frequently and spread rapidly within healthcare facilities (Adal *et al.,* 1996; Everts *et al.,* 1996; Munoz *et al.,* 1999; Cunney *et al.,* 2000; Voirin *et al.,* 2009; Vanhems *et al.,* 2011; Eibach *et al.,* 2014; Vanhems *et al.,* 2014) contributing to morbidity and mortality among at-risk

patients (Serwint & Miller 1993; Evans & Kline 1995; Everts *et al.,* 1996; Cunney *et al.,* 2000). Kuster *et al.* (2011) conducted a systematic review and estimated a pooled annual incidence of influenza infection of 18.7 and 6.5 per 100 HCWs per season in unvaccinated and vaccinated HCWs, respectively. These estimates were significantly higher than the incidence rates among adults working in non-healthcare settings (Kuster *et al.,* 2011). Nosocomial infection is a large concern and is particularly concerning for patients who are at an increased risk of severe infection and complications.

A large body of international evidence exists regarding the burden of healthcare-associated influenza, with an estimated 2.0%-6.8% of hospitalised patients' laboratory-confirmed influenza infection being hospital-acquired or hospital-onset influenza (Enstone *et al*., 2011; Macesic *et al.,* 2013; Jhung *et al.,* 2014; Taylor *et al.,* 2014). A study by Voirin *et al.* (2009) synthesised 28 nosocomial outbreaks to highlight existing knowledge of the detection of incidence of cases and the evidence of influenza transmission between patients and HCWs. This review highlighted that, although relatives and visitors were implicated as sources of transmission, influenza transmission by staff had been reported in 10 studies that were included in the review. The results revealed that nosocomial transmissions are probably under-reported, making transmission pathways difficult to track (Voirin *et al.,* 2009). These studies highlight that nosocomial transmission of influenza occurs in all healthcare settings and that these outbreaks are associated with low vaccination coverage among HCWs (Salgado *et al.,* 2002; Osterholm *et al.,* 2012; Sayers *et al.,* 2013).

The influenza virus can spread rapidly between patients and HCWs in healthcare settings after it is introduced by visitors, staff or patients (Bridges *et al*., 2003). There is clear evidence supporting the role HCWs play in transmitting infections to their patients through nosocomial transmission, since HCWs who are asymptomatic or have mild influenza illness acquired from the community or from patients can spread the virus to susceptible patients (Salgado *et al.,* 2002; Bridges *et al.,* 2003). A study carried out in 1989 reported that 35% of HCWs developed ILI during an influenza season and that, while they were ill, 76% of these HCWs continued to care for patients (Weingarten *et al.,* 1989). Although this study was carried out over

30 years ago, similar findings have recently been reported. A cross-sectional study of registered nurses found that 78.4% of the nurses reported ILI in the previous year and 81.8% of these continued to work while they were ill (Ofstead *et al.,* 2008).

An investigation of an outbreak of influenza among HCWs found that 65% of infections may have resulted from healthcare-associated transmission, primarily from HCWs to other HCWs. Many of them reported working for one or more days after illness onset (Magill *et al.,* 2011). As a result of frequent contact and the fact that HCWs who are mildly symptomatic often continue to work (Weingarten *et al.,* 1989; Coles *et al.,* 1992), influenza outbreaks can easily occur (Van Den Dool *et al.,* 2008a; Van den Dool *et al.,* 2008b).

2.5.3 Benefits on laboratory-confirmed influenza cases

Individuals such as HCWs who are effectively vaccinated and develop a protective immune response to the prevalent influenza strains help to prevent transmission to secondary and subsequent individuals (Dorratoltaj *et al.,* 2017). A study by Benet *et al.* (2012) found a protective effect against laboratory-confirmed influenza where staff influenza vaccine coverage was greater than 35%, indicating a shielding effect of vaccinated HCWs on hospital-acquired influenza among patients in acute care units (Benet *et al.,* 2012). The efficacy of influenza vaccination against laboratory-confirmed influenza has been found to be consistent across reviews and is reported to be approximately 60% in healthy adults (Kliner *et al.,* 2016). Therefore, it is proposed that it is reasonable to generalise this effect to HCWs (who themselves are often 'healthy adults') (Kliner *et al.,* 2016). The results of this review also suggest that the vaccine would prevent an estimated 2.5 episodes of influenza per 100 vaccinated HCWs (Kliner *et al.,* 2016). According to Van Den Dool *et al.* (2008a), at least seven HCWs need to be vaccinated to prevent one influenza infection per patient (Van Den Dool *et al*., 2008a).

2.5.4 Benefits on reducing absenteeism from work

HCWs may also acquire influenza from infected patients during an outbreak, resulting in morbidity and absenteeism from work (Saxén & Virtanen 1999; Wilde *et al.,* 1999). Vaccinating HCWs greatly reduces sick leave and the duration of absenteeism from work (Saxén & Virtanen 1999; Wilde *et al.,* 1999; Lemaitre *et*

al., 2009; Imai *et al.,* 2018). Non-vaccinated HCWs are reported to lose 2.47/100 person-days of work, compared with 1.92/100 person-days of work among vaccinated HCWs (Antinolfi *et al.,* 2020). Absenteeism from work can have negative impact on patient outcome and cause additional pressure on health services. Evidence suggests that fewer nurses per patients as a result of absenteeism can cause an increase in mortality rates (Cho *et al.,* 2008).

2.6 Factors associated with influenza vaccination practices

Many studies suggest that the reasons HCWs' accept or reject the influenza vaccine are complex and interrelated among different health systems, and a number of reviews have been conducted on HCWs' attitudes, beliefs and predictors to vaccination practices (Hofmann *et al.,* 2006; Hollmeyer *et al.,* 2009; Riphagen-Dalhuisen *et al.,* 2012). According to Hofmann *et al.* (2006), self-protection was a key motivating factor associated with HCWs' vaccination uptake rates. This review also found that HCWs were insufficiently vaccinated due to a misperception of influenza, its risks, the role HCWs play in its transmission and the importance and risks of vaccination and a lack (or perceived lack) of accessible free vaccination. A main barrier to vaccination among HCWs identified in this review was fear of adverse reactions due to vaccination (Hofmann *et al.,* 2006).

In 2009, Hollmeyer *et al.* reviewed studies on HCWs' attitudes and predictors to influenza vaccination and identified that a wide range of misconceptions and lack of knowledge about influenza infection and a lack of convenient access to the influenza vaccine were associated with low vaccine uptake rates among HCWs. Similar to Hofmann *et al.* (2006), Hollmeyer *et al.* (2009) identified self-protection as the main factor associated with HCWs' acceptance of influenza vaccination. Three predictive factors associated with HCWs' influenza vaccination were previous receipt of vaccine, belief in vaccine effectiveness, and older age. The main assumption from this review was that HCWs get the influenza vaccine for their own personal benefit and not for that of the patient (Hollmeyer *et al.,* 2009).

A review by Riphagen-Dalhuisen *et al.* (2012) found the strongest predictors towards influenza vaccination were knowing that the vaccine is effective, being willing to prevent influenza transmission, believing that influenza is highly

contagious, believing it is important to prevent flu, and having a family member who is usually vaccinated (Riphagen-Dalhuisen *et al.*, 2012). These findings are consistent with the results of the previous reviews in that raising awareness about vaccine effectiveness and the risk of influenza makes vaccination of HCWs more effective and can have a positive impact on vaccination rates.

A review by Zhang *et al.* (2010) identified a strong association between nurses' knowledge of influenza and their vaccination status. It also identified a positive relationship between perceptions of influenza as a serious illness and vaccination (Zhang *et al*., 2010).

Busy work schedules, inconvenience and forgetting to get vaccinated are other common reasons for not getting vaccinated against influenza (Lester *et al.*, 2003; Kimura *et al.*, 2007), as well as the belief that they will never get influenza (Kimura *et al.*, 2007). Other factors included younger age, being a nurse or nursing assistant, and belief that homeopathic medication is more effect than the vaccine itself (Trivalle *et al.*, 2006). Timely access to the vaccine was also found to have a significant impact on HCW uptake rates. One study found that 27.2% of HCWs were unwilling to wait longer than 10 minutes, and 56.8% were unwilling to wait more than 20, minutes to receive the influenza vaccine (Quan *et al.*, 2012).

A review of the literature identified a small number of studies conducted in different health settings in the Irish context (O'Rorke *et al.*, 2003; Cornally *et al.*, 2013; Quinn, 2014; O'Callaghan *et al.*, 2019). Among a hospital survey conducted in 2001 on 300 HCWs, the most cited reason for receiving the influenza vaccine was to avoid getting influenza (O'Rorke *et al.*, 2003). This study also found similar results to international literature in that nurses were less likely to be vaccinated than other health professional groups (O'Rorke *et al.*, 2003). In 2013, a study of final year nursing students (n=218) recruited from a single Irish university reported that the students did not have strong intentions to accept the influenza vaccine. Reasons included lack of perceived risk and concerns about the side-effects of the vaccine (Cornally *et al.*, 2013). A small qualitative study of nurses' experiences of the seasonal influenza vaccine in a single public residential care setting in Ireland highlighted the complexity of issues surrounding, and concerns among nurses in

relation to, the influenza vaccine in Ireland (Quinn, 2014). These issues and concerns included influences such as family, friends and peers, the media and how nurses inform themselves. More recently, a cross-sectional study was carried out among clinical staff working in oncology day wards. Fear of vaccine side-effects, believing that if one is healthy there is no need for vaccination, and doubt about vaccine effectiveness negatively predicted vaccination (O'Callaghan *et al.,* 2019).

Most studies investigating HCWs vaccination practices in healthcare settings have done so within the context of the wider healthcare workforce, and therefore fail to adequately explore the specific issues related to nurses as a professional group (Smith *et al.,* 2016a; Smith *et al.,* 2016b). Nurses are known to have different attitudes about influenza than physicians (Hollmeyer *et al.,* 2009). In addition, the effectiveness of interventions targeting influenza vaccine uptake rates has been found to vary among different categories of HCWs, with the impact of interventions reported to be less successful among nurses and other health professionals than among physicians (Bouadma *et al*., 2012; Friedl et al., 2012). These findings suggest that different approaches to improving influenza vaccination are necessary among nurses and other HCWs (Bouadma *et al*., 2012; Dominguez *et al*., 2014).

Nurses represent the largest group of health professionals internationally (World Health Organization, 2016) and it is well known that vaccination uptake rates are lower among them than among physicians (Martinello *et al.,* 2003; Trivalle *et al.,* 2006; Christini *et al.,* 2007; Esposito *et al.,* 2007; Bouadma *et al.,* 2012; Bonaccorsi *et al.,* 2013; Mytton *et al.,* 2013; Naleway *et al.,* 2014). Vaccination is a complex behaviour and must be understood in terms of multi-factorial components such as attitudes, beliefs, self-efficacy, motivation, perceived threat and socio-cultural influences (Corace & Garber, 2014). A recent systematic review in 2016 reported on studies that used behavioural change frameworks to improve HCWs' vaccination uptake rates (Corace *et al.,* 2016). The review found that behaviour change frameworks constructs were successful in differentiating between vaccinated and unvaccinated HCWs (Corace *et al.,* 2016).

It is clear from the evidence that the reasons for nurses' low vaccine uptake rates are multifactorial and unique among health systems. It is important that these

factors are well-understood to develop tailored interventions aimed at promoting vaccination uptake rates among the various categories of HCWs. A study conducted in the US during the 1995-1996 influenza season achieved influenza vaccine uptake of 21% among HCWs (Begue & Gee, 1998). However, when HCWs were questioned about their reasons for vaccine refusal, and when these concerns were addressed during the following influenza campaign, vaccine coverage increased to 38%. Similarly, a study of Swiss HCWs who were questioned about their attitudes regarding influenza and vaccination found, when their answers were used to design interventions to improve vaccination coverage, an increase in HCW vaccination from 10% during the 1995/1996 influenza season to 26-37% during the 1996/1997 season (Harbarth *et al.,* 1998). These results demonstrate that, by integrating the findings as a routine and integral part of an influenza vaccination campaign, it is possible to improve the subsequent season's uptake of the influenza vaccine.

2.7 Interventions to increase influenza vaccine uptake rates

A number of systematic reviews have evaluated the effectiveness of interventions on all HCWs' influenza vaccine uptake (Lam *et al.,* 2010; Hollmeyer *et al.,* 2013; Lytras *et al.,* 2016; Rashid *et al.,* 2016; Bechini *et al.,* 2020). Although the implementation of mandatory vaccination programmes has not been evaluated through methodologically rigorous study designs (Rashid *et al.,* 2016), evidence from observational studies suggests that mandatory vaccination is the most effective single intervention at increasing HCWs' influenza vaccine uptake rates (Hollmeyer *et al.,* 2013; Pitts *et al.,* 2014; Lytras *et al.,* 2016; Bechini *et al.,* 2020). With the exception of mandatory vaccination policy, results from three previous systematic reviews (Hollmeyer *et al.,* 2013; Rashid *et al.,* 2016; Bechini *et al.,* 2020) conclude that combined interventions are more effective at increasing vaccine uptake rates among HCWs.

Lam *et al* (2010) conducted a systematic review that identified twelve studies evaluating interventions to increase HCWs' influenza vaccine uptake rates in LTCFs, hospitals and primary care. None of the most common interventions reported - education, promotion or improving access to the vaccine - reached the recommended vaccine uptake level (Lam *et al.,* 2010). Lytras *et al.* (2016) found that interventions such as increased access and awareness were the most effective

interventions. This review also recognised that, although educational interventions were not effective overall, they may be useful among particular groups of HCWs (Lytras *et al*., 2016).

Although intervention programmes that use a number of combined components have been shown to increase vaccine uptake rates among all HCWs (Hollmeyer *et al.,* 2013; Rashid *et al.,* 2016; Bechini *et al.,* 2020), it is hard to separate the benefit of one intervention from the others in evaluating multiple component interventions (Jenkin *et al.,* 2019).

Three cluster randomised control trials (cRCTs) were also identified in the literature search (Rothan-Tondeur *et al.,* 2009; Abramson *et al.,* 2010; Looijmans-van den Akker *et al.,* 2010). Two of these studies (Abramson *et al.,* 2010; Looijmans-van den Akker *et al.,* 2010) assessed the effect of multi-component intervention programmes, and one study (Rothan-Tondeur *et al.,* 2009) assessed that of a single component intervention programme, on HCWs' vaccination uptake rates. The intervention programme Rothan-Tondeur *et al.* (2009) implemented was a single educational intervention that provided top-down scientific information and a sense of altruism to staff working in geriatric facilities. Although this single intervention programme was ineffective in increasing the vaccination uptake rates of all HCWs, the results found that vaccination rates differed according to occupation groups with physicians more likely than other HCWs to be vaccinated. There was no statistically significant difference between the proportion of vaccinated nurses in the intervention and control group and the proportion of revaccinated nurses. However, there was a statistically significant difference in the proportion of revaccinated physicians in the intervention group ($p<0.05$). This finding strongly supports the plea for targeting physicians and other HCWs separately with influenza campaigns, especially since Friedl *et al.* (2012) claim that doctors accept the rationale of evidence-based data more easily than other HCWs do.

Looijman *et al.* (2010) conducted a cRCT involving 33 nursing homes to assess the effects of a systematically developed, multifaceted intervention programme. This programme consisted of three main components: an outreach visit to the nursing home by the researcher, who provided all required materials and background

information (component A) plenary one-hour information meeting organised twice in each nursing home by a specialised nurse (component B); and the appointment of preferably a physician as local program coordinator (component C). Although the results of this study found a significantly higher, though moderate increase, in vaccine uptake rates of HCWs (25% in the intervention group and 16% in the control group; p=0.02), the vaccination uptake rate for nurses in the intervention group and control group was 52.5% and 49.3%, respectively (p=0.11). Despite most of the study participants being nursing assistants, this multifaceted intervention programme was not effective for the nurses in the study, although it was effective for all the HCWs (nurses, doctors and nursing assistants). Vaccine uptake at the nursing home level did show a large variation in effect between individual homes and part of this variation may be explained by the nursing home's compliance with the various elements of the programme (Looijmans-van den Akker *et al.,* 2010).

Abramson *et al.* (2010) evaluated the effect of a multiple component intervention in 27 primary care centres in Israel. The intervention included a lecture session to the staff given in the clinic by a family physician, reminders and relevant literature distributed by e-mail, and recruitment of a key figure from the local staff (physician or nurse) who personally approached each staff member. The overall vaccine uptake for all HCWs in the intervention and control groups was 52.8% and 26.5% respectively. When these vaccination uptake rates were compared to the HCWs' vaccination uptake for the previous season, an absolute increase of 25.8% and 6.6% was observed in both the intervention group and control group. Variables that were independently and positively associated with vaccine uptake were having been vaccinated during the previous season, and being a nurse or physician. The vaccine uptake for nurses in this trial was high, and reported to be 60.6% (20/33) in the intervention group compared with 25.7% (9/35) in the control group (p=0.04). This intervention was not associated with an increase in vaccination among nursing assistants or pharmacists (Abramson *et al.,* 2010). This finding might be due to lecture attendance being significantly higher among physicians and nurses, and vaccine uptake was significantly higher (P = .009) among lecture participants (66% among participants, compared with 30% among non-participants).

2.8 Strengths and limitations of this literature review

The strengths of this literature review include the broad search that was undertaken. This ensured all studies that focused on nurses within all categories of HCWs were included. The searches were saved in each electronic database and were automatically rerun every three months which ensured no new literature was omitted. The screening and selecting of studies to be included in this review was undertaken by a single individual which is a limitation.

2.9 Chapter summary

Vaccinating against seasonal influenza is an essential patient safety initiative. Despite recommendations for vaccination among HCWs; vaccine uptake remains considerably low among nurses, even though they are the largest workforce in the health service. The evidence suggests that nurses continue to work even though they are symptomatic with ILI, putting patients at greater risk of infection. Influenza is a serious disease and causes significant mortality and morbidity among patients as well as an economic burden on health services during annual epidemics.

Despite annual influenza programmes and initiatives such as information and media campaigns, little progress in such uptake rates among nurses has been observed since the introduction of national reporting of influenza vaccine uptake among HCWs in 2006 in Ireland. It is essential to identify and understand the reasons why nurses working in the acute hospital sector are not availing of a freely accessible, safe and effective vaccine. There is considerable discussion about the best policy to encourage vaccine acceptance, with certain professional groups recommending the implementation of mandatory vaccination policy for influenza vaccination of HCWs (Royal College of Physicians in Ireland, 2018). Some countries have achieved high vaccine uptake without implementing mandatory vaccination by initially identifying the barriers and developing initiatives to target these barriers. It is therefore important that these factors are well understood in the Irish context in order to promote and sustain excellent vaccination uptake rates among the nursing profession in the absence of mandatory vaccination policy. The following chapter will discuss the range of methodological approaches and the theoretical framework used in this study.

Chapter 3: Theoretical Framework, Methodology and Methods Used

3.1 Introduction

The aim of this chapter is to provide a detailed description of the range of methodological approaches that were employed throughout this thesis. The chosen methodology is mixed methods. The philosophical worldview and chosen theoretical framework underpinning this research will be provided. The decision surrounding the choice of research design and how this decision was influenced by the research question will be discussed. Finally, a description of the methods chosen to answer the research questions will be provided.

3.2 Paradigm/worldview

Each research method is based on a particular paradigm that includes a set of assumptions regarding reality (ontology), knowledge of that reality (epistemology) and the particular ways of knowing that reality (methodology) (Guba, 1990). Although philosophical paradigms remain mainly hidden in research (Slife & Williams, 1995), they have a major influence on research practice (Creswell, 2009).

Ontology is known as the nature of existence and structure of reality (Crotty, 1998) and concerns our beliefs about the kind and nature of reality and the social world, i.e. what exists (Al-Saadi, 2014). Ontological assumptions are concerned with what constitutes reality (Scotland, 2012). Epistemology is associated with the 'nature' of knowledge and is a way of looking at the world and making sense of it (Crotty, 1998). Its assumptions are concerned with how knowledge can be created, acquired and communicated (Scotland, 2012). These assumptions greatly affect the decision a researcher makes about the kind of methods to use to reveal knowledge (Cohen *et al.*, 2007; Al-Saadi, 2014).

Every paradigm is based upon its own ontological and epistemological assumption (Scotland, 2012). For example, positivist epistemology is one of objectivism in that positivists discover absolute knowledge about an objective reality (Scotland, 2012). The ontological position of positivism is one of realism, which consists of the view that objects have an existence independent of the knower (Cohen *et al.*, 2007). A

fundamental assumption of the positivist paradigm that is associated with quantitative research is that there is an objective reality and a real world driven by real, natural causes (Polit & Beck, 2014). Sometimes referred to as the scientific method (Creswell, 2009), positivists or post-positivists maintain that social science enquiry should be objective and that real causes of social scientific outcomes can be determined reliably and validly (Johnson & Onwuegbuzie, 2004). The knowledge that develops through a post-positivist lens is based on observations and measurements of the objective reality that exists "out there" in the world (Creswell, 2009). Positivists see objectivity as a goal, while striving to be as neutral and unbiased as possible. However, within the positivist worldview, accusations such as narrowness and inflexibility of vision along with the inability to capture the full breadth of human experiences have been made (Polit & Beck, 2014).

The interpretive epistemology on the other hand is one of subjectivism or constructivism that is based on real world phenomena (Scotland, 2012). The ontological position of interpretivism is relativism that consists of the view that reality is subjective and is different from person to person (Guba & Lincoln, 1994; Scotland, 2012). Knowledge and meaningful reality are constructed in and out of interactions between humans and the world and are developed and transmitted in a social context (Crotty, 1998). Social constructionism shares the view of interpretivism and is typically seen as an approach to qualitative research (Creswell, 2009). Social constructivists hold assumptions that individuals seek understanding of the world in that they live and work (Creswell, 2009) and that reality is not a fixed entity but a creation of the participants in the research (Polit & Beck, 2014). Constructivist research is heavily focused on understanding human experiences through the careful collection and analysis of qualitative material that are narrative and subjective (Polit & Beck, 2014). Rather than research commencing with a theory, the researcher develops or inductively develops a theory or pattern of meaning (Creswell, 2009).

The constructivist researcher takes the position of relativism, assuming that knowledge is maximised when the distance between the researcher and participants in the study are minimised (Polit & Beck, 2014). Subjective meanings are developed, leading the researcher to search for the complexity of views rather than

narrowing meaning into a few categories or ideas (Creswell, 2009). Studies guided by constructivism are heavily focused on understanding the human experience as it is lived, through the careful collection and analysis of qualitative research (Polit & Beck, 2014).

Although the dichotomy between quantitative and qualitative data represents key methodological distinctions, some experts argue that the paradigms that underpin both qualitative and quantitative research are fundamentally incompatible (Polit & Beck, 2014). The resulting implication that they cannot and should not be mixed (Johnson & Onwuegbuzie, 2004) is known as the 'paradigm wars' (Lincoln & Guba, 1985). Pragmatism, however, rejects the position between the two opposing viewpoints and provides a philosophical basis for research that is not committed to any one system of philosophy or reality (Cherryholmes, 1992; Morgan, 2007; Creswell, 2009). Pragmatists place the research question above such philosophical considerations, providing a basis for a position that has been referred to as the dictatorship of the research question (Teddlie & Tashakkorí, 2006). Pragmatists believe the research question should drive the enquiry, its design and its methods (Polit & Beck, 2014). Pragmatism is a worldview associated with mixed methods research and can be viewed as a middle position that is essentially, outcome driven (Johnson & Onwuegbuzie, 2004). It draws on both the positivist belief system underlying quantitative research and the interpretivists' epistemology that qualitative studies espouse (Cohen *et al.*, 2011).

Pragmatism as a research paradigm does not get involved in the contentious metaphysical concepts of truth and reality, but accepts that there can be single or multiple realities (Creswell & Plano Clark, 2011). Pragmatism positions itself towards solving practical problems in the real world (Kaushik &, Walsh, 2019), and has emerged as a method of enquiry for more practical-minded researchers (Maxcy, 2003; Rorty, 2000; Creswell & Plano Clark, 2011). Rather than assigning post-positivism and constructivism to two separate ontological and epistemological sites, the pragmatic researcher focuses on the two contrasting approaches to enquiry (Morgan, 2014). A major factor underpinning pragmatism epistemology is that knowledge is always based on experience (Kaushik & Walsh, 2019). Pragmatist epistemology does not view knowledge as a reality (Rorty, 2000); instead that it is

created with a purpose to better manage one's existence and to take part in the world (Goldkuhl, 2012). It does not require adherence to one worldview but instead considers the worldview that is most appropriate to understand the research aims and objectives. Unlike positivism, where researchers proclaim that an objective knowledge is acquired by examining empirical evidence and hypothesis testing, or constructivism, where researchers propose that knowledge is relative and reality is too complex, pragmatists believe that the process of acquiring knowledge is a continuum rather than two opposing and mutually exclusive poles of objectivity or subjectivity (Goles & Hirschheim, 2000; Kaushik & Walsh, 2019).

Pragmatism was the most suitable worldview for this research study. In terms of epistemology, pragmatism allows the research question to drive the enquiry in order to acquire new knowledge. This approach was essential in order to study the complex vaccination practices of nurses. From an ontological perspective, pragmatism is not committed to any one reality and accepts the notion that there can be single or multiple realities. Having this freedom regarding the nature of reality was also essential in this research study. From a methodological perspective, the deductive and inductive approaches of enquiry were also essential to explore the concepts of this study from more than one worldview, since neither a qualitative nor quantitative approach alone was deemed adequate to address the complexity of the problem under enquiry (Creswell & Plano Clark, 2011).

3.3 Theoretical perspective

No research can ever be theory-or value-free (Sandelowski, 2010). It is common for researchers to explore the application of a theory that is derived from beyond their home domain to facets of their own research, and/or to use tools that have been developed in another discipline to support their own projects (Hall, 2003). Theories that focus on the factors that influence behavioural change and those that posit the existence of stages are rooted in the Lewinian tradition (Glanz *et al.*, 2008). During the 1940s and 1950s, researchers sought to learn how individuals make decisions about health and what determines their health-related behaviour (Glanz *et al.*, 2008). Since then, considerable progress has been made in understanding the determinants of individuals' health-related behaviour and ways to stimulate positive

behavioural changes in this regard. Value expectancy theories, which include the Health Belief Model (HBM) and the Theory of Reasoned Action (TRA) and its companion, the Theory of Planned Behaviour (TPB), have matured during this time (Champion & Skinner, 2008).

Social psychologists have developed theories to explain the antecedents to behaviour so as to prevent disease, and several nurse researchers have borrowed and used these theories (Villarruel *et al.,* 2001). Health behaviour consists of various activities that individuals make to maintain or improve their health regardless of their perceived health status or whether the behaviour actually achieves those goals (Sarafino, 2008). The role of behaviour in health has received much attention over the years due our knowledge of how individuals' behaviours influence their likelihood of developing illness or disease (Sarafino, 2008). Health behaviours shape the health and well-being of individuals and populations, and affect individuals' health. Although such behaviours are frequently discussed as individual-level behaviours, they can also be measured and summarised for groups, or even populations (Short & Mollborn, 2015).

There are many factors associated with individuals' decisions regarding preventive health-related behaviours. Many characteristics such as socio-economic status, gender, ethnicity and age have been known to be associated with preventive health-related behaviour patterns (Rosenstock, 1974). However, since health education cannot modify these characteristics, it was hypothesized that other potentially modifiable characteristics could be changed through educational interventions and thereby alter the pattern at a population level (Abraham & Sheeran, 2001).

This thesis adopted the HBM framework (Rosenstock, 1974; Janz & Becker, 1984) as its conceptual basis since it was deemed to provide the most appropriate framework to explore the wide range of factors that act as facilitators and barriers influencing nurses' decision regarding the influenza vaccine. The HBM has been used across many disciplines and the adoption of what is termed 'borrowed theory' is common in nursing and appropriate when placed in a nursing context (Villarruel *et al.,* 2001).

The HBM is an example of a middle-range theory which is specific to certain phenomena (Polit & Beck, 2014). Historically, the HBM was initially applied in preventive behaviours and later successfully extended to identify the correlates of health service usage and adherence to medical advice (Becker & Maiman, 1975). Many studies have also applied the HBM in an attempt to understand a broad range of preventative and health promotion behaviours (Janz & Becker, 1984) including influenza vaccination (Corace *et al.,* 2016). The HBM constructs have been reported to be robust in explaining influenza vaccination decision making in HCWs (Prematunge *et al.,* 2012). A recent systematic review of primary studies where behavioural change frameworks were used to improve HCWs' influenza vaccination rates found that most studies that applied a theory of behavioural change to understand influenza vaccination were mainly based on the HBM model with many of its variables identified as modifiable factors predicting vaccination among HCWs (Corace *et al.,* 2016). Among the studies included in this systematic review, the majority of studies (60%) applied the HBM with only two studies using the TPB (Corace *et al.,* 2016).

The HBM emphasises the function of beliefs and attitudes in individuals' decision-making process (Naidoo & Wills, 2016). Although psychological frameworks have been used to predict HCWs' vaccination behaviours (Godin *et al.,* 2010; Johansen *et al.,* 2012; Cornally *et al.,* 2013; Real *et al.,* 2013), the HBM constructs were identified as the most suitable to provide this study's theoretical framework in identifying the barriers and facilitating factors associated with nurses' decisions to have the seasonal influenza vaccine. The TPB, which originally evolved from the Theory of Reasoned Action in 1980 (Fishbein & Ajzen, 1975), was considered but deemed less suitable as it adopts more of a cognitive approach to explaining behaviour and centres on individuals' attitudes and beliefs. The TPB is also not considered useful or effective in relation to planning and designing the type of intervention that will result in behavioural change (Webb *et al.,* 2010). The key component to the TPB is behavioural intent. According to the theory, behaviour that is volitional is determined by people's intention to perform that behaviour. These intentions are affected by attitudes towards the behaviour, subjective norms (i.e. perceived social pressure to perform or not perform the behaviour) and

perceived behavioural control (i.e., anticipated ease or difficulty of engaging in the behaviour) (Polit & Beck, 2014).

3.3.1 Background to the HBM

The HBM (Hochbaum, 1958; Rosenstock, 1974; Janz & Becker, 1984) was developed in the 1950s by a group of social psychologists according to the value-expectancy theory (Rosenstock, 1974) to explain and predict behaviours in health contexts. Initially, Hockbaum (1958) studied perceptions about whether individuals believed they were susceptible to tuberculosis and their beliefs about the personal benefits of early detection (Hockbaum, 1958). Since its development, the HBM has been one of the most widely used conceptual frameworks in health-related behaviours and has been a guiding framework for health-related interventions (Champion & Skinner, 2008). The HBM contains several primary concepts that predict why people will take actions to prevent, to screen for, or to control illness conditions (Champion & Skinner, 2008). According to the model, these individuals' health-related behaviours are influenced by their 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).

Threat perceptions are based on two beliefs: the perceived susceptibility and the perceived severity of the illness for the individual (Conner *et al.*, 2011). Therefore, individuals are most likely to follow a particular health action if they believe they are susceptible to a condition they consider to be serious and that the benefits taken to counteract the health threat outweigh the costs of the action (Conner *et al*., 2011).

Originally, the HBM consisted of four main constructs including perceived susceptibility and perceived severity of the disease and the perceived benefits and perceived barriers (Rosenstock, 1974). By the 1980s, work on locus of control by Rotter (1966) and Wallston *et al.* (1978), and, more recently on perceived self-efficacy by Bandura (1977) had recognised perceived control as an important determinant of health behaviour (Rosenstock, 1974; Rotter, 1966; Wallston *et al.*, 1978). Janz & Becker (1984) also acknowledged its importance but initially suggested that it might be thought of as a component of perceived barriers rather than an additional theoretical construct (Janz & Becker, 1984). However,

Rosenstock (1988) later acknowledged Janz and Becker's (1984) underestimations of the importance of self-efficacy and a revised HBM amalgamated the constructs of self-efficacy and later cues to action (Rosenstock *et al.,* 1988). Self-efficacy refers to the expectations about an individual's own competence to perform the behaviour (Rosenstock 1974; Rosenstock *et al.,* 1988) and cues to action are assumed to include a diverse range of triggers to the individual taking action that may be internal or external to the individual (Janz & Becker, 1984). An individual's perception of the presence of cues to action would be expected to prompt the adoption of the health behaviour if the individual already holds key beliefs favouring the action (Conner *et al.,* 2011). Other constructs, such as health motivation and knowledge, have been added to the model (Janz & Becker, 1984).

3.3.1.1 Perceived threat (susceptibility and severity)

Perceived susceptibility refers to an individual's subjectively perceived level of risk or vulnerability of contracting an illness or condition. If the individual's perceived level of risk is high, the likelihood of engaging in a health-related behaviour may increase (Adams *et al.,* 2014). Perceived seriousness includes beliefs about the disease itself and broader impacts of the disease on functioning in work and social roles (Janz & Becker, 1984). Perceived severity also includes an assessment of the severity of a health problem and the potential consequences as a result of contracting the illness or condition (Janz & Becker, 1984). The combination of perceived susceptibility and perceived severity constitutes a perceived threat to the individual (Adams *et al.,* 2014). The health belief model predicts that higher perceived threat leads to a higher likelihood of engagement in health-related behaviour (Janz & Becker, 1984).

3.3.1.2 Perceived benefits

This dimension refers to an individual's perception of the benefit of undertaking a specific behaviour to reduce their risk of disease or minimise their susceptibility to, or severity of, the disease. According to Janz and Becker (1974), an individual who is sufficiently threatened would not be expected to accept the recommended health action unless they perceived it as feasible and efficacious. Whether this perception leads to a behavioural change is influenced by the person's belief regarding the perceived benefits (Champion & Skinner, 2008).

3.3.1.3 Perceived barrier

Perceived barriers are identified as an individual's belief that their participation in health-related behaviour is restricted due to physical or financial factors (Adams *et al.,* 2014). Therefore, the potentially negative aspect of a particular health action may act as a barrier or impediment to undertaking the recommended behaviour (Janz & Becker, 1984). A non-conscious cost-benefit analysis occurs wherein individuals weigh the action's expected benefits with its perceived barriers (Champion & Skinner, 2008).

3.3.1.4 Self-efficacy

Self-efficacy is the belief that one can successfully perform the behaviour required to produce the outcome (Bandura, 1997). Therefore, it is the individual's belief or confidence that he or she can perform a specific behaviour or take a specific action (Janz & Becker, 1984). If an individual does not believe in his or her own ability, then the individual will not be likely to pursue the action (Adams *et al.,* 2014).

3.3.1.5 Cues to action

The HBM proposes that a cue to action or trigger is necessary to prompt engagement in health-promoting behaviours (Janz & Becker, 1984). This cue might be internal (i.e., symptoms) or external (e.g. mass media, communication, interpersonal actions).

3.3.1.6 Modifying variables

Diverse demographic, sociopsychological and structural factors may influence perceptions of susceptibility, severity, benefits and barriers and indirectly influence health-related behaviours (Champion & Skinner, 2008). Other variables identified as modifiable factors are used in the model to assist explanations regarding an individual's choice of action. In addition, cues to action and modifying factors influence perceptions of severity, susceptibility benefits and barriers and self-efficacy (Adams *et al.,* 2014).

According to the HBM, 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, to screen for or improve health behaviours (Luquis & Kensinger, 2019). Figure 3.1 illustrates the constructs of the HBM.

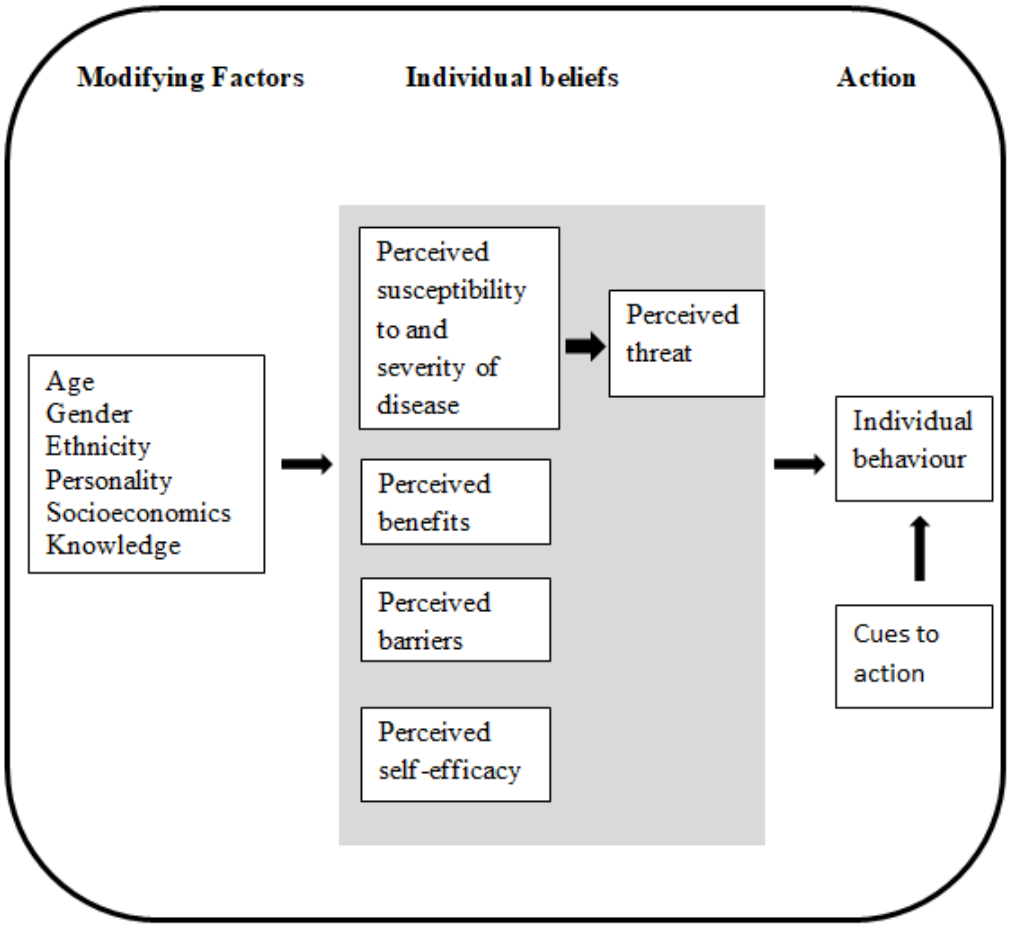

Figure 3.1 Health Belief Model (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988)

3.4 Inductive and deductive reasoning

This study was guided by both a deductive and inductive logic. In a quantitative study, researchers often start with a theory using deductive reasoning, making predictions about how a phenomenon would behave in the real world if the theory were true (Polit & Beck, 2014). Post-positivists see human knowledge as speculative and, therefore, not based on unchallengeable, rock solid foundations. This often results in the application of a deductive approach that relies on a series of steps to reach specific conclusions based on general premises (Wheeldon & Åhlberg, 2012). In general, quantitative research seeks generalizability through controlled value free (or value neutral) processes (Wheeldon & Åhlberg, 2012).

However, a main critique of this approach is that they can be statistic-dependent, can inflate the importance of mathematical averages, and may not capture the complexity associated with human behaviour (Wheeldon & Åhlberg, 2012). Some approaches, by focusing solely on numeric information, miss the depth and detail participants themselves assign to phenomena (Wheeldon & Åhlberg, 2012). The deductive approach in this mixed methods study was guided by the HBM and was fundamental to measuring nurses' level of knowledge, risk perception and health beliefs, and vaccination practices. This approach was essential to explain the relationship between the concepts and nurses' influenza vaccination practices.

Inductive logic, by contrast, takes a "bottom-up" approach, using the views of the participants to build broader themes and generate a theory interconnecting the themes (Creswell & Plano Clark, 2011). Therefore, in qualitative studies, information from study participants is used inductively to develop a theory rooted in the participants' experience (Polit & Beck, 2014). Qualitative research seeks to understand or make sense of the world based on how individuals experience and perceive it (Wheeldon & Åhlberg, 2012).

Qualitative researchers have struggled with a persistent pressure for methodological flexibility and structure (Holloway & Todres, 2003), and there is increasing debate around research studies that do not fit within established methodologies (Caelli *et al.*, 2003). Generic (also known as 'descriptive') qualitative research, used in the qualitative phase of this study, is not guided by the explicit set of philosophical assumptions inherent in the more established qualitative methodologies (Caelli *et al.*, 2003) such as the "big three" – phenomenology, grounded theory, and ethnography (Richards & Morse, 2007). However, it does offer an opportunity for researchers to play with these boundaries, to use the tools that established methodologies offer and to develop research designs that fit their epistemological stance, discipline, and research question (Kahlke, 2014). According to Merriam (2002), generic qualitative studies, like all qualitative studies, seek to understand how people interpret, construct, or make meaning from their world and their experiences. These studies are epistemologically constructivist and theoretically interpretive, and focus on how people interpret their experiences and construct their worlds, and what meaning they attribute to their experiences (Merriam, 2009). The

generic approach was used in the qualitative phase of this study because the qualitative phase was not guided by an explicit set of philosophical assumptions in the form of one of the known qualitative methodologies (Caelli *et al.,* 2003). Generic research are studies that epitomize the characteristics of qualitative research by simply seeking to discover and understand a phenomenon, a process, or the perspectives of the worldviews of those involved rather than focusing on culture as does ethnography, or the building of theory as does grounded theory (Merriam, 2009). This choice was consistent with the pragmatic worldview of the researcher and the study aims.

Mixed methods research represents an important departure from either assumption of quantitative or qualitative approaches because it values both methods depending on the type of research question under investigation. Within pragmatism, the researcher will typically employ an abductive reasoning process that moves back and forth between an inductive and deductive reasoning process (Morgan, 2007). Abductive reasoning can be understood as a process that values both deductive and inductive approaches but relies principally on the researcher's expertise, experience and intuition (Wheeldon & Åhlberg, 2012).

3.5 Mixed methods methodology

Mixed methods research collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative methods in a single study of enquiry or series of studies investigating the same phenomenon (Teddlie & Tashakkorí, 2006). The concept of mixing different methods originated in 1959 and, since then, has gained significant popularity as research methodologies have evolved and developed (Creswell, 2009). In the late 1970s, the term triangulation was first introduced to the methodology and was identified as a combination of methodologies in the study of the same phenomenon in order to decrease the bias inherent in using a single method (Morse, 1991).

Mixed methods research combines elements of qualitative and quantitative research for the purpose of increasing the breadth and depth of understanding and corroboration (Johnson *et al.,* 2007). Quantitative data can support qualitative research by identifying representative sample, while the qualitative data can further

clarify the quantitative research by assisting with interpreting, describing and validating results during data analysis (Doorenbos, 2014). Mixed methods research also offers the ability to resolve the issue of methodological dominance and can provide a rich and comprehensive picture of the overall issue under investigation (Creswell *et al.*, 2011). Therefore, one of the main goals of mixed methods research is not to replace either quantitative or qualitative approaches but rather to draw from the strengths and minimise the weaknesses of both approaches by ensuring the weakness of one approach is offset by the strength of the other (Creswell *et al.*, 2011). The five different purposes for mixing research methods include triangulation, complementarity, development, initiation and expansion (Greene *et al.*, 1989; Schoonenboom & Johnson, 2017). The literature describes four main mixed methods research designs: the convergent design, the embedded design, the explanatory design, and the exploratory design. Within each of these designs, a number of variations exist including timing, weight, mixing and theoretical perspective (Creswell, 2009; Creswell *et al.*, 2011).

In mixed methods studies, the timing of data collection is categorised as concurrent or sequential (Morse, 1991). In the first phase, either quantitative data (QUAN) are collected, followed by qualitative (QUAL) data. In addition to selecting the timing of the data collection, consideration must be given to the relative weight or priority of the two methods; the researcher decides whether both methods will have equal priority or if one method will have greater priority than the other (Morgan, 1998). The theoretical worldview that is used should determine the weight allocation and depends on whether the theory that drives the research is developed inductively from it or used deductively (Morse, 1991). If the research is driven inductively and the theory is developed through qualitative research and then complemented by quantitative methods, the notation QUAL+quan is used to show that the qualitative phase of the study has taken priority. If the project is deductive and driven by *a priori* theoretical framework, with quantitative methods taking precedence and complemented by qualitative methods, the notation QUAN+qual is used (Morse, 1991; Polit & Beck, 2014). Therefore, a post-positivistic worldview calls for a quantitative priority, a naturalistic worldview calls for a qualitative priority and a pragmatic worldview calls for either equal or unequal weighing, depending on the research question (Creswell & Plano Clark, 2011).

3.5.1 Data integration

A rigorous and strong mixed method design also addresses the decision of how to mix the data (Creswell, 2009). This mixing can occur at several stages including during the data collection, the data analysis and the interpretation phases. Although much of the literature refers to integration as the mixing of qualitative and quantitative data, it is defined as the bringing together of the quantitative and qualitative components of a study (O'Cathain *et al.,* 2010). Integration is essentially the point where quantitative and qualitative phases connects, and is referred to as the mixing in a mixed methods study (Doyle *et al.,* 2016).

Data integration is an important aspect of mixed methods research and its absence can minimise the amount of knowledge generated from both studies (O'Cathain *et al.,* 2010). Without integration, the knowledge yield is equivalent to that from a qualitative study and a quantitative study undertaken independently (O'Cathain *et al.,* 2010). Integration adds value and can occur at one or more stages during the research process - from devising the research question through to writing it up, including the stage of research design, sampling, analysis and interpretation of the results (O'Cathain *et al.,* 2007a). Data integration can be conducted using a broad spectrum of approaches and techniques with the aim to blend, weave, combine, and ultimately synthesise two or more types of data (Johnson *et al.,* 2017). During analysis, techniques for integration range from discussing separately generated results from different phases of a study together as part of the conclusion, to synthesis of data from these different phases, to combination of data sources or conversion of data types to build a blended set of results (Bazeley, 2012).

Data transformation or conversion as a technique for data integration includes transforming qualitative textual data into quantitative numerical data, or vice versa (Johnson *et al.,* 2017). In addition to this technique, a matrix or joint display can be used to visually present qualitative and quantitative data in parallel (Johnson *et al.,* 2017). Other common integration techniques include following a thread that involves identifying key themes and questions that require further exploration (O'Cathain *et al.,* 2010), and triangulation of data sets, which includes checking for agreement or disagreement between findings examining the same phenomena.

(Teddlie & Tashakkorí, 2006; O'Cathain *et al.*, 2007b; Bazeley, 2009; O'Cathain *et al.*, 2010; Creswell *et al.*, 2011; Bazeley, 2012).

3.6 Research design

This thesis consists of three manuscripts representing three studies. Study one employed a sequential explanatory mixed methods research design. Study two employed a descriptive qualitative methodology and reports findings from a subset of participants' data exploring nurses' views in relation to mandatory vaccination for seasonal influenza. Study three consists of a systematic review that aimed to determine interventions that are effective in increasing the seasonal influenza vaccine uptake among nurses.

This mixed methods design was chosen as it is best suited to explaining and interpreting quantitative results by collecting and analysing follow-up qualitative data (Creswell, 2009). Quantitative data obtained by surveys rarely probe deeply into the complexities of human behaviour and feelings (Polit & Beck, 2014). Within this mixed method design, quantitative and qualitative research strands were implemented in sequence with the purpose of using the follow-up qualitative data to elaborate, explain in depth and confirm the quantitative results (Clark & Ivankova, 2016). Figure 3.2 illustrates Creswell's mixed method sequential explanatory model. The presentation of using this design to this thesis (adapted from Creswell, 2009; Figure 3.2) is also displayed in Figure 3.3.

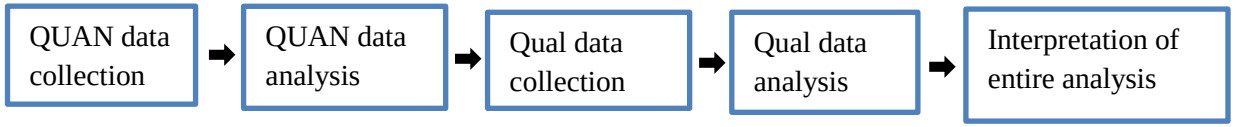

Figure 3.2 Explanatory design: follow up explanations model (Creswell & Plano Clark 2007)

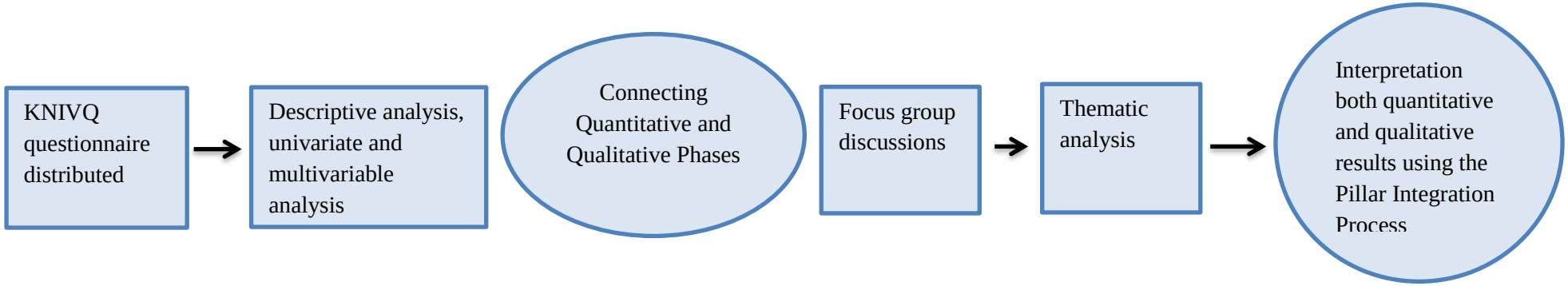

Figure 3.3 Visual model for sequential explanatory mixed methods design (adopted from Creswell & Plano Clark 2007, Ivankov & Creswell 2006)

Although, the type of mixing in this study could be considered developmental as the results from the quantitative phase were used to inform the qualitative phase (Clark & Ivankova, 2016), the main purpose of using mixed methods research was complementarity. i.e., that both approaches would complement each other (Polit & Beck, 2014). Complementarity aims to obtain conclusions that are more meaningful and complete by using the two methods to get results that enhance coverage and clarify and/or supplement each other to address the complexity of a topic (Clark & Ivankova, 2016).

Both methods in this research study were assigned equal weight. The rationale for equal weight was that they are in continuous interaction and the outcomes they produce are integrated during, and at the end of, the research process (Schoonenboom &Johnson, 2017).

This method was chosen for this thesis as the quantitative findings were unable to provide detailed information on the subjective attitudes and vaccination behaviours of nurses. It also allowed a more comprehensive understanding by using a methodology that purposefully set out to investigate different components of the same phenomenon (Greene, 2007) by elaborating, enhancing and clarifying the results of one method with the results from the other (Greene *et al.*, 1989). Therefore, it was anticipated that the results from the quantitative survey would provide a greater breadth of information and the qualitative findings would add greater depth while elaborating and clarifying results from the survey findings. Table 3.1, below, displays the mixed methods research designed and employed in this thesis.

Table 3.1 Mixed methods strategy

Timing	Sequential
Weight	Equal (QUAN + QUAL)
Mixing	Connected and integration
Theoretical perspective	Pragmatic

Morse's (1991) notation system

3.6.1 Quantitative study

The first phase of this study used a quantitative research design. Quantitative research is a broad umbrella term for research that uses methods that collect evidence that can be transformed into numeric data and are based upon a positivist position (Gerrish & Lathlean, 2016). Quantitative research is used to address various types of research questions since different designs are appropriate for different questions (Polit & Beck, 2014). Data from quantitative studies tend to be quantifiable and structured with the same information gathered from all participants in a comparable, pre-specified way (Polit & Beck, 2014).

A survey or questionnaire is used to obtain information on the current status of phenomena and describe what exists with respect to variables or conditions (Sim & Wright, 2000). Surveys are particularly useful to gather self-reported information about people's actions, knowledge, intentions, opinions and attitudes, and are one of the most common approaches to data collection in nursing studies with one of their main advantages being their flexibility and broad scope (Polit & Beck, 2014).

The aim of the quantitative phase in this study was to examine the relationship between nurses' knowledge, risk perception, health beliefs and vaccination behaviours. The King's Nurses' Influenza Vaccination Questionnaire (KNIVQ) (Zhang *et al.*, 2012a) was used to collect the data. Permission was granted to use the KNIVQ which consisted of six parts that 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.

3.6.1.1 Sample

Between September 2017 and February 2018, a convenience sample of qualified nurses attending mandatory on-site training at two large hospital sites (referred to as site A and site B) was invited to participate in the study. At the time of recruitment, site A and site B had a vaccine uptake of <40% and >40% respectively for nurses. Mandatory training was chosen to recruit participants as this ensured nurse's from different specialities and grades would be invited to participate. The questionnaire was distributed in paper format to qualified nurses attending moving and handling and cardiopulmonary resuscitation (CPR) training in site A and moving and handling in site B.

3.6.1.2 Data collection

This questionnaire 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 *et al.*, 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 during the previous 12 months, and to gauge their future vaccine intentions. Factors associated with vaccine practices were collected using two open-ended questions that identified reasons for and against vaccination. The final section collected the demographic characteristics of each nurse.

3.6.1.2 Pre-test/pilot

Prior to the initial mixed methods research study, the questionnaire was pre-tested to identify any problems and assess the survey's overall usability and acceptability in the Irish context. The questionnaire was disseminated at a venepuncture and cannulation training day in a small hospital located in the east of Ireland.

A total of 15 nurses were registered to attend the training day, of which 12 attended. Of these, 11 completed the questionnaire (91.6% response). The average time completing the questionnaire was acceptable and took no long than 10 minutes to complete per participant. Open discussion in relation to the overall structure of the questionnaire was positive. As a result of the pilot, minor changes were made to the demographic section to reflect current speciality of work, and the variable "other speciality" was added to the form.

3.6.1.3 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, where 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 to identify factors associated with future vaccine intentions. Odds ratios (ORs) were calculated with 95% confidence intervals (CIs), with 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.

3.6.2 Qualitative study

Phase two of this sequential explanatory mixed methods study used a generic/descriptive qualitative design. The participants in this phase were recruited from the larger group of participants in phase one. The word 'qualitative' implies an emphasis on the qualities of entities and on processes and meanings that are not experimentally examined or measured (Denzin & Lincoln, 2000). The collection of data during qualitative research provides the opportunity to potentially clarify the dimensions of a complicated phenomenon since findings are typically grounded in the real-life experiences of people (Polit and Beck 2014). The subjectivity associated with using this approach where the researcher and the research are closely intertwined has its own challenges, so it is essential that they are addressed.

Several approaches are used to collect qualitative data, focus group discussions were chosen over other research methods for this phase. Although face-to-face interviews have the capacity to describe, explain and explore issues from the perspective of the participant, a focus group is a form of group interview that collects qualitative data through group interaction on a topic the researcher has determined (Gerrish & Lathlean, 2016). Several reasons influence the choice of data collection for this phase. Firstly, the interactions that occur among participants in focus groups can yield important data (Morgan, 1997). Secondly, while focus groups share some assumptions with other qualitative methods, they are unique on account of this social interaction that occurs between participants, and also between the group moderator and participants (Rabiee, 2004). A distinct feature of focus group discussions is the dynamics of the group, and hence the type and range of data generated through the social interaction are often deeper and richer than those obtained in one-to-one interviews (Rabiee, 2004). This was considered to be important in gathering views and experiences of nurses from all nursing grades. The

ability to observe the extent and nature of participants' agreement and disagreement is a unique strength of focus group discussions (Morgan, 1997).

Therefore, this method of data collection provides access to forms of data that are not easily obtainable using other methods (Morgan, 1997). It involves engaging a small number of people in an informal group discussion focused around a particular topic (Wilkinson, 2004; Onwuegbuzie *et al.,* 2009). There are numerous benefits in undertaking focus group discussions as a method of qualitative focus group discussions. Firstly, they are less threatening to research participants, and the socially orientated environment in which they are undertaken encourages participants to discuss perceptions, ideas, opinions and thoughts (Kreuger & Casey, 2014). They are also economical, fast, and an efficient method for obtaining data from multiple participants (Kreuger & Casey, 2014). In addition, the sense of belonging to a group can increase the participants' sense of cohesiveness and allow them to feel safe and share information more openly (Onwuegbuzie *et al.,* 2009). This method of data collection was considered appropriate to the research question as it ensured participants' interaction and the freedom to delve deeply to obtain true meaning.

3.6.2.1 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.

3.6.2.2 Data collection

Each focus group was conducted face-to-face in a quiet training room in both hospitals. The results of the questionnaire informed a topic guide, which 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). Two additional questions were added to the end of this topic guide to explore nurses' views regarding mandatory vaccination policy. These questions were exploratory only and not based on the theoretical framework that guided the other questions. These two questions were best placed at the close of the focus groups because the discussion that preceded would have potentially informed the

participants' responses. An assistant moderator attended each focus group to help clarify and add contextual details (Mack *et al.*, 2005). All focus groups were audio recorded with permission and transcribed verbatim by the first author. Pseudonyms were assigned to ensure confidentiality.

3.6.2.3 Qualitative data analysis

Qualitative analysis involves the organisation and interpretation of narrative data for the purpose of discovering important underlying themes, categories or patterns (Polit & Beck, 2014). The process of analysing data in qualitative research is not necessarily linear or even predictable as it does not follow the traditional route of hypothesising (Gerrish & Lathlean, 2016). Insights cannot emerge until the researcher becomes completely familiar with the data (Polit & Beck, 2014).

The analysis of qualitative data usually begins with a search for broad categories or themes (Polit & Beck, 2014), and there are many approaches to analysing qualitative data. A theme brings meaning and identity to a current experience and captures the nature of the experience into a meaningful whole (DeSantis & Ugarriza, 2000). The search for themes involves not only discovering commonalities among participants but also seeks variation (Polit & Beck, 2014). During this process, iteration is necessary and the researcher derives the themes, goes back to the narrative material with the theme in mind to see if there is a true fit, and then refines the theme (Polit & Beck, 2014).

Thematic analysis was chosen for analysing the qualitative data in this thesis. It is a method for identifying, analysing and reporting patterns or themes within the data and offers an accessible and theoretically-flexible approach to qualitative data analysis (Braun & Clarke, 2006). This method is essentially independent of theory and epistemology, and can be applied across a range of theoretical and epistemological approaches. This freedom associated with thematic analysis is what makes it unique and different to other analytical methods and is the reason why it was chosen to analyse the data in this study. Although grounded theory and interpretative phenomenological analysis (IPA) also seek to identify patterns or themes, they are theoretically confined (Braun & Clarke, 2006). Through the theoretical freedom of thematic analysis, the method provides a flexible and useful

research tool that can provide a rich and detailed account of the data (Braun & Clarke, 2006). There are six phases to thematic analysis: familiarisation with the data; generating initial codes; searching for themes; reviewing the themes; defining and naming themes and producing the report (Braun & Clarke, 2006; Braun & Clarke, 2020).

With thematic analysis, themes within the data are identified in an inductive, theoretical or deductive way (Braun & Clarke, 2006). The qualitative phase in this thesis used an inductive approach where the themes were data-driven (Braun & Clarke, 2006). Although there are two 'levels' at which the themes are identified, the themes in this thesis were generated at a semantic level. With a semantic approach, the themes are identified within the explicit or surface meaning of the data, which means the researcher is not looking for anything beyond what the participants have said (Braun & Clarke, 2006). In contrast, a latent level goes beyond the semantic content of the data and identifies the underlying ideas, assumptions, conceptualisations and ideologies that are theorised as shaping or informing the data (Braun & Clarke, 2006). This approach to the analysis of the data was consistent with the pragmatic worldview of the research and the chosen methodology.

3.6.3 Method used for data integration

An adapted version of a joint display called the Pillar Integration Process (PIP) (Johnson *et al.,* 2017) was used to integrate the findings at the interpretation stage. This version was chosen because the insight from both methods was essential to answer the overall research questions. Although the PIP has many similarities with other techniques for integrating both quantitative and qualitative data, it's main strengthen is that the PIP provided a systematic, transparent, step by step flexible approach to integrating data (Johnson *et al.,* 2017). The repetition in listing and matching during the PIP reflects the technique of following a thread, however following a thread does not specify particular steps and focuses heavily on early identification of themes. In comparison to transformation, transformation is necessary in PIP to formulate the central pillar, however transformation is a technique in itself and researchers may move directly to interpretating data. Triangulation and the PIP are similar as they both allow agreement and disagreement of the two datasets to be identified, however the PIP explores and expands findings, generating new insights that was in line with the study aims and objectives (Johnson *et al.,* 2017). Recognised limitations include the fact that the PIP requires knowledge in two approaches to data collection and analysis (Johnson *et al.,* 2017). All behavioural data analysis requires a combination of empiricism and interpretation, and it can be argued that both quantitative and qualitative approaches, components, data, and/or strategies for analysis are necessary to adequately understand individual, group or societal behaviour (Bazeley, 2012). Figure 3.4 illustrates the stages of integration in this study.

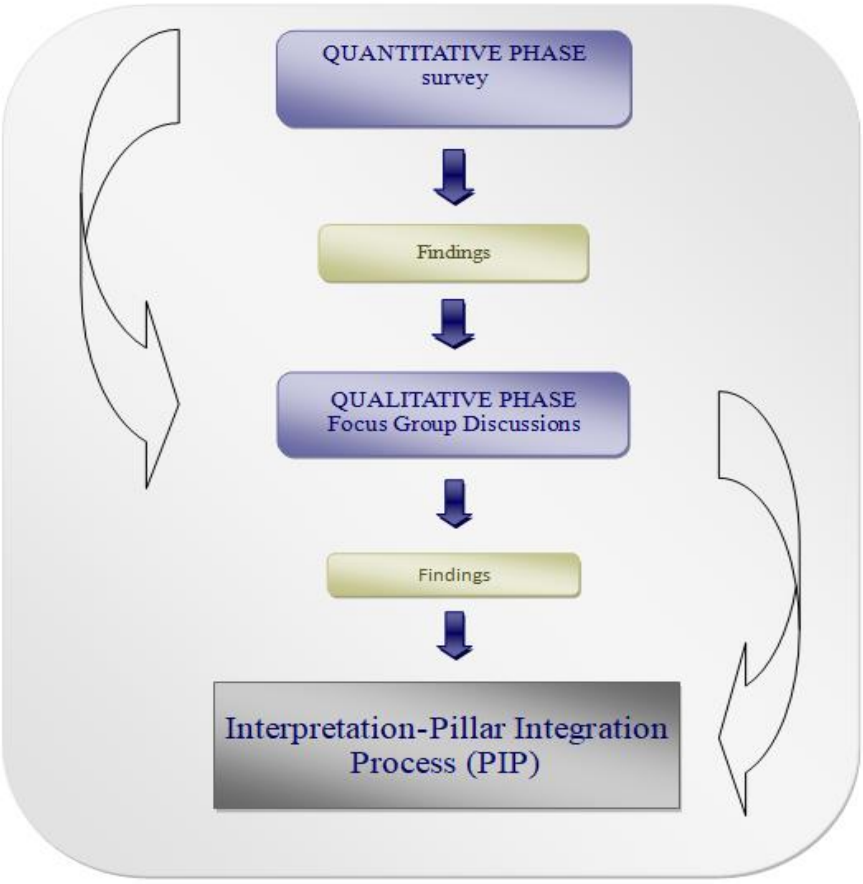

Figure 3.4 Stages of integration in this study

3.6.4 Systematic review

A systematic review is defined as "*the rigorous search, selection, appraisal, synthesis and summary of the findings of primary research in order to answer a specific question"* (Parahoo, 2006: pg134). The term 'systematic review' is sometimes referred to as secondary research because, unlike primary research, it does not collect new information but makes use of the findings from previous research (Parahoo, 2006). The process of conducting a systematic review methodically integrates research evidence about a specific research question using careful sampling and, data collection procedures that are clearly defined in advance in a protocol (Polit & Beck, 2014). The final study in this thesis consisted of a systematic review to identify and synthesise rigorous, high-quality primary research studies that explored the effectiveness of interventions that increased the influenza vaccine uptake among nurses.

The Cochrane Effective Practice and Organisation of Care (EPOC) group conducts, supports and publishes systematic reviews of the global evidence to guide health system decision-making to improve health services and population health outcomes (Effective Practice and Organisation of Care, 2015). The EPOC taxonomy (2015) of health systems interventions was followed and directed this systematic review (Effective Practice and Organisation of Care, 2015). This was chosen as it provides a standardised framework and provides criteria to improve the quality of reporting of research (Mazza *et al.,* 2013). The EPOC checklist was created for the purpose of assisting reviewers to select papers for inclusion in a systematic review. A review protocol was developed a priori and published in Prospero which allowed peer review and commentary on this systematic review. The aim of the protocol, that guided this systematic review, was to describe the rationale, hypothesis and planned methods for conducting the review (Moher *et al.,* 2009). The following section will outline the methods of conducting the systematic review in this thesis (chapter 6, section B).

3.6.4.1 Why is it important to do this review?

Multiple systematic reviews have been conducted that evaluate the effectiveness of interventions among all HCWs however, the effectiveness of these interventions are unclear for nurses. It is acknowledged in the literature that HCWs are not a homogenous group and that they have different attitudes to vaccination practices compared to other categories of HCWs. Nurses are also known to respond to interventions that aim to increase influenza vaccine uptake rates differently. As nurses' vaccination uptake rates remain consistently low, this review is essential to identify what interventions are effective at increasing seasonal influenza vaccination uptake rates of nurses who are the largest workforce of our health service. To my knowledge, this is the first systematic review reporting the effectiveness of interventions in increasing seasonal influenza vaccination uptake among nurses.

3.6.4.2 Objective

The objective of this systematic review is to determine the effectiveness of interventions in increasing seasonal influenza vaccination uptake among nurses

3.6.4.3 Methods

All methods, including the review objectives of the review and types of included studies were determined a *priori.*

3.6.4.3.1 Criteria for considering studies for this review

3.6.4.3.1.1 Types of studies

Randomised trials[1], non-randomised trials[2], controlled before and after studies[3], interrupted time series studies[4] and repeated measure studies[5] were identified as eligible for inclusion (Effective Practice and Organisation of Care, 2015). Studies that reported all other vaccines including studies relating to a pandemic vaccine were excluded.

[1] An experimental study in which people are allocated to different interventions using methods that are random. http://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/EPOC%20Study%20Designs%20About.pdf

[2] An experimental study in which people are allocated to different interventions using methods that are not random. http://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/EPOC%20Study%20Designs%20About.pdf

[3] A study in which observations are made before and after the implementation of an intervention, both in a group that receives the intervention and in a control group that does not. http://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/EPOC%20Study%20Designs%20About.pdf

[4] A study that uses observations at multiple time points before and after an intervention (the 'interruption'). The design attempts to detect whether the intervention has had an effect significantly greater than any underlying trend over time. http://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/EPOC%20Study%20Designs%20About.pdf

[5] An Interrupted time series (ITS) study where measurements are made in the same individuals at each time point. http://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/EPOC%20Study%20Designs%20About.pdf

3.6.4.3.1.2 Types of participants

Qualified nurses working in any healthcare setting

3.6.4.3.1.3 Types of interventions

Intervention

For the purpose of this systematic review the intervention may consist of either single or multiple components.

Any intervention or strategy implemented with the aim of increasing seasonal influenza vaccination uptake rates among nurses. The US health care advisory committee on immunisation practices (Pearson *et al.,* 2006) recommend five components to improve HCWs immunisation rates. These include:

- Educational interventions
- Access to the vaccine
- Staff incentives
- Champions and role models
- Leadership and management
- Monitoring and feedback incorporated in single or multifaceted interventions

Comparator intervention

Comparator intervention(s) are limited to no intervention or to another intervention. Interrupted time series studies do not use a control group.

3.6.4.3.1.4 Types of outcome measures

Primary outcome

The primary outcome measure in this review is a change in the seasonal influenza vaccination uptake rate of nurses

Secondary outcome

There is no secondary outcome(s) in this review

3.6.4.3.2 Search methods for identification of studies

The following electronic databases were searched. MEDLINE Ovid (1946 to 2020), EMBASE Ovid (1974 to 2020), Cinahl (EBSCO Host, 1937 to 2020) and Scopus. The Database of Abstracts of Reviews of Effects (DARE), Cochrane Database of Systematic Reviews and Cochrane Central Registry of Controlled Trials (CENTRAL) will also be searched. The initial search will be performed in Medline using a combination of controlled vocabulary and free-text terms to ensure maximum retrieval. The search terms will then be adapted for EMBASE, Cinahl, Scopus, DARE and CENTRAL. No limits will be applied to publication date. The initial search will not bet limited to English language only; however, this criteria will be applied at full text screening stage. In order to identify further studies of interest, reference lists of all relevant studies and systematic reviews will be tracked. Authors of trials will be contacted for additional information where relevant. The following websites will also be searched for grey literature: World Health Organization (WHO), European Centre for Disease Prevention and Control (ECDC), Centre for Disease Prevention and Control (CDC) and Public Health England (PHE).

3.6.4.3.3 Data collection and analysis

Data collection and analysis methodology were informed by the EPOC taxonomy (2015) of health systems interventions. Citations identified on the search were imported and merged into Endnote library and duplicates removed. This file was then imported to Covidence software for systematic reviews.

3.6.4.3.3.1 Selection of studies

All results were screened independently by title and abstract and then by full text by at least two reviewers (GG, MD, JM, PF). Any conflicts were resolved by discussion.

3.6.4.3.3.2 Data extraction and management

A modified version of the EPOC data extraction template was used for extracting the data (Effective Practice and Organisation of Care, 2015). This was conducted by two reviewers independently. A third colleague, my supervisor (GG) was also available to resolve any disagreements if they arose.

3.6.4.3.3.3 Assessment of risk of bias in included studies

Biases are factors that create distortions and that undermine the researchers' efforts to capture and reveal truth in the real world (Polit & Beck, 2014). The EPOC risk of bias criteria was used to assess the risk of bias for studies with a separate control group in this systematic review (Effective Practice and Organisation of Care, 2015). The risk of bias was assessed using the six domains of trial methodology: random sequence generation; allocation concealment; blinding of participants; incomplete outcome; and selective reporting and other bias. These six domains were assessed and classified as having high, low or unclear risk of bias. Although there were no ITS studies identified for inclusion in this systematic review, it was planned that for assessing the risk of bias in non-randomised studies such as in ITS studies as recommended by EPOC, the Risk of Bias in Non-Randomised Studies of Interventions (ROBINS-I) would have been used. Many of the features of ROBIN-I are shared with assessing the risk of bias in randomised trials (Cochrane, 2017).

3.6.4.3.3.3.1 <u>Selection bias (sequence generation, allocation concealment)</u>

Bias tends to make the recorded measure consistently above or below the true value (Daly, 2000). There are many factors that contribute to bias in a study such as the study design being poor, or because a study is poorly conducted. Selection bias occurs at the point of allocating participants to groups at the beginning of a trial (Ryan, 2013) and in order to avoid selection bias, the process of random allocation should be concealed from the person(s) recruiting participants into the study if possible. Methods of randomisation, which minimise selection bias, have two components. These include sequence generation and allocation concealment (Gerrish & Lathlean, 2015).

Sequence generation

If successfully accomplished, randomisation avoids the influence of either known or unknown factors that predict the outcome, such as severity of illness or presence of comorbidities on the assignment of individual participants to intervention groups. To achieve this, and to randomise participants into a study, an allocation sequence that specifies how participants will be assigned to interventions is generated, based on a process that includes an element of chance. This process is known as sequence generation (Higgins *et al.,* 2021).

Allocation concealment

Allocation concealment refers to the process of allocating participants to the different groups to which they have been randomly assigned and it is essential that this process is concealed by the researcher recruiting the participants (Higgins *et al.,* 2021). If there is poor allocation concealment, there is a risk for systematic differences in characteristics between participants allocated to the different arms or treatment group of the study and as a result, these are at a higher risk of bias favouring the intervention group in the study (Higgins *et al.,* 2021).

3.6.4.3.3.3.2 Performance bias (blinding of participants and personnel)

Performance biases are biases that arise due to deviations from intended interventions (Higgins *et al.,* 2021). This occurs when the researcher and the participants have knowledge of the allocated intervention during the study period. Blinding refers to measures that are taken after study participants have be assigned to their groups ensuring that it is unclear which participant belongs to which group throughout the course of the study (Higgins *et al.,* 2021; Schulz & Grimes, 2002; Jüni *et al.,* 2001). When interventions are complex, in that they have more than one component that could contribute to the interventions' effectiveness, it is important that the researcher understand the various elements that make up the intervention (Gerrish & Lathlean, 2015).

Risk of bias in this domain may differ between outcomes, even if the same people were aware of intervention assignments during the trial. For example, knowledge

of the assigned intervention may affect behaviour (Higgins *et al.,* 2021).

3.6.4.3.3.3.3 Detection bias (Blinding of outcome assessment)

Bias in measurement of the outcome is referred to as detection bias. Such bias can arise if the outcome assessors are aware of intervention status (particularly when assessment of the outcome is subjective); if, different methods (or intensities of observation) are used to assess outcomes in the different intervention groups; and if measurement errors are related to intervention status (or to a confounder of the intervention-outcome relationship) (Higgins *et al.,* 2021). Blinding of outcome assessors often occurs even when blinding of participants and personnel during the trial is not feasible. However, it is particularly difficult for participant-reported outcomes. The potential for bias cannot be ignored even if the outcome assessor cannot be blinded. For trials in which outcome assessors were not blinded, the risk of bias will depend on whether the outcome assessment involves judgement, which depends on the type of outcome (Higgins *et al.,* 2021).

3.6.4.3.3.3.4 Attrition bias (Incomplete outcome reporting)

Missing measurements of the outcome may lead to bias in the intervention effect estimate. Attrition bias refers to the differences between the comparison groups due to the loss of participants from the study (Higgins *et al.,* 2021). These cannot be described as withdrawals, dropouts or protocol deviations, and the way in which they are handled has potential for biasing the results of an RCT (Higgins *et al.,* 2021). Having a significant minority of people without any final outcome data can threaten the validity of the results of an RCT as it is unknown if the participants in the intervention group managed well or not (Higgins *et al.,* 2021). It is important that people who were lost to follow-up are not ignored in the results and analysis, as this would undermine what was achieved by using randomization (Gerrish & Lathlean, 2015).

3.6.4.3.3.3.5 Reporting bias (Selection reporting)

Study outcomes that are statistically non-significant and unfavourable to the experimental intervention are less likely to be published than statistically significant results, and unfortunately, as a result, are less likely identified by systematic reviews. This can lead to results being missing systematically from syntheses, which can lead to syntheses over-estimating or under-estimating the effects of an intervention (Boutron *et al.*, 2021).

3.6.4.3.3.3.6 Publication bias

Publication bias means that studies with significant results are more likely to be published (Gerrish & Lathlean, 2015). If unpublished studies are not included in meta-analyses, the effectiveness of an intervention may be overestimated (Mc Auley, 2000). Despite this, it is important to recognise that even the most comprehensive literature search cannot eliminate the possibility of publication bias. Every review should incorporate a formal assessment of this risk and statistical and modelling techniques such as funnel plots are available to assist and highlight these biases (Gerrish & Lathlean, 2015). The name 'funnel plot' arises from the fact that precision of the estimated intervention effect increases as the size of the study increases. Effect estimates from small studies will therefore scatter more widely at the bottom of the graph, with the spread narrowing among larger studies. In the absence of bias, the plot should approximately resemble a symmetrical (inverted) funnel (Sterne *et al.*, 2017). Test for funnel plot asymmetry should be used only when there are at least ten studies included in the meta-analysis, because when there are fewer studies the power of the tests is too low to distinguish chance from real asymmetry (Sterne *et al.*, 2017). In some situations, the minimum numbers of studies may be substantially more than ten studies (Sterne *et al.*, 2017).

An assessment of publication bias was planned to be conducted in this systematic review for each analysis over more than ten studies. The funnel plot would have been assessed visually and statistically using Egger's test for dichotomous outcomes with intervention effects measured as risk ratios or risk differences (Egger

et al., 1997). Although funnel plot asymmetry has long been equated with publication bias (Light, 1984; Begg, 1988), the funnel plot should be seen as a generic means of displaying small-study effects – a tendency for the intervention effects estimated in smaller studies to differ from those estimated in larger studies (Sterne, 2000; Sterne ,2011). Small-study effects may be due to reasons other than publication bias and differences in methodological quality are an important potential source of funnel plot asymmetry (Sterne *et al.,* 2017). It is important to note that smaller studies tend to be conducted and analysed with less methodological rigour than larger studies. True heterogeneity in intervention effects may also lead to funnel plot asymmetry (Sterne *et al.,* 2017). Other possible causes of funnel plot asymmetry was planned to be investigated in the systematic review in chapter six by undertaking a sensitivity analyses in order to explore the robustness of the meta-analysis' conclusions to different assumptions about the causes of funnel plot asymmetry (Sterne *et al.,* 2017).

3.6.4.3.3.3.6 Comparability of baseline outcomes and characteristics

The risk of bias tool includes consideration of situations in which baseline characteristics indicate that something may have gone wrong with the process of randomisation. It is important that baseline imbalances that are consistent with chance are not interpreted as evidence of risk of bias**.** Chance imbalances are not a source of systematic bias, and the RoB 2 tool does not aim to identify imbalances in baseline variables that have arisen due to chance (Higgins *et al.,* 2021).

3.6.4.3.3.3.7 Risk of contamination

Contamination occurs when the control group is exposed to the intervention (Effective Practice and Organisation of Care, 2015).

Within this review any included study that has an intervention and control group (e.g. RCTs, BNAs) within the same setting was planned to be assessed for contamination and scored low risk of bias, if allocation was by hospital or healthcare facility and it was unlikely that the control group was exposed to the intervention.

3.6.4.3.3.3.8 Other sources of bias

Other possible sources of bias were assessed under this section in the risk of bias assessment table. These included recruitment bias and cover-over bias. Recruitment bias can occur when individuals are recruited to the trial after the clusters have been randomized, as the knowledge of whether each cluster is an 'intervention' or 'control' cluster could affect the types of participants recruited (Higgins *et al.*, 2021). A recruitment bias could not be excluded from the included study in this systematic review because only participants that agreed to participate were included in the study and no information was available collected on those participants that did not agree to participate.

3.6.4.3.3.4 Measurement of treatment effect

3.6.4.3.3.4.1 Dichotomous outcome data

The intervention effect will be measured using the relative risk (RR) and 95% confidence interval (CI).

3.6.4.3.3.5 Unit of analysis issues

3.6.4.3.3.5.1 Cluster-randomised trials

Unfortunately, many cluster-randomised trials have in the past failed to report appropriate analyses and are commonly analysed as if the randomisation was performed on the individuals rather than the clusters (Higgins *et al.*, 2021). If this is the situation, approximately correct analyses should be performed if the following information can be extracted.

1. the number of clusters (or groups) randomized to each intervention group and the total number of participants in the study; or the average (mean) size of each cluster
2. the outcome data ignoring the cluster design for the total number of individuals (e.g. the number or proportion of individuals with events, or means and standard deviations for continuous data); and
3. an estimate of the intracluster (or intraclass) correlation coefficient (ICC) (Higgins *et al.*, 2021).

The planned analysis for this type of study design was guided by the recommendations in section 16.3.4 of the Cochrane Handbook for Systematic Reviews of Interventions. If meta-analysis was appropriate in this context, an estimate of the intracluster (or intraclass) correlation coefficient (ICC) would have been performed. However, it was not possible to conduct a meta-analysis in this review as the data did not permit it.

3.6.4.3.3.6 Dealing with missing data

Missing measurements of the outcome may lead to bias in the intervention effect estimate (Higgins *et al.,* 2021). In situations where missing outcome data lead to bias, the extent of bias will increase as the amount of missing outcome data increases. There is a tradition of regarding a proportion of less than 5% missing outcome data as 'small' (with corresponding implications for risk of bias), and over 20% as 'large'. However, the potential impact of missing data on estimated intervention effects depends on the proportion of participants with missing data, the type of outcome and (for dichotomous outcome) the risk of the event (Higgins *et al.,* 2021).

3.6.4.3.3.7Assessment of heterogeneity

Any kind of variability among primary studies in a systematic review may be termed heterogeneity. There are various types of heterogeneity within studies, variability in the participants, interventions and outcomes studied are referred to as clinical heterogeneity, and variability in study design and risk of bias are described as methodological heterogeneity (Deeks *et al.,* 2021). Variability in the intervention effects being evaluated in the different studies is known as statistical heterogeneity, and is as a result of clinical or methodological diversity, or both, among the studies (Deeks *et al.,* 2021). The appropriate use and interpretation of statistical methods is fundamental to the validity and reliability of meta-analysis results (Riley *et al.,* 2011). Although a meta-analysis in the systematic review conducted in chapter six of this thesis was not possible, it was planned that this would be assessed by the I^2 statistic. The I^2 can be readily calculated from basic results obtained from a typical meta-analysis. Negative values of I^2 are put equal to zero so that I^2 lies between 0% and 100%. A value of 0% indicates no observed heterogeneity, and larger values

show increasing heterogeneity. The I^2 statistic describes the percentage of variation across studies that is due to heterogeneity rather than chance (Higgins *et al.*, 2003). The principal advantage of I^2 is that it can be calculated and compared across meta-analyses of different sizes, of different types of study, and using different types of outcome data. Although other tests are available to test for heterogeneity, e.g. the Chi^2 this test is known to be poor at detecting true heterogeneity as in some instances, certain meta-analyses include small numbers of studies, the power of the test in these situations is low (Higgins *et al.*, 2003).

3.6.4.2.3.8 Data synthesis

It was planned that Review Manager software (RevMan, 2014) would be used to carry out the statistical analysis in the systematic review in chapter six of this thesis however, the data did not permit this. If this was permitted, and depending on the degree of heterogeneity, pooled RR estimates would have be calculated using either fixed-effect model (FEM) or random-effect model (REM). Heterogeneity affects not only whether a meta-analysis is appropriate but also which of the two statistical models should be used in the analysis (Polit & Beck, 2014). When heterogeneity is low, the fixed effect model may be chosen and when results are more varied, it is better to use a random effects model (Polit & Beck, 2014).

3.6.4.2.3.9 Subgroup analysis and investigation of heterogeneity

Heterogeneity may be explored by conducting subgroup analyses. Although, findings from multiple subgroup analyses may be misleading, subgroup analyses are observational by nature and are not based on randomized comparisons (Deeks *et al.*, 2021). False negative and false positive significance tests increase in likelihood rapidly as more subgroup analyses are performed. Subgroup analyses may be done for subsets of participants (such as males and females), or for subsets of studies (such as different geographical locations). Subgroup analyses may be done as a means of investigating heterogeneous results, or to answer specific questions about particular patient groups, types of intervention or types of study (Deeks *et al*., 2021). This was not conducted in the systematic review in chapter six

of this thesis as the data did not permit a meta-analysis and the heterogeneity was not assessed.

3.6.4.2.3.10 Sensitivity analysis

A sensitivity analyses may be undertaken to assess the potential impact of missing outcome data, based on assumptions about the relationship between missingness in the outcome and its true value (Deeks *et al.,* 2021). The process of undertaking a systematic review involves a sequence of decisions. Whilst many of these decisions are clearly objective and non-contentious, some will be somewhat arbitrary or unclear (Deeks *et al*., 2021). It is highly necessary to prove that the findings from a systematic review are not dependent on such arbitrary or unclear decisions by using sensitivity analysis (Deeks *et al.,* 2021). A sensitivity analysis is a repeat of the primary analysis or meta-analysis in which alternative decisions or ranges of values are substituted for decisions that were arbitrary or unclear (Deeks *et al.,* 2021). Although this was not conducted in the systematic review, planned sensitivity analyses were to explore the effect of ICC variations and causes of substantial heterogeneity that could not have been explained by sub-group analysis.

3.7 Quality in qualitative analysis

In quantitative research, the criteria for quality include the concepts of reliability and validity. However, these criteria are considered inappropriate to use in qualitative research (Gerrish & Lathlean, 2016). Although qualitative research cannot be subjected to these same criteria, methods of analysis are provided that should be applied rigorously to the data (Braun & Clarke, 2006; Braun & Clarke, 2020). A concise checklist of criteria (table 3.2) developed by Braun and Clarke (2006) was followed in detail during the qualitative thematic analysis phase of this thesis. The researcher was fully active in the research process and checking was also undertaken by the supervisors. In addition, the analysis process was reviewed, and the data checked, for representation within the generated themes by the supervisors.

Table 3.2 A 15-point checklist for good thematic analysis

Process	No	Criteria
Transcription	1	The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'
Coding	2	Each data item has been given equal attention in the coding process.
	3	Themes have not been generated from a few vivid examples (an anecdotal approach), but instead the coding process has been thorough, inclusive and comprehensive.
	4	All relevant extracts for all each theme have been collated
	5	Themes have been checked against each other and back to the original data set.
	6	Themes are internally coherent, consistent, and distinctive.
Analysis	7	Data have been analysed-interpreted, made sense of-rather than just paraphrased or described.
	8	Analysis and data match each other-the extracts illustrate the analytic claims.
	9	Analysis tells a convincing and well-organised story about the data and topic
	10	A good balance between analytic narrative and illustrative extracts is provided.
Overall	11	Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly.
Written report	12	The assumption about, and specific approach to, thematic analysis are clearly explicated.
	13	There is a good fit between what you claim you do, and what you show you have done-i.e. described method and reported analysis are consistent.
	14	The language and concepts used in the report are consistent with the epistemological position of the analysis.
	15	The researcher is positioned as *active* in the research process; themes do not just 'emerge'

(Braun & Clarke, 2006)

Reflective thematic analysis emphasises the importance of the researcher's subjectivity as an analytic resource, and their reflective engagement with theory,

data and interpretation (Braun & Clarke, 2020). Reflexivity is an important element of qualitative research. The subjectivity associated with using a qualitative research approach where the researcher and the research are closely intertwined can be problematic (Gerrish & Lathlean, 2016). Therefore, reflexivity is the continuous process of reflection by the researcher as to how their values, perceptions, behaviours or presence, and those of the research participants can affect the data collected (Parahoo, 2006).

3.7.1 The researchers reflective account

Reflexivity by the researcher was an important part of quality, rigour and trustworthiness in the qualitative phase of this mixed methods study. In my role as principal investigator, it is essential to provide a reflective statement since certain factors such as my values which include compassion, respect, equality fairness and responsibility as well as my views and position in the world, may have influenced the research, my interpretation of the data and the findings.

I came to this research from a background in nursing. I have worked in health protection (on vaccine-preventable and respiratory diseases) for over a decade and have been involved in the enhanced surveillance of confirmed influenza cases admitted to intensive care units. As a result of my expertise in my area of work, I was hugely aware of the severity and impact that seasonal influenza can have on patients, families and our health services. Although I have always had an interest in seasonal influenza, my interest in nurses' influenza vaccination uptake arose after observing the consistently low vaccine uptake rate among nurses each year and the negative coverage associated with it. When I started this study, nurses consistently had the lowest vaccine uptake for influenza and, despite my nursing background; my knowledge of what factors influence nurses' decisions regarding vaccination was very poor. I had very strong feelings about the importance of accepting the seasonal influenza vaccine annually. I was aware of the mounting pressure facing policy makers and nurses themselves to increase vaccination rates each year. I was also aware of the negative media attention that cited disappointment among health officials that HCWs, primarily nurses, were failing to meet nationally

recommended vaccination rates for influenza despite raffles and free coffee incentives (Hennessey, 2018). Although I strongly supported vaccination against seasonal influenza for all HCWs, I did not support the call from medical professionals for the implementation of mandatory vaccination policy for HCWs for influenza, and I could have subconsciously displayed this to the participants. As a nurse, I may also have been influenced negatively by the media coverage.

As I was conscious of how my own experiences and biases might impact this study, I kept a reflective diary of my interactions and perceptions after each focus group discussion. I was aware that the participants might have developed their own perceptions of my position regarding the influenza vaccine, even though I was not known to them or employed at the hospital. The reflective diary was also especially important since the participants and I, as the researcher, may have disagreed during certain discussions (e.g. that the influenza vaccine causes “flu” or that the vaccine isn’t safe, or doesn’t work; or should be made mandatory). I remained open-minded during these stages of data collection and was aware of the importance of allowing all participants to voice their opinions and views. As I was a novice qualitative researcher, I dedicated time during the coding of the data to constantly question what exactly I was interpreting the data to mean and I had regular discussions with both supervisors during the coding and analysis phase. Having these regular discussions during the phases of analysis with my supervisors and having the transcripts, codebook and themes read and reviewed by an experienced qualitative researcher ensured trustworthiness in the qualitative findings.

3.8 Thesis by publication

The three articles presented in this thesis were a contribution to evidence regarding the barriers to, and facilitators of, the seasonal influenza vaccination among nurses. The process of producing a thesis through publication allowed me to expand and become skilled in research methodology and methods while contributing to publications in peer-reviewed journals. Figure 3.5 presents the contribution to research made within this thesis.

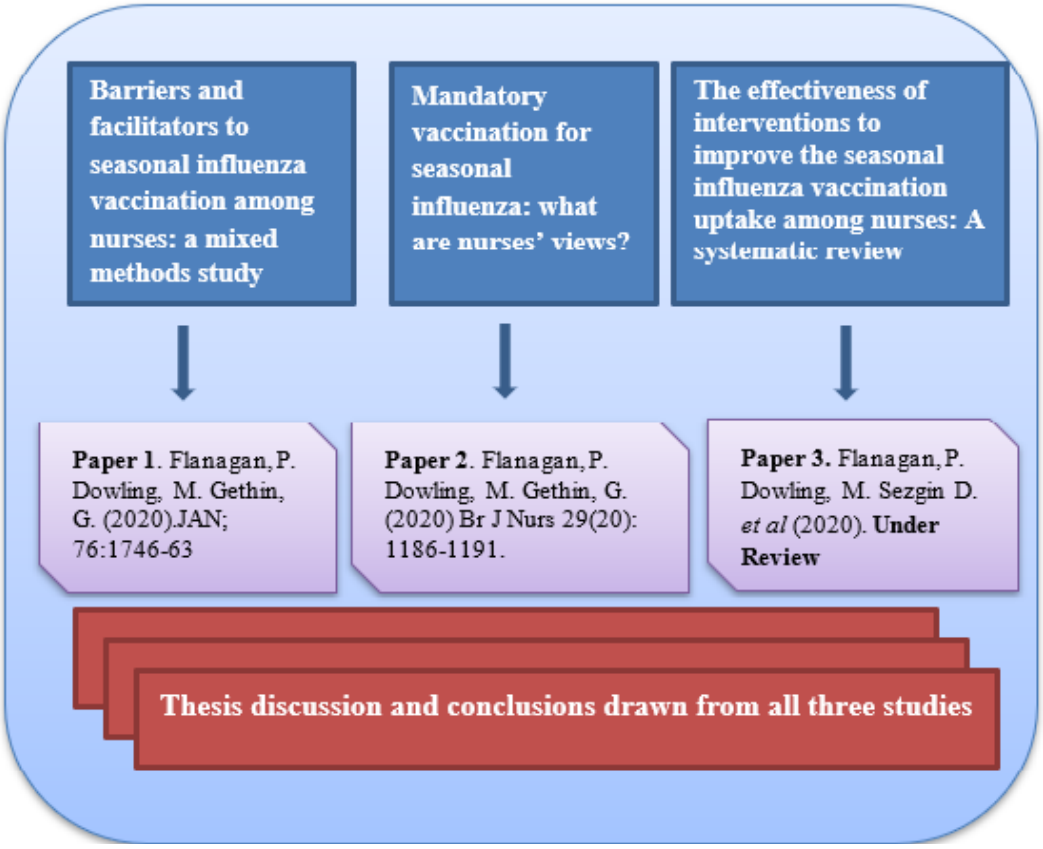

Figure 3.5 Thesis mixed methods research design diagram-contribution to research

3.9 Ethical approval

Ethical approval (appendix A) was obtained from the research ethics committee at the two hospital sites where nurses participated in this study.

3.10 Chapter summary

This chapter has summarised and outlined the worldview, theoretical framework and methodology underpinning this research thesis. A description of the methods used to answer the research questions has also been provided. The following chapter presents the findings from the first study in this thesis.

Chapter 4: Paper one

4.1 Introduction

This chapter presents the explanatory sequential mixed methods study on the barriers and facilitators to seasonal influenza vaccination uptake among nurses. This text that follows in this chapter consists of the final accepted manuscript.

Chapter 4: Paper One

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

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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.

4.2 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: A sequential explanatory 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.

4.3 Introduction

Seasonal influenza is an acute, respiratory infection that remains a public health concern (World Health Organization, 2019a). Although the illness is often self-limiting, it can contribute to significant mortality and morbidity among older persons 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 [ECDC], 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 older persons 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 (European Council 2009; Health Service Executive 2017; World Health Organization 2012a; Centers for Disease Control and Prevention 2019).

4.4 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, Sim, & Halcomb, 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, While, & Norman, 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 individual's 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 4.1). 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.

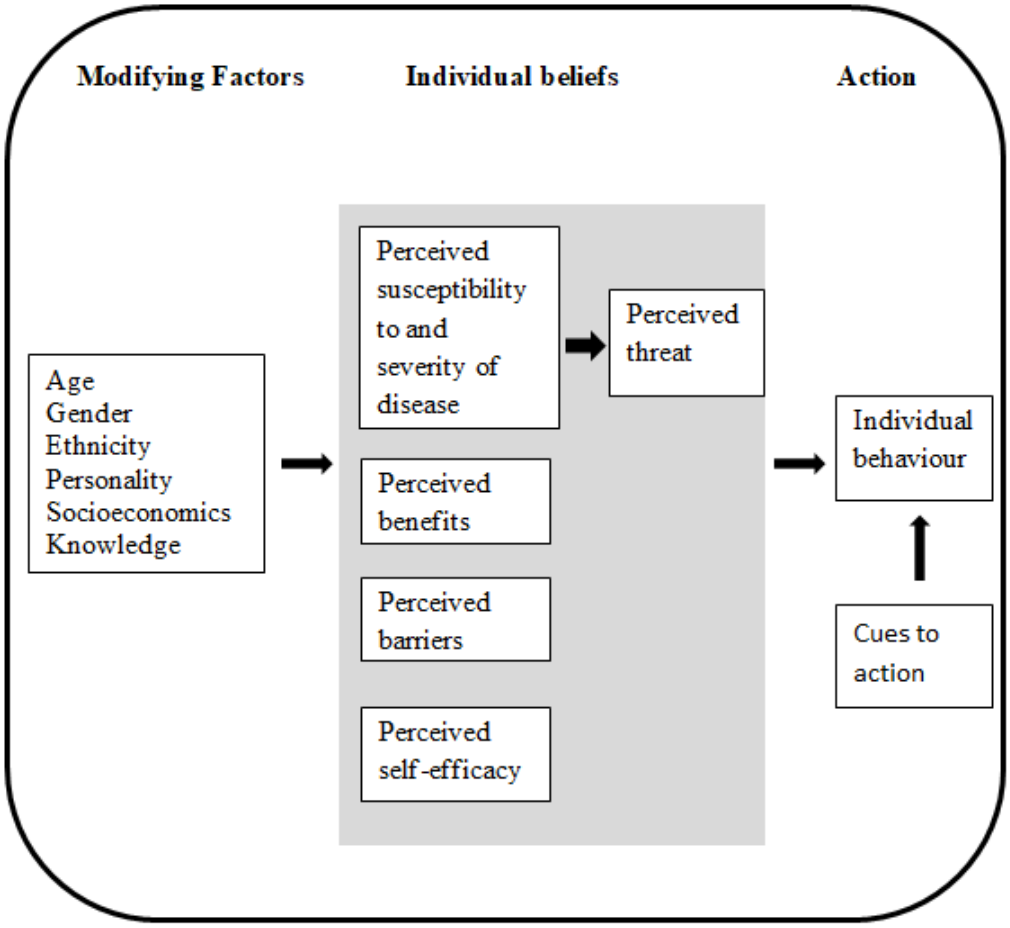

Figure 4.1 Health Belief Model (Janz & Becker, 1984; Rosenstock, Strecher, & Becker, 1988)

4.5 The study

4.5.1 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.

4.5.2 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.

4.6 Quantitative study

4.6.1 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.

4.6.2 Data collection

Permission was granted to use the King's Nurses Influenza Vaccination Questionnaire (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.

4.6.3 Validity and reliability

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

4.6.4 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.

4.7 Qualitative study

4.7.1 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.

4.7.2 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.

4.7.3 Validity and reliability

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

4.7.4 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.

4.8 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.

4.9 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 4.2 illustrates a generic visual representation of the PIP and the four stages; listing, matching, checking and pillar building by Johnson et al., (2017).

Column 1 **Column 2** **Column 3** **Column 4** **Column 5**

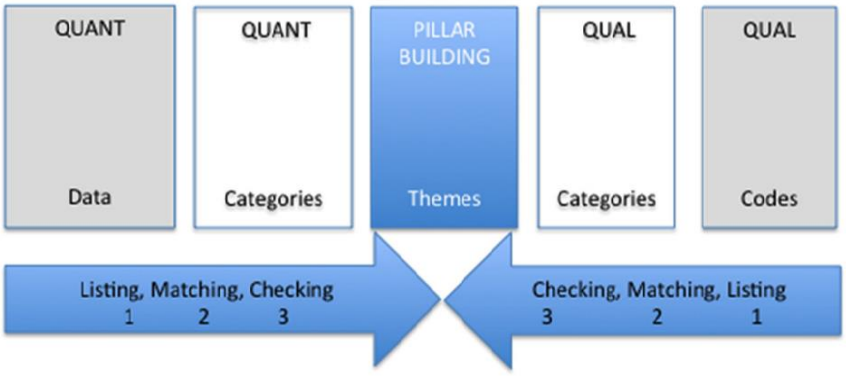

Figure 4.1 A generic diagrammatic representation of the Pillar Integration Process to demonstrate column headings and direction of Integration

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).

4.10 Results

4.10.1 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 4.1).

Table 4.1 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 4.2).

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 4.2).

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 4.2). Figure 4.3 illustrates the risk perception responses of nurses.

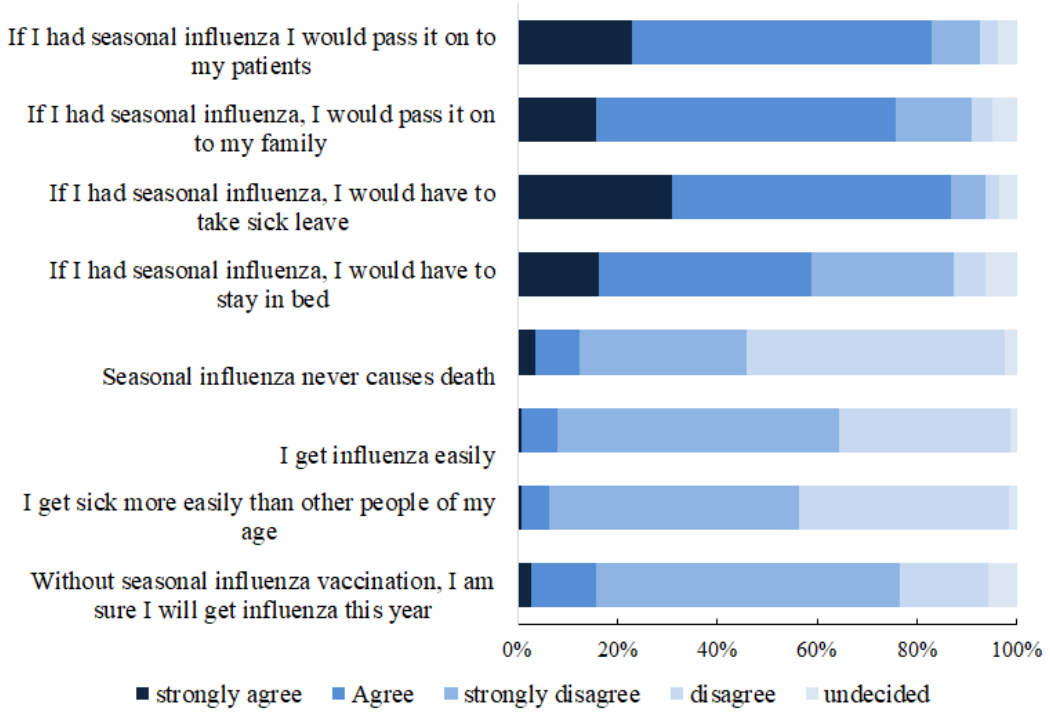

Figure 4.3 Nurses perception of influenza risk

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 4.2).

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 4.2).

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 4.2 Factors associated with influenza vaccine uptake in the previous 12 months and future vaccine intentions

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 Manageme	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 qualificati	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 emploment	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 4.2 continued

	mean	SD	OR (95% CI)	P value	OR (95% CI)	P value	mean	SD	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

4.10.2 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).

4.10.3 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 4.3 Pillar Integration Process

Survey findings		Pillar	Focus group findings	
1	**2**	**3**	**2**	**1**
Knowledge: This data represents nurses' knowledge in relation to the influenza virus and the influenza vaccine.	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*)	**The influence of knowledge on vaccine uptake**	Knowledge is core	*"I think nurses …maybe lack of knowledge and we feel it's not that serious " [#4, FGD 5]*
	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*)			*"I think its knowledge" [P6, FGD 3]*
	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			*"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*

	future, $p<0.001^{‡}$			*we all take it" [P7, FGD 4]*
	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, $p<0.05^{§}$.		Reinforce the knowledge	*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 hospital .....we 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]
This data represents the type and source of information nurses receive regarding influenza and the vaccine. The results illustrated here are from the focus group discussions only		**Dissemination of information**	Ineffective communication systems	*"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]
				"Yeah, it just flashes on the computer screen across the hospital …like, you might see it and you mightn't" [P3, FGD 4]
				"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]
			Rely on self	*"Yeah it's not, we are encourage to get it, like you said, you're encouraged to get it…to go 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]
				*"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 didn't know about the HSE land" [P3, FGD 2]
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?	*"There might be long term complications that there might be a long term effect" [*P4, FGD 2]

	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.			*"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]
	38.3% (n=70) of unvaccinated nurses cited fear of vaccine side effects as a reason for vaccine refusal			*"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]*
	32.2% (n=59) of unvaccinated nurses cited concerns about vaccine effectiveness and safety as a reason for vaccine refusal			*"Em, I still have a concern about how safe is it"* [P2, FGD 5]
				"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]
	21.3% (n=39) of unvaccinated nurses cited fear of illness post vaccination as a reason for vaccine refusal		It doesn't work	*"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]
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	*"Oh I think you have to protect yourself" [P8, FGD 3]*
	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-		Perceived susceptibility to influenza infection	*"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]*

	3.89, p<0.0001*)			
	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			*"I mean l 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]
	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		I'm fit and healthy	*"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]
	0.9% (n=4) strongly agreed and 5.4% (n=25) agreed that they get sick more easily than other people of their age		Older age	*"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]

	17.0% (n=28) of vaccinated nurses cited being a HCW as a reason for accepting the vaccine		Personal responsibility	*"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]*
	87.2% (n=389) of all participants either disagreed or strongly disagreed that influenza never causes death.		Don't put patients at risk	*"You know I work here I have to think of them" [P5, FGD 3]*
	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.			*"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]*

	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.			
	15.7% (n=72) of all participants strongly agreed and 60% (n=276) agreed that they would transmit seasonal influenza to their family.			*"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]*
	32.7% (n=54) of vaccinated nurses cited protection of family or friends as a reason for vaccination.			*"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]*
	15.2% (n=25) of vaccinated nurses cited protection of patient or colleagues as a reason for accepting the vaccine.			*"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]*

			High risk patient care	*"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]
This information represents the Multi-Dimensional Health Locus of Control (Chance, Internal and Powerful others subscales)	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*)	**Influencers**	Personal control	*"Yeah, I think we are in control of our health" [P5, FGD 2]*
	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*)		Experts	*"I know last year I heard [consultants name] you know ….from the lab speaking and for me, the way he phrased it and the way he ….I 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]

			Ward managers	"*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]
			Other nurses	*" 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]

	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 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)***
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 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]
				"*Getting to occ health, it's a long way" [*P10, FGD 3]
			Challenge: shift work	*"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]
				"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]
			Facilitation: stay on the unit	*"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]*
				"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]
This data repesents findings relating to pressure	4.9% (n=9) of unvaccinated nurses cited organisational pressure as a	**Organisational pressure**	Brute force	***"****Like my staff is going down and we got a good result last year but that was by sheer brute force"* [P3, FGD 4]

experienced by nurses in the workplace	barrier to vaccination.			*"Why are we forced to get it? I don't think no one should be forced to take it"* [P6, FGD 2]
			Autonomy	*"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]
	13.9% (n=23) of vaccinated nurses cited to prevent sick leave from work as a reason for vaccine acceptance		Bullying tactic	*"I'm one of the ones who give the flu injection and em, I found last year that people were nearly been bullied into it .....in 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"* [P4, FGD 2]
			Guilt and Blame	*"If you don't get it and your patients get it well then it's your fault"* [P4, FGD 2]
				"*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*" [P1, FGD 5]

* Multivariable logistic regression analysis
† Independent sample *t* test
‡ ANOVA test
§ Tukey's post-hoc test

4.10.3.1 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 4.3).

4.10.3.2 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 4.3).

4.10.3.3 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 4.3).

4.10.3.4 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 4.3).

4.10.3.5 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 4.3).

4.10.3.6 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 4.3).

4.10.3.7 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 4.3).

4.11 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 (Falomir-Pichastor, 2009; O’Reilly, Cran, & Stevens, 2005). Prior vaccination was also found to be associated with future vaccine intentions (Falomir-Pichastor et al., 2009; Godin, Vézina-Im, & Naccache,2010; Smith, Sim, & Halcomb, 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 (Smith et al. 2016a, 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 Guiseppe, 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% (ECDC, 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.

4.11.1 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.

4.12 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.

4.13 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.

4.14 Conflict of interest

No conflict of interest has been declared by the authors.

4.15 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.

Chapter 5: Paper two

5.1. Introduction

This chapter presents the qualitative findings on nurses' views in relation to mandatory vaccination policy. This text that follows in this chapter consists of the final accepted manuscript.

Chapter 5: Paper Two

Mandatory vaccination for seasonal influenza: what are nurses' views?

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Flanagan P, Dowling M, Gethin G. Mandatory vaccination for seasonal influenza: what are nurses' views? *British Journal of Nursing*, November 2020 *29*(20), 1188-1191.

5.2 Abstract

Background

Preventing seasonal influenza is a public health priority and although the benefits of vaccinating healthcare workers (HCWs) are emphasised, seasonal influenza vaccine uptake rates remains low. Voluntary vaccination policies have been less successful in achieving high vaccine uptake when compared to mandatory policies and the persistently low vaccine uptake among HCWs has fuelled debate on whether mandatory vaccination programmes should be implemented in the interest of patient safety.

Aim

This study explored nurses' views on mandatory vaccination policy for seasonal influenza.

Methods

A self-selected sample (n=35) of qualified nurses working in two large hospital sites in Ireland participated in five focus groups. Data were analysed using Braun and Clarke's framework.

Findings

Two themes were identified: (1) mixed views on mandatory vaccination and (2) leave nurses make their own choice on vaccination.

Conclusion

This study provides an understanding of nurses' views regarding mandatory vaccination policy for seasonal influenza and highlights individual choice and autonomy are crucial for vaccine acceptance.

Keywords

Seasonal influenza vaccination, mandatory vaccination policy, immunisations, nurses, focus group discussions, qualitative research

5.3 Introduction

Vaccinating healthcare workers (HCWs) against seasonal influenza is recommended to reduce the risk of nosocomial infection between patients and HCWs (European Council 2009; Fiore et al. 2010; World Health Organization (WHO) 2012a; National Immunisation Advisory Committee, 2017). Each year, epidemics of seasonal influenza contribute to a significant increase in mortality and morbidity among high risk groups, especially older people (Luliano et al, 2018) with rates of serious illness and death highest among those aged ≥ 65 years, children aged < 2 years and any person with an underlying medical condition (WHO, 2012b).

Internationally there has been substantial interest in addressing the issue of poor vaccine uptake among HCWs (European Centre for Disease Prevention and Control (ECDC), 2018). In the interest of patient safety, vaccinating HCWs against seasonal influenza is recognised as a key public health measure with coverage rates of ≥75% recommended by the WHO since 2003 (WHO, 2003). HCWs influenza vaccine coverage rates for three consecutive seasons (2015–16, 2016–17 and 2017-18) were reported by twelve European Member States and ranged from 15.6% to 63.2%. Although highest vaccine uptake rates were reported by Belgium, the UK-England and the UK-Wales (2016–17), with vaccine uptake increased in Greece, Ireland and the UK; however, coverage rates remained below the goal of 75% (ECDC, 2018).

Since 2004, some healthcare facilities and local health departments in the United States (US) require certain HCWs to be vaccinated against influenza as a condition of employment and, since this, many other facilities in the US have implemented similar policies (Stewart and Cox, 2013). These mandatory vaccination programmes have been more effective at increasing vaccine coverage rates (Hollmeyer et al, 2013; Lytras et al, 2016) with some US health systems reporting coverage rates up to 99.3% (Keller, 2010; Rakita et al, 2010; Feemster et al, 2011; Karanfil et al, 2011). Despite this, mandatory vaccination remains a controversial topic among different health professional groups and also among different countries

(Karnaki et al, 2019). Although this strategy is advocated by many health professionals who consider it to be ethically justifiable (Helms and Polgreen, 2008; McLennan et al, 2008; Galanakis et al, 2013; Dubov and Phung, 2015), others argue that it infringes HCWs' autonomy (Isaacs and Leask, 2008; Quinn, 2014; Pless et al, 2017).

With the exception of some US states, vaccination programmes remain voluntary and although some voluntary multifaceted interventions have been found to be successful at increasing HCWs influenza vaccination uptake rates, others have been found to be less successful (Lam et al, 2010; Hollmeyer et al, 2013; Rashid et al, 2016; Bechini et al 2020). The low vaccine uptake as a result of voluntary policy has fuelled debate on whether mandatory vaccination programmes should be implemented in the UK and the Republic of Ireland (Carter and Yentis, 2018; Royal College of Physicians in Ireland (RCPI), 2018). In 2018, the Faculties of Occupational Medicine, Pathology and Public Health Medicine of the RCPI in Ireland recommended introducing mandatory seasonal influenza vaccination for certain categories of HCWs using a risk assessment framework (RCPI, 2018). They highlighted that the health of the patient population as a whole takes priority over the personal choice of the individual HCW (RCPI, 2018). While recognising that mandating influenza vaccination for HCWs increases vaccine rates, the decision to introduce mandatory vaccination needs to recognise the challenges which accompany it (Quach et al, 2013). It is highly likely that influenza will coincide with the current coronavirus (COVID-19) pandemic in the coming influenza season (2020/2021) and increasing HCWs influenza vaccine uptake will be a major priority to reduce the pressure on health services. Although high HCWs influenza vaccine uptakes would be ideal, implementing mandatory vaccination for influenza could have the opposite effect to those intended.

5.4 Methods

This qualitative study formed phase two of a sequential explanatory mixed methods study reported elsewhere (Flanagan et al, 2020a). A self-selected sample of qualified nurses participated in five homogenous focus group discussions between

September and October 2018. Nurses attending mandatory training courses (cardio pulmonary resuscitation (CPR) and manual handling) at two hospital sites (referred to as site A and site B), where medical and surgical services are provided, were invited to consent to participate. This ensured a wide variety of nurses were recruited from various clinical settings within the two hospitals. An information leaflet was provided to all nurses at the start of each mandatory training session which provided detailed information about the study. A separate paper-based consent form was also provided and although the risk of unconscious bias was possible, nurses were advised they would receive a €25 voucher as an honorarium for attending the focus groups before consenting. These vouchers were posted to participants a number of weeks after all the focus groups were undertaken. Contact information was requested from the nurses who provided written consent so a suitable date and time could be arranged to conduct the focus groups. A text message or email was sent to each nurse and for those who did not respond to the initial invite, one reminder message was sent. The focus groups were held shortly after recruitment and took place in a training room in the hospital site where the nurses were employed allowing for comfort, convenient access and minimal distractions. The researchers were cognisant of possible social desirability bias, which can result in 'questionable appearance of consensus'(Bergen and Labonté, 2020: 784). Therefore, before each focus group, all nurses were reminded about the aim of the study, confidentiality of the discussions and assured of their anonymity in the reporting of the findings. They were also advised they could stop participating and leave the focus group at any stage. Each focus group lasted approximately one hour and light refreshments were provided.

A sample size in qualitative research is usually determined based on information needs. A guiding principle is data saturation (Lincoln and Guba, 1985). Although the number of participants needed to reach data saturation depends on many factors, using multiple focus groups allows the extent to which saturation has been reached be assessed (Lincoln and Guba, 1985; Onwuegbuzie et al, 2009) with three to six focus groups consisting of an average of six to eight participants adequate (Morgan 1997; Kreuger and Casey, 2014). One potential challenge when arranging focus

group discussions is the lack of guarantee that those recruited will attend on the day. To overcome this, participants were over-recruited for each focus group (Rabiee, 2004).

A topic guide was developed and informed the focus group discussions. This was pre-tested on two nurses from a different healthcare setting in advance of the focus groups to ensure clarity of the questions. Nurses were asked their views on mandatory vaccination policy in general and also their views if mandatory vaccination was implemented for seasonal influenza in Ireland. The first author served as the moderator and an assistant moderator also attended each focus group and took field notes. Both were not employees in either hospital site and were not known by participants. The topic guide assisted managing the discussion, although it was not rigidly adhered to. It also ensured there was consistency across the different focus groups. All questions were open ended. Immediately after each focus group, debriefing took place between the moderator and assistant moderator to discuss observations noted, such as how the focus group progressed and if all nurses in attendance were given an opportunity to share their views. The focus group interviews were audio recorded and transcribed verbatim by the first author. Pseudonyms were assigned to maintain participants' confidentiality. Braun and Clarke's framework, which is widely used in the analysis of focus group interviews (Lauri, 2019) guided thematic analysis in Nvivo version 12 (a qualitative data analysis application) (Braun and Clarke, 2006). The transcripts were read multiple times and notes were taken by the first author (PF) to ensure familiarisation with the data. Initial codes were then generated from the data and codes with similar meaning were combined to form overarching themes. These themes were reviewed to ensure they represented the data. The final report consisted of data from the transcripts which supported the final themes. All transcripts, codes and themes were validated by the second author (MD).

5.5 Ethical approval

Ethical approval was obtained from the two hospital sites. Written consent was provided by each nurse prior to participating in the focus groups.

5.6 Results

A total of 35 nurses participated in the five focus groups. Three focus groups were conducted in site A and two in site B. The majority of participants were female (91.4%, *n*=32) and vaccinated (57%, n=20) against seasonal influenza in the previous 12 months (*Table* 5.1). Two themes were identified; duty of care and invasion of personal autonomy.

Table 5.1 Number and proportion of participants vaccinated by focus group discussion

	Vaccinated		**Unvaccinated**		**Intend to vaccinate**		**Total**
	N	**%**	**N**	**%**	**N**	**%**	**N**
Focus group 1	4	66.6	2	33.3	0	0	6
Focus group 2	3	42.9	4	57.1	0	0	7
Focus group 3	7	63.6	1	9.1	3	27.3	11
Focus group 4	6	85.7	0	0	1	14.3	7
Focus group 5	0	0	4	100	0	0	4
Total	**20**	**57.1**	**11**	**31.4**	**4**	**11.4**	**35**

5.6.1 Theme One - Mixed views on mandatory vaccination

Overall, the idea of mandatory vaccination was criticised by nurses and their views were clearly divided among those vaccinated and unvaccinated. Although some vaccinated nurses agreed with implementing mandatory vaccination policy for influenza, the majority strongly disagreed with it.

> **'No, not [mandatory] for flu.'**
>
> ***Participant 6, focus group discussion (FGD) 2***

> **'Personally I don't. I think there's better buy-in from people.'**
>
> ***Participant 7, FGD 3***

Nurses in favour of mandatory vaccination were more likely to have been vaccinated against influenza in the previous 12 months.

> **'I would be in favour of it [mandatory vaccination].'**
>
> ***Participant 1, FGD 1, vaccinated nurse***

> **'Yes, it should be [mandatory].'**
>
> ***Participant 7, FGD 4, vaccinated nurse***

They expressed that they had a duty of care and a professional responsibility to protect their patients by accepting the vaccine.

> **'I suppose again, I'm talking as an advocate for my patients, our patients are our frequent visitors or current visitors. They're very high risk for 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.'**
>
> ***Participant 5, FGD 3, vaccinated nurse***

> **'There's a responsibility on us to get vaccinated.'**
>
> ***Participant 1, FGD 1***

Nurses were also aware of the impact influenza had on vulnerable patients and the role vaccinating HCWs played in offering indirect protection to patients in healthcare facilities.

> **'By mandating it I feel I am protecting myself and my family, yes…I am protecting my patients.'**
>
> ***Participant 8, FGD 3***

> **'Yeah [to mandatory vaccination] I think if you're working with patients that are vulnerable and they're immunocompromised, all patients that come into hospital are sick.'**
>
> ***Participant 3, vaccinated nurse, FGD 4***

In contrast, nurses who did not agree and who were not in favour of mandatory influenza vaccination policy cited multiple concerns including the fact that the seasonal influenza vaccine needs to be administered annually.

> **'I think it shouldn't be mandatory for that reason, because someone has to do it every year.'**
>
> ***Participant 5, FGD 2***

> **'No, simple reason is that it's new every year, it's a different strain you're getting, you're not getting the same strain every year.'**
>
> ***Participant 6, FGD 2***

Other nurses also voiced safety concerns as a justification for not implementing mandatory vaccination.

'I think its dangerous ground by making it mandatory, because it changes every year and how safe is it every year.'

Participant 2, FGD 5

5.6.2 Theme two – Leave nurses make their own choice on vaccination.

Nurses expressed that implementing mandatory vaccination policy for influenza would invade their personal autonomy and take away their choice to decide to accept the vaccine or not.

> **'It's taking away your choice as well isn't it?'**
>
> ***Participant 1, FGD 5***

They expressed that choice is vital for vaccine acceptance and by having a choice they believed vaccination uptake rates would be higher. In addition, they did not agree with being forced to get vaccinated.

> **'I think you'd find the uptake will be higher if people have a choice.'**
>
> ***Participant 4, FGD3***

> **'If someone doesn't want to take a vaccine for whatever reason then really I don't agree with forcing them to take it, I really don't.'**
>
> ***Participant 3, FGD 5***

They also conveyed that they should be more informed about the influenza vaccine and that being informed should be mandatory as this would afford them the opportunity to make an informed decision to accept or reject the influenza vaccine.

> **'I think being informed should be mandatory as a healthcare professional should be and I think after that, you should be offered [the chance] to make your own decision.'**
>
> ***Participant 5, FGD 2***

Nurses viewed themselves as intelligent professionals who were highly capable of making an informed decision whether to accept the vaccine or not.

> **'I think we are professionals and we are intelligent enough to make our own decision whether we want it or not or whether it's good for us or not you know.'**
>
> ***Participant 4, FGD 2***

It was the opinion of most nurses that implementing mandatory vaccination for influenza would contribute to a significant increase in resistance among staff. They felt this would have a negative impact on vaccine uptake rates.

> **'If you push people one way they will definitely dig in their heels and go the other.'**
>
> ***Participant 4, FGD 1***

> **'There'd be uproar.'**
>
> ***Participant 2, FGD 1***

> **'There would be huge issues with it in Ireland'**
>
> ***Participant 1, FGD 1***

Despite this, other nurses expressed that if the vaccine was made mandatory there should be an "opt out" option for nurses and all other HCWs.

> **'An "opt out" option, so everybody gets it unless you categorically sign something and say "I am not having this for whatever reason.'**
>
> ***Participant 1, FGD 4***

> **'I think maybe the "opt out" option is fairer, for everybody.'**
>
> ***Participant 5, FGD 4***

5.7 Discussion

This study found nurses' views varied in relation to mandatory vaccination policy. Although a minority supported introducing it based on patient safety and duty of care, the majority did not support it and believed it would be a violation of their autonomy and choice. This finding has also been reported elsewhere (Looijmans-Van Den Akker et al, 2009a; Rhudy et al, 2010; Pless et al, 2017; Quinn, 2014; Stead et al, 2019a).

Implementing mandatory influenza vaccination policy infringes HCWs' autonomy (Isaacs and Leask, 2008; Quinn, 2014; Pless et al, 2017). Our study supported this view as the majority of nurses believed that implementing mandatory vaccination for seasonal influenza would negatively impact on vaccine acceptance and cause "uproar". This finding was also reported in a recent UK study which found that mandatory vaccination would antagonise those who currently accept the vaccine and also create "absolute uproar" (Stead et al, 2019a).

Despite some US states having successfully implemented mandatory influenza vaccination policy for HCWs, multiple ethical issues have been raised, including the infringement of HCWs' autonomy, freedom of choice and damage to staff morale (Stewart, 2009; Hollmeyer et al, 2013; Wang et al, 2017). A recent study conducted in the Netherlands found that measures which give nurses some decisional autonomy such as signing a 'declination' form were more acceptable

than measures which are merely decreed (Pless et al, 2017). Our study reported that giving nurses the option to sign a form and "*opt-out*" of having the vaccine would be more acceptable as they would still be given some choice regarding vaccine acceptance. This indicates that enforced measures such as the use of declination forms might be accepted among nurses within the Irish context. However, according to Stead et al (2019) if declination forms are adopted in the UK, they should be used in a constructive intelligence-gathering manner which avoids stigmatising HCWs.

Although nurses' influenza vaccination uptake rates have increased slowly over the years since national reporting first began (O'Lorcain et al, 2019) implementing an enforced measure such as mandatory vaccination might reverse this and have a negative impact on vaccine acceptance. In addition, it is evident that mandatory vaccination policy raises several ethical issues. According to van Delden et al (2008), if voluntary vaccination programmes are able to increase vaccine uptake to over 50% of the relevant HCWs, mandatory vaccination programmes are not necessary. This was observed in two randomised controlled trials (Carman et al, 2000; Hayward et al, 2006) where vaccination in the intervention facilities varied between 50.9% and 43.2% indicating that even a moderate increase in HCWs vaccine uptake may have a significant impact on patient outcomes (van Delden et al, 2008). In addition, a recent UK systematic review also reported low quality evidence that a mandatory influenza policy was associated with an increase in vaccine uptake (National Institute for Health and Social Care Excellence, 2017).

Vaccinating HCWs plays an important role in preventing nosocomial transmission of influenza in healthcare facilities and although mandatory vaccination policy has the potential to increase vaccination rates, concerns remain about the acceptability of it. This year, the health service will face a significant challenge with COVID-19 and seasonal influenza potentially occurring at the same time. To improve HCWs influenza vaccine uptake rates in the absence of mandatory vaccination policy, tailoring interventions to the needs of different categories of HCWs is essential. In the Irish context, mandatory vaccination policy for seasonal influenza is not

favoured by frontline nurses and the potential for resistance is evident. Mandatory training or access to high quality evidence for HCWs about influenza and the vaccine may also result in an increase in vaccination uptake without a mandatory policy (Carter and Yentis, 2018; Flanagan et al, 2020a).

Despite years of intensive voluntary vaccination campaigns, persistently low vaccine rates in nurses have been observed and for the previous influenza season uptake rates were reported to be 50.4% for nurses employed in acute hospitals in Ireland (O'Lorcain et al, 2019). Although improvements in vaccination coverage have been observed since national reporting first began, challenges exist in reaching the target of 75%.

5.8 Limitations

There are several limitations to qualitative methods and especially focus group discussions due to the small sample sizes. Although five focus groups were undertaken in this study, it was limited to two hospital sites only. Therefore, the generalizability of the findings is limited by the self-selected sample of nurses recruited at two hospital sites. However, a substantial number of nurses participated in the focus groups in this study which ensured data saturation was reached. The majority of nurses participating in this study were vaccinated against influenza in the previous 12 months which may also be a limitation.

5.9 Conclusion

This study provides information for policy makers on nurses' views in relation to mandatory vaccination for influenza. Nurses in this study regarded influenza vaccination as an individual choice despite being aware of the evidence and rationale supporting HCWs vaccination on patient safety. Although nurses are currently given the freedom to decide whether or not they wish to accept or reject the influenza vaccine, uptake rates remain disappointingly low.

5.10 Key points

1. Nurses' views in relation to mandatory vaccination were mixed although the majority of participants in this study did not support it.
2. Nurses considered mandatory vaccination policy for influenza as a violation of their autonomy and choice.
3. Implementing mandatory vaccination for influenza would negatively impact on vaccine acceptance.
4. Giving nurses decisional autonomy such as signing declination forms was identified as being a more acceptable approach among nurses.

5.11 CPD reflective questions

1. Have you had the seasonal influenza vaccine?
2. Do you believe in protecting yourself, your family and your patients against influenza?
3. Has the recent COVID-19 had any influence on your current views on mandatory seasonal influenza vaccine?
4. Do you want the decision in relation to the influenza vaccine to be taken away from you?

5.12 Declaration of interest

None

5.13 Funding

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5.14 Acknowledgments

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Chapter 6: Paper three

6.1 Introduction

This chapter presents the protocol and systematic review which evaluated the effectiveness of interventions to improve seasonal influenza vaccination rates among nurses. This text that follows in this chapter consists of the final submitted manuscript.

Section A: Systematic Review Protocol

Citation

Paula Flanagan, Maura Dowling, Jolita Mereckiene, Georgina Gethin. The effectiveness of interventions to improve seasonal influenza vaccination rates among Nurses. PROSPERO 2020 CRD42020169735 Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020169735

Review question

What interventions are effective in increasing seasonal influenza vaccination uptake rates among nurses?

Searches

A comprehensive search of both electronic databases and grey literature will be conducted. The database of abstract reviews of effects (DARE) and the Cochrane Central Registry of Controlled Trails (CENTRAL) will be searched. The following electronic databases will also be searched, MEDLINE (OVID) CINAHL (EBSCO) (Cumulative index to nursing and allied health literature), Embase (OVID) and Scopus (Elsevier).

Types of included studies

Randomised controlled trials, cluster randomised controlled trials, controlled before and after studies and interrupted times series and repeated measures studies will be included.

The selection criteria were developed in line with the population, intervention comparison and outcome (PICO) format.

Condition or domain being studied

The effectiveness of interventions to improve seasonal influenza vaccination rates among nurses

Participants/population

Qualified nurses

Intervention(s), exposure(s)

Any intervention, campaign or strategy including (but not limited to) education, access, incentives, role models, leadership and management, implemented with the aim to increase seasonal influenza vaccination uptake among qualified nurses will be included. For the purpose of this review, the intervention may consist of single or multiple factors.

Comparator(s)/control

Comparison to any other intervention or no intervention

Context

Main outcome(s)

Change in nurses' uptake of seasonal influenza vaccination

Timing and effect measures

The intervention effect will be measured using the relative risk (RR) and 95% confidence interval (CI).

Additional outcome(s)

None

Timing and effect measures

Not applicable

Data extraction (selection and coding)

Records identified from the search will be screened by title and abstract and full text independently by at least two members of the review team. Two reviewers will also independently extract the data from included studies using a modified version of the Cochrane effective practice and organisation of care (EPOC) data extraction tool. Information pertaining to the study Author, year of study, study design, population, study setting, intervention type and nurses vaccine uptake (pre and post) will be extracted from the primary studies. Any disagreements will be resolved by including a third reviewer if necessary.

Risk of bias assessment

Two reviewers will independently assess the risk of bias using the suggested risk of bias domains for Cochrane EPOC reviews. Conflicts will be resolved through further discussion between the two reviewers. Where conflicts cannot be resolved a third reviewer will be consulted.

Strategy for data synthesis

All primary studies in this review will be summarised using Revman version 5.3. The data from the primary studies will be synthesised narratively and tabular presentation of study characteristics and outcome will be provided. If the primary studies are found to be homogenous then a meta-analysis will be performed. The impact of statistical heterogeneity will be quantified using the I-squared statistic (I^2).

Analysis of subgroup or subset

Subgroup analysis will be conducted by health care facility and intervention type where feasible.

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Type and method of review

Intervention, systematic review, meta-analysis

Anticipated or actual start date

December 2019

Anticipated completion date

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Data extraction

Risk of bias assessment

Data analysis

Section B: Systematic Review

The effectiveness of interventions to improve the seasonal influenza vaccination uptake among nurses: A systematic review.

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Under review

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6.2 Abstract

Background

Seasonal influenza is a significant cause of mortality and morbidity worldwide. Despite annual recommendations, influenza vaccination uptake rates are disproportionately lower among nurses compared to other health care professionals, especially when compared to physicians. Nurses have an additional risk of exposure to influenza infection due to the nature of their work.

Aim

To determine the effectiveness of interventions in increasing seasonal influenza vaccination uptake among nurses

Methods

Evidence on the effectiveness of interventions to improve seasonal influenza vaccination uptake among nurses was systematically reviewed. A comprehensive search of six electronic databases and grey literature was undertaken. A minimum of two reviewers completed study selection, data extraction and risk of bias assessment independently.

Results

One hundred and thirty-four studies were identified of which one cluster randomised trial met the inclusion criteria. The results of the included study found the implementation of an intervention with multiple components increased nurses' seasonal influenza vaccination rates during a single influenza season in geriatric healthcare settings in France. As the evidence in this review was very limited, it was not possible to make recommendations regarding which interventions were effective at increasing the seasonal influenza vaccination rate for nurses.

Conclusion

This systematic review highlights a lack of high-quality studies that assessed interventions to improve the seasonal influenza vaccination of nurses. In view of the likelihood of influenza and the coronavirus (COVID-19) pandemic occurring together, it is imperative to have evidence on effective interventions for the nursing workforce and for policy decision makers.

Keywords
Seasonal influenza vaccination, immunisation programmes, nurses, vaccination, healthcare workers, seasonal influenza vaccination behaviours.

6.3 Introduction

Seasonal influenza is a key public health priority. Globally, annual epidemics contribute to a significant increase in morbidity and mortality among high risk groups (World Health Organization, 2018) with the majority of deaths occurring in those aged over 65 years (Nair *et al.,* 2012). Contributing to this disease burden is the fact that influenza infection can be transmitted within healthcare settings between vulnerable patients, staff and visitors (Weber *et al.,* 2010).

Healthcare workers (HCWs) are three times more likely to be infected with influenza compared to other adults working outside the health service (Kuster *et al.,* 2011). Nurses have an additional risk of exposure to influenza infection compared to other HCWs due to the nature and duration of their work (Chen *et al.,* 2010; Kuster *et al.,* 2011). Nurses may not only acquire, but also transmit and spread infection to vulnerable patients (Haviari *et al.,* 2015). These vulnerable patients have a high case fatality rate and are also at higher risk of acquiring nosocomial influenza infections (Salgado *et al.,* 2002). It is estimated that 25% of all HCWs are infected with influenza each year and the rate of asymptomatic infections in fact might be higher (Odelin, 1993; Kuster *et al.,* 2011). Evidence also suggests that HCWs who are asymptomatic or have mild influenza illness often continue to work (Weingarten *et al.,* 1989) contributing to influenza transmission and nosocomial outbreaks within healthcare settings (Bridges *et al.,* 2003).

Although a number of measures are available to prevent transmission, annual vaccination remains the cornerstone for influenza prevention and recommendations internationally highly favour vaccination for high risk individuals including HCWs (European Council, 2009; World Health Organization, 2012a; Health Service Executive, 2017; Centers for Disease Control and Prevention, 2019). Although vaccine effectiveness can vary each year (Osterholm *et al.,* 2012), the seasonal influenza vaccine is safe and effective (Michiels *et al.,* 2011) with vaccine effectiveness reported to be 50-90% in adults of working age (Michiels *et al.,* 2011). Although the influenza vaccine has been criticized for this varying efficacy, it

remains the primary method of preventing morbidity and mortality associated with influenza (Pitts *et al.,* 2014).

Outbreaks of influenza in both hospitals and long-term care facilities (LTCFs) have been associated with low vaccination coverage among HCWs (Cunney *et al.,* 2000; Salgado *et al.,* 2002; Salgado *et al.,* 2004; Osterholm *et al.,* 2012; Sayers *et al.,* 2013). Even though nurses are known to be at higher risk of influenza infection (Chen *et al.,* 2010, Kuster *et al.,* 2011), they have one of the lowest vaccination uptake rates compared to all other HCWs (Martinello *et al.,* 2003; Sartor *et al.,* 2004; Bautista *et al.,* 2006; Leitmeyer *et al.,* 2006; Christini *et al.,* 2007; De Juanes *et al.,* 2007; Esposito *et al.,* 2007; Riphagen-Dalhuisen *et al.,* 2012; Wicker *et al.,* 2009, O'Lorcain *et al.,* 2019) with uptake rates much lower than national and international targets of 75% (World Health Organization, 2003; European Council, 2009; Health Service Executive, 2018).

Vaccination uptake rates and decision-making reasons for accepting or rejecting the influenza vaccine covers a wide diverse spectrum and in general are themed around attitudes, beliefs, level of knowledge and perceived risk associated with influenza and the vaccine (Hofmann *et al.,* 2006; Riphagen-Dalhuisen *et al.,* 2012; Hollmeyer *et al.,* 2013). These factors have been found to vary according to individual categories of HCWs (Martinello *et al.,* 2003; Livni *et al.,* 2008; Bouadma *et al.,* 2012; Dominguez *et al.,* 2014; Edelstein & Pebody, 2014). For instance, good medical knowledge about influenza and the vaccine has been found to be associated with an increase in HCWs' vaccine uptake (Martinello *et al.,* 2003; Livni *et al.,* 2008; Zhang *et al.,* 2012b; Dominguez *et al.,* 2014; Smith *et al.,* 2016a; Flanagan et al. 2020a) however, lower levels of knowledge about influenza has been found to negatively impact nurses' vaccination uptake when compared to physicians (Martinello *et al.,* 2003; Livni *et al.,* 2008; Dominguez *et al.,* 2014). In contrast, vaccination decisions have been found to be associated with professionalism (being a role model or for patient protection) among physicians (Bouadma *et al.,* 2012). Therefore, due to the dissimilarities in vaccination decision making among the

different categories of HCWs, encouraging influenza vaccination is a complex issue.

The effectiveness of interventions has also been found to vary among different categories of HCWs, in particular interventions aimed at promoting vaccine uptake have been reported to be less successful among nurses and other health professionals when compared to physicians (Bouadma *et al.,* 2012, Friedl *et al.,* 2012). These findings suggest that different approaches to influenza vaccination are necessary among nurses and also other HCWs (Bouadma *et al.,* 2012; Dominguez *et al.,* 2014). Nurses are the largest workforce in the health service and identifying interventions that are effective in increasing seasonal influenza vaccine coverage among them is essential. Although there have been a number of systematic reviews conducted which focused on interventions among HCWs (Lam *et al*., 2010; Hollmeyer *et al.,* 2013; Lytras *et al.,* 2016; Rashid *et al.,* 2016), they did not compare and evaluate the interventions implemented by each occupational category. To address this gap, the aim of this systematic review is to determine what interventions are effective in increasing the seasonal influenza vaccine uptake among nurses.

6.4 Methods

This review followed a detailed protocol which is registered with Prospero (Flanagan *et al.,* 2020c). The Population, Intervention, Comparison and Outcome (PICO) model was used to formulate the research question for this review and is displayed in table 6.1. The Effective Practice and Organisation of Care (EPOC) taxonomy (2015) of health systems interventions was followed and directed this systematic review. Identification of all relevant studies followed the preferred reporting item for a systematic review and meta-analysis (PRISMA) (Moher *et al.,* 2009) (Figure 6.1).

Table 6.1 PICO framework

PICO	Criteria
Population	Qualified nurses working in any healthcare setting
Intervention	Any intervention or strategy implemented with the aim of increasing seasonal influenza vaccination uptake rates among nurses. The US health care advisory committee on immunisation practices (Pearson et al. 2006) recommend five components to improve HCWs immunisation rates. These include: • Educational interventions • Access to the vaccine • Staff incentives • Champions and role models • Leadership and management • Monitoring and feedback incorporated in single or multifaceted interventions For the purpose of this systematic review the intervention may consist of either single or multiple components.
Comparison	To another intervention or no intervention
Outcome	Primary outcome: Any change in seasonal influenza vaccine uptake among nurses Secondary outcome: None

6.4.1 Search strategy

A comprehensive search of electronic databases and grey literature was undertaken. The following databases were systematically searched; MEDLINE Ovid (1946 to June 2020), EMBASE Ovid (1974 to May 2020), Cinahl (EBSCO Host, 1937 to June 2020) and Scopus. The Database of Abstracts of Reviews of Effects (DARE), Cochrane Database of Systematic Reviews and Cochrane Central Registry of Controlled Trials (CENTRAL) were also searched. The initial search was performed in Medline using a combination of controlled vocabulary and free-text terms to ensure maximum retrieval. The search terms were then adapted for EMBASE, Cinahl, Scopus, DARE and CENTRAL. No limits were applied to publication date. The initial search was not limited to English language only; however, this criteria was applied at full text screening stage. In order to identify further studies of interest, reference lists of all relevant studies and systematic reviews were tracked. Authors of trials were contacted for additional information where relevant. The following websites were also searched for grey literature: World Health Organization (WHO), European Centre for Disease Prevention and

Control (ECDC), Centre for Disease Prevention and Control (CDC) and Public Health England (PHE). The results of the search strategy are displayed in the PRISMA flow chart in figure 6.1 and the full search strategy is available in Appendix A.

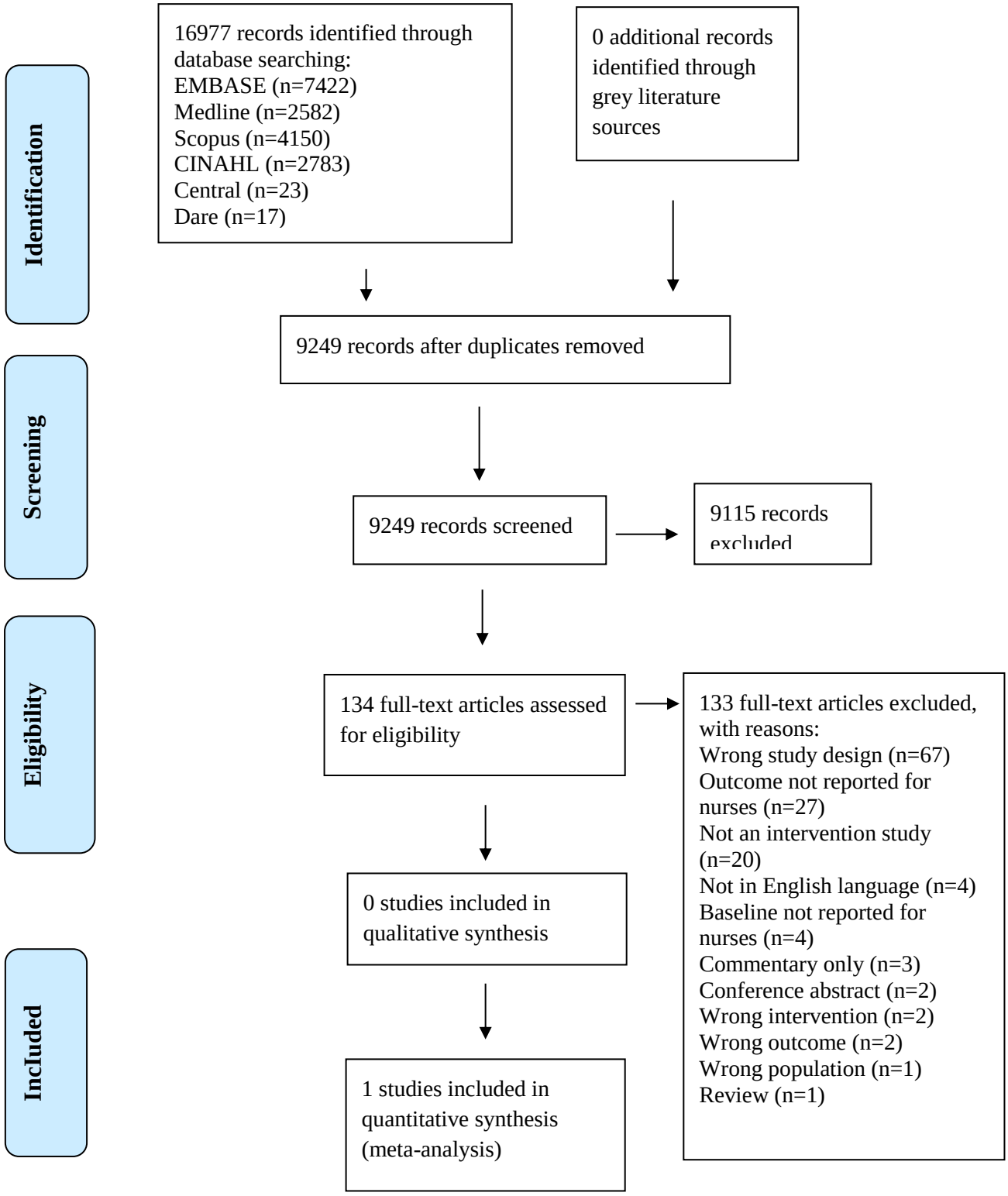

Figure 6.1. The "Preferred Reporting Item for Systematic Reviews and Meta-analyses" (PRISMA) flow diagram for the selection and inclusion of studies (Moher et al 2009)

6.4.2 Eligibility criteria

Research studies that reported an intervention with the aim of increasing the seasonal influenza vaccination uptake among nurses were included. All eligible studies had to report the proportion or number of nurses who received the seasonal influenza vaccination as an outcome measure.

Randomised trials, non-randomised trials, controlled before and after studies, interrupted time series studies and repeated measure studies were identified as eligible for inclusion (Effective Practice and Organisation of Care, 2015). Studies that reported all other vaccines including studies relating to a pandemic vaccine were excluded.

6.4.3 Study selection

Records identified in the search were imported into Covidence software for systematic reviews and duplicates were removed. All results were screened independently by title and abstract and then by full text by at least two reviewers. Any conflicts were resolved by discussion.

6.4.4 Data extraction and analysis

Two reviewers extracted the data of the included study using a modified version of the EPOC data extraction template (Cochrane, 2017). A narrative summary of the findings are presented and also displayed in table 6.2.

6.4.5 Methodology quality

The same two reviewers independently assessed the methodological quality of the included study using the EPOC risk of bias criteria (Effective Practice and Organisation of Care, 2015). The risk of bias was assessed using the six domains of trial methodology: random sequence generation; allocation concealment; blinding of participants; incomplete outcome; and selective reporting and other bias. These six domains were assessed and classified as having high, low or unclear risk of bias (table 6.3). The same two reviewers used the modified data collection form to independently extract the data from the included study (table 6.2).

Table 6.2 Data extraction summary table

Author	Year	Design	Setting/Country	Year of study	HCW (n)	Nurses (n)	Intervention	Baseline vaccine rate of nurses[a]	Vaccination status of nurses	Intervention	Control	Total*
Rothan-Tondeur et al. (program 2)	2011	Cluster randomised controlled trial	Geriatric healthcare settings (n=43) in France	2006-2007	1335 in the intervention group and 1539 in the control group	686 nurses; 347 in the intervention group and 339 in the control group	Program 2: Vesta study: incentive, slide show, two booklets, information leaflets, rubber bracelets and posters	33% in the intervention group and 36% in the control group	**Vaccinated**	**170 (49%)**	**92 (27%)**	**262**
									Unvaccinated	**177 (51%)**	**247 (73%)**	**424**
									Total	**347**	**339**	**686**

[a]Baseline vaccination uptake rate for nurses was 33% and 36% for the intervention and control group respectively (i.e. after program 1 and before program 2)
*P value <0.01

6.5 Results

The initial search strategy yielded 16, 997 citations. No records were identified through searching the grey literature. After duplicates were removed (n=7, 728), a total of 9, 249 records were screened by title and abstract (figure 1). After closely examining the title and abstracts, a total of 134 articles were identified as potentially eligible and assessed by full-text. Only one study was identified as eligible and therefore included in this review.

6.5.1 Characteristics of the included study

Rothan-Tondeur *et al.* (2011) reported a cluster randomised trial. The trial participants consisted of all HCWs employed in 43 geriatric health care settings in France (n=1,335 intervention group vs n=1,539 in the control group). This study formed program 2 of the VESTA study. The VESTA study was a cluster randomised interventional study and included two programs (program 1 and program 2) that were consecutively developed and assessed. The included study in this systematic review consists of the findings reported only from program 2 as baseline vaccination uptake rates for nurses was not reported for program 1. Program 1 was implemented between October 1st and November 15th 2005 (single component intervention study) and program 2 (multiple component intervention study) was implemented over one influenza season, between November 1st and December 5th 2006 (one year after program one). The geriatric healthcare facilities that agreed to participate in this study that were randomly allocated to the program 1 cluster, were also allocated to the program 2 cluster the following year and those allocated to the control 1 cluster to the control 2 cluster. Program 2 efficacy was assessed between December 10th and December 20th 2006. The study authors reported that 20 clusters were randomly allocated to program 2 and 23 clusters allocated to control 2. In both clusters, approximately a quarter of HCWs were nurses (n=347 in the intervention group and n=339 in the control group) (table 2). All other HCWs in this study consisted of physicians and nursing auxiliaries (Rothan-Tondeur *et al.*, 2011).

The intervention

There were multiple components to the intervention implemented in this study. The objective of the intervention program (referred to as program 2) was to involve HCWs in creating a "safety zone" which the influenza virus could not get through. The program included two Kits. The aim of Kit 1 was to improve HCWs vaccination uptake and Kit 2 was to reward healthcare settings when an increase in vaccination uptake was observed. Kit 1 included a slide show, posters, two booklets/leaflets, and rubber bracelets for staff. The local investigator in each of the included healthcare settings contacted a number of HCWs previously identified as opinion leaders to provide support to them and assist in promoting the influenza vaccine. Those HCWs identified as opinion leaders and whom agreed to promote the vaccine, delivered the "myths and reality about flu vaccination" slide-show to staff and answered questions. Posters indicating that the department was combating influenza were also displayed on the doors within each healthcare setting. One information leaflet was disseminated by the HCWs to families visiting their elderly residents and the other was kept for the HCWs. A rubber bracelet with the message "all together against flu" was given to all vaccinated HCWs. When HCWs flu vaccination reached >50% uptake, the healthcare setting received Kit 2 which comprised of posters indicating that the department had reached its objective. These posters were displayed on the department doors and seen by the HCWs, the elderly residents and their families (p128).

Primary outcome

Vaccination uptake rates of nurses increased significantly in the intervention group compared to the control group (49% vs 27%, $p<0.01$) (table 6.2). A change in nurses' baseline vaccination uptake rates was observed in the intervention and control group; 33% to 49% and 36% to 27% respectively. This observation was assessed over one influenza season.

Risk of Bias of included study, Rothan-Tondeur *et al*. (2011)

Details of the judgement of the risk of bias of each domain for the included study (Rothan-Tondeur *et al.* 2011) are provided in table 6.3.

Table 6.3 Risk of bias assessment

Cluster randomised controlled trial	**Judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear	Insufficient information provided
Allocation concealment (selection bias)	Unclear	Insufficient information provided
Incomplete outcome data (attrition bias)	High	There were healthcare facilities lost to follow up but they had new facilities included in the control group between program 1 and program 2. Characteristics of those lost to follow up were not reported.
Selective reporting data (reporting bias)	Low	Not observed
Blinding of participants and personnel	High	Not observed
Blinding of outcome assessment (detection bias)	High	Not observed
Other bias		**Recruitment bias:** only HCWs agreeing to participate were included in the study and no information was collected on HCWs not included in the study. Therefore, a recruitment bias cannot be excluded. The 7 centres included in the control cluster between the implementation of the two active programs probably differed from the other centres that had immediately agreed to participate in the study. **Crossover bias:** Program 2 was developed and applied after Program 1, and potentially a small part of the effect of Program 2 may have been due to Program 1.

6.6 Discussion

The main objective of this review was to provide a synthesis of the evidence which assessed the effectiveness of interventions on the seasonal influenza vaccination uptake among nurses. The EPOC taxonomy of health systems interventions informed this review to ensure that methodologically rigorous study designs were

included. Only one study met the inclusion criteria (Rothan-Tondeur *et al.,* 2011) and evaluated the effectiveness of a multiple component intervention program on the seasonal influenza vaccination uptake by occupational category. Although the included study concluded that the intervention program was effective in increasing the seasonal influenza vaccination among all occupational groups of HCWs; non-vaccinated nurses were particularly receptive to the intervention program (Rothan-Tondeur *et al.,* 2011). Although the vaccination uptake rate in this study remained low, a change in nurses' baseline vaccination uptake rates was observed in the intervention and control groups; 33% to 49% and 36% to 27% respectively. The results also highlighted that the influenza vaccination uptake varied among the different occupational health groups with physicians more likely to accept the vaccine compared to nurses (91% versus 49% in the intervention group and 63% versus 27% in the control group) (Rothan-Tondeur *et al.,* 2011). Despite the improvement observed in the vaccine uptake rate of nurses in this study the vaccine uptake remained considerably low. Multiple component or multifaceted interventions have been reported to be more successful compared to single components in achieving higher vaccination uptake rates among HCWs (Lam *et al.,* 2010; Hollmeyer *et al.,* 2013; Lytras *et al.,* 2016; Rashid *et al.,* 2016; Bechini *et al.,* 2020). However, evaluating multifaceted interventions can make the effect of specific interventions difficult to establish. The randomised trial included in this review was conducted over a single influenza season and the short duration evaluating the intervention may impact the accuracy of the actual effect observed. The impact of interventions are encouraged to be observed over time, to improve the accuracy of the observed outcomes (Lam *et al.,* 2010).

In comparison to multiple component interventions and although mandatory vaccination programmes have not been evaluated through methodologically rigorous study designs (Rashid *et al.,* 2016), previous systematic reviews have reported mandatory vaccination to be the most relevant single intervention effective at increasing vaccination uptake rates of HCWs (Hollmeyer *et al.,* 2013; Rashid *et al.,* 2016). In the Unites States (US) HCWs' vaccination coverage is reported to be highest among personnel who are required by their employers to be vaccinated and

lowest among HCWs employed in settings where vaccination is not required, promoted or offered on site (Black *et al.,* 2018). Although several studies have showed support for this policy (Hollmeyer *et al.,* 2013), the concept of implementing mandatory vaccination raises many ethical issues especially among nurses (*Stead et al.,* 2019a). Making vaccination a mandatory condition of initial and continued employment is likely to be the most controversial, yet it is possibly the most likely successful method for increasing uptake (Hollmeyer *et al.,* 2013; Lytras *et al.,* 2016; Bechini *et al*., 2020,). Despite this, a recent systematic review suggested better results in HCWs vaccination uptake were in fact obtained by combining interventions in different areas (Bechini *et al.,* 2020).

Based on the results of our systematic review, the randomised trial included in this systematic review did report a significant increase in the vaccination uptake among nurses as a result of an intervention program with multiple components over a single influenza season. Program 1 of this study implemented a single component intervention which aimed to provide top down scientific information and develop a sense of altruism to the same population and healthcare settings in France (Rothan-Tondeur *et al.,* 2009). In comparison to program 2, program 1 was ineffective in promoting vaccination uptake rates of HCWs. Although there was no baseline vaccination data provided for nurses before the implementation of program 1, the authors reported that there was no statistically significant difference observed between the two clusters in the percentage of vaccinated nurses and also nursing auxiliaries ($p>0.05$). However, this program (program 1) was found to be effective for physicians and other HCWs ($p<0.05$) (Rothan-Tondeur *et al.,* 2009). This finding suggests that although multiple components may be more effective for nurses, the content of program 1 (top down scientific evidence and a sense of altruism) was met with resistance among nurses.

The findings from this review recommend high quality research studies are conducted and studies that aim to evaluate influenza campaigns or interventions should have a comparable control group. The evaluation of the intervention programmes should be provided by each occupational category and not by all

HCWs in general as it is important to identify the effectiveness of interventions by the different categories of HCWs. Evidence suggests that the reasons HCWs accept or reject the seasonal influenza vaccine differ, therefore supporting the need to develop and tailor interventions differently when targeting each category of HCWs (Bouadma *et al.,* 2012). The evidence in this systematic review on interventions aimed to increase the seasonal influenza vaccination among nurses is very limited.

The main strength of this review is found in the comprehensive search and the independent study selection, risk of bias assessment and data extraction procedures. This review followed a detailed protocol (Flanagan *et al.,* 2020c) and adhered to the selection criteria recommended in the EPOC taxonomy of health systems interventions. However, there are some limitations associated with this systematic review. Despite a comprehensive search strategy, some studies might not have been included. Many other study designs were excluded as they did not meet our pre-specified inclusion criteria. Studies that failed to report the outcome measure (i.e. vaccine uptake rate for nurses) or baseline vaccination rate for nurses before the study began were also excluded. Moreover, this review did not include studies assessing the pandemic vaccine. Therefore, this rigorous approach resulted in only one study eligible for inclusion. In addition, the risk of bias assessment indicated that there was a risk of bias present in the included study. It was also not possible to conduct a meta-analysis using Revman (RevMan) and also to assess statistical heterogeneity (Higgins & Green, 2011) as the data did not permit carrying out this analysis.

Detailed results from excluded studies are also not provided, however studies that have previously explored this topic have done so within the context of all HCWs and therefore it was not possible to distinguish the true effect of the intervention on vaccine uptake rates by individual occupational groups.

6.7 Conclusions

Vaccination is a complex behaviour. Although vaccination uptake rates of HCWs vary, vaccinating HCWs against seasonal influenza has been shown to be effective in protecting service users, patients and staff. Despite this, vaccination uptake amongst HCWs especially among nurses remains suboptimal. A limited number of controlled studies were available on interventions aimed at improving nurses' vaccination rate and found that most of the literature identified uncontrolled studies of multifaceted campaigns among HCWs in general. This systematic review revealed a gap in the evidence about the appropriate interventions for increasing influenza vaccination among nurses. In view of the likelihood of influenza and the coronavirus (COVID-19) pandemic occurring together further high-quality research studies are urgently needed to assess the impact of interventions aimed at increasing the seasonal influenza vaccination uptake among nurses.

6.8 Funding statement

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6.9 Acknowledgments

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6.10 Conflict of interest

No conflict of interest has been declared by the authors.

Chapter 7: Discussion and Conclusion

7.1 Introduction

The aim of this chapter is to present the overall discussion and conclusion of this thesis. Following a brief outline, this chapter will discuss the key findings from each of the three studies in the context of the wider literature. This chapter will also discuss the contribution this thesis has generated to existing knowledge about the barriers and facilitating factors associated with seasonal influenza vaccine among nurses. The overall strengths and limitations of the thesis, and the implications for policy, practice and research, will also be included.

7.2 Overview of thesis

In order to enhance our understanding and contribute to the current knowledge of the barriers and facilitating factors associated with the seasonal influenza vaccine uptake among nurses, study one employed a sequential explanatory mixed methods design. This study first collected and analysed quantitative data and measured nurses' knowledge, risk perceptions, health beliefs and influenza vaccination practices using the KNIVQ (Zhang *et al.,* 2012a). The findings from the quantitative study (phase one) informed the development of phase two, which collected and analysed qualitative data through focus group discussions to further explore and elaborate the findings from phase one. The findings from phase one and phase two were integrated, which is essential for a mixed methods study (Onwueguzie, 2009; Creswell, 2011). The second study in this thesis, a generic qualitative study, used a subset of participant data from study one and explored nurses' views regarding mandatory vaccination policy. Finally, the third study was a systematic review undertaken to evaluate and determine the effectiveness of interventions on increasing seasonal influenza vaccine uptake rate among nurses.

7.3 Key findings

As discussed by Flanagan *et al.* (2020a) in chapter four of this thesis, the impact of nurses' knowledge, risk perception and health beliefs were measured using the KNIVQ (Zhang *et al.,* 2012a) and later explored using focus group discussions. Similar to other studies (Mehta *et al.,* 2008; Hollmeyer *et al.,* 2009; Zhang *et al.,*

2012b; Leong, 2015; Kadi *et al.*, 2016; Smith *et al.*, 2016a; Schmid *et al.*, 2017; Shahar *et al.*, 2017), analysis of the questionnaire found that greater knowledge about influenza and the vaccine, and higher risk perceptions, were associated with nurses' vaccinated in the past and with their future vaccine intentions. The results also indicated that, although nurses who believed they were in control of their health (internal subscale) were more likely to be vaccinated in the previous 12 months, the subscale 'powerful others' was found to be associated with nurses' future vaccine intentions. The influence of 'powerful others' and prior vaccination has also been reported elsewhere (Zhang *et al.*, 2012b; Smith *et al*., 2016a; Schmid *et al.*, 2017).

Although knowledge on its own is insufficient to change an individual's behaviour (Rhudy *et al.*, 2010), lower levels of knowledge about influenza and the vaccine was especially evident among younger nurses in this study. Those aged 20-29 years of age had lower mean knowledge scores than all other age groups. The study also found that nurses employed at staff grade had lower mean knowledge scores than those at nurse management grades. This finding is concerning as 65.3% of the current nursing workforce in Ireland consist of staff nursing grades (Health Service Executive, 2020). Harrison *et al.* (2016) also reported that younger nurses had lower levels of knowledge about influenza and stressed that nursing schools are an important environment for delivering educational information about vaccinations. Such delivery can be an effective method to increase nurses' knowledge and thereby positively influence their attitudes towards vaccination (Harrison *et al.*, 2016). It is of the upmost importance to teach and convince nurses as early as possible in the nurse education process that influenza is not a harmless cold (Friedl *et al.*, 2012). Delivering influenza education and training through nursing schools has also the potential to reach both undergraduate and post-graduate nurses.

It is important to note that, although this study showed that high levels of knowledge about influenza and the vaccine were positive predictors of vaccine acceptance, both vaccinated and unvaccinated nurses had good knowledge about influenza and the vaccine in general, with the mean knowledge score of vaccinated and unvaccinated nurses reported to be 18.25 vs 17.19 respectively (range 0-22). These

findings were similar to those reported in two cross-sectional studies conducted on a sample of nurses in the UK and Australia respectively (Smith *et al.,* 2016a; Zhang *et al.,* 2012b). Previous studies have shown that HCWs have refused the influenza vaccine, despite correctly responding to knowledge questions about it (Dey *et al.,* 2001; Martinello *et al.,* 2003; O'Rorke *et al.,* 2003). The study results support this finding. They showed that, although 99% of nurses were aware that having the influenza vaccine was recommended, the low vaccine uptake rate (40.3%) highlights that awareness about this recommendation alone does not appear to influence vaccination uptake rates among nurses.

Despite these findings, it is clear that nurses' levels of knowledge about influenza and the vaccine can affect their perception of risk. Perception of risk is an inherent part of the decision-making process and is a significant predictor of vaccine-related behaviour (Freimuth *et al.,* 2017). Perceived risk is the extent to which an individual believes they are subject to a threat. The greater the perceived risk, the more likely it is that the individual will be motivated to take health-protective steps (Freimuth *et al*., 2017). A meta-analysis of risk and vaccination concluded that there is a consistently a strong relationship between risk perception and vaccination behaviour (Brewer *et al.,* 2007). In particular, this review found studies that focused on influenza vaccination had larger effect size than studies about other types of vaccination (Brewer *et al.,* 2007). Analysis showed that nurses with a higher risk perception were more likely to have been vaccinated in the past and also have intentions to be vaccinated in the future, with the desire for self-protection and the protection of family and friends influencing their perceived levels of risk.

Nurses participating in the qualitative phase of this study also highlighted the influence that knowledge has on their perception of the seriousness of influenza. Nurses who believed they were 'fit and healthy' and 'not at risk' did not perceive themselves as being susceptible to influenza. According to Nowak *et al* (2015), there are differences in perceived risk between those vaccinated and unvaccinated, with the latter being more likely to report comparatively lower susceptibility to influenza and, as a result, believing influenza not to be a serious threat (Nowak *et*

al., 2015). In addition to the perception of risk of contracting influenza, the current study also found perception of risk as a result of vaccine side-effects. A broad range of misconceptions about the vaccine, including fear of side-effects and fear of adverse reactions, were found to be barriers to vaccination. Analysis showed that 38.3% and 32.2% of nurses cited fear of vaccine side-effects, and vaccine safety concerns, as reasons for refusing the influenza vaccine. These misconceptions and fears appear to have been influenced by a lack of knowledge and trust about the vaccine. Among studies that have assessed the relationship between disease risk and perceived risk of side-effects, fear of side-effects is salient in vaccination decisions, especially among those who are unvaccinated (Freimuth *et al.*, 2017). These fears and concerns have been commonly reported in the literature as major barriers to influenza vaccination among nurses and other HCWs (Kimura *et al.*, 2007; Hollmeyer *et al.*, 2009; Looijmans-van den Akker *et al.*, 2009b; Albano *et al.*, 2014; Naleway *et al.*, 2014; Shahar *et al*., 2017). As a result, vaccination is perceived as being both unsafe and unnecessary, and this lack of confidence in vaccines is a threat to the success of future vaccination programmes (Dubé *et al.*, 2013).

Risk perception is influenced by an individual's assessment of the risk, and the adequacy of any risk assessment relies on the adequacy of the risk information that is accessible (Williams & Noyes, 2007). Effective communication of health risk is essential to limiting morbidity and mortality caused by communicable diseases (European Centre for Disease Prevention and Control, 2013). It was apparent from the findings in the qualitative focus groups that some of the mass communication systems used within the workplace to disseminate information about influenza and the vaccine were ineffective. Effective and efficient communication strategies for delivering information are crucial in healthcare since poor communication can lead to various negative outcomes and can compromise patient safety (Vermeir *et al.*, 2015). Reducing negative consequences from ineffective communication strategies relies heavily on cooperation and communication. It must successfully instruct, inform and motivate appropriate self-protective behaviour as well as update risk information, build trust and dispel rumours (Vaughan & Tinker, 2009). The results

of the first study found that there was no standardised method of delivering information about influenza and the vaccine to nurse, and that despite nurses being informed about vaccine clinic times and being encouraged by hospital management to get vaccinated against influenza, they do not receive adequate information about influenza and the vaccine unless they source it themselves. Unfortunately, vaccination has become a source of fear and a target for misinformation (Dubé *et al*., 2013). Although there is robust evidence regarding the safety and effectiveness of the influenza vaccine, many studies have demonstrated the negative influence that media controversies have on vaccine uptake (Mason & Donnelly, 2000: Smith *et al.,* 2007; Dubé *et al.,* 2013). The issues surrounding nurses sourcing information independently about influenza and the vaccine, means that they may be at greater risk of accessing misinformation about the vaccine. Therefore, it is essential that information about influenza and the vaccine is obtained or delivered to nurses by reputable sources.

Although nurses who believed they were in control of their health were more likely to be vaccinated, 'powerful others' such as senior colleagues were found to be associated with nurses' future vaccine intentions. Llupiá *et al.* (2016) investigated the influence of social networks and peers and found that links to vaccination were more likely to occur between HCWs of the same professional category (Llupià *et al.,* 2016). Nursing colleagues were found to be influential in the first study in that they sought reassurance and opinions from each other about the vaccine. The influence of peers and colleagues on vaccine acceptance or refusal has also been widely cited in the literature (Manuel *et al*., 2002; Yassi *et al.,* 2010; Quach *et al.,* 2013; Hwang & Lim, 2014; Lehmann *et al.,* 2014; Prematunge *et al.,* 2014; Quinn, 2014).

The first study also found that nurses were strongly influenced by information disseminated to them by flu experts. It has been reported elsewhere that encouragement from both colleagues and employers were positively associated with vaccination against influenza (Nowrouzi-Kia & McGeer, 2014). The influence of people close to HCWs, and receiving information about influenza from a

physician, were important determinants of vaccine uptake (Looijmans-van den Akker *et al.,* 2009b). Coe *et al.* (2011) revealed that HCWs were more likely to intend to get the vaccine if a physician had recommended it. Senior nursing and medical colleagues must recognise the important role they play in recommending and encouraging the influenza vaccine to peers and colleagues. The role of middle managers in fostering high vaccine uptake rates has also been previously reported (Seale *et al.,* 2012; Quach *et al.,* 2013; Mounier-Jack *et al.,* 2020). In addition, senior staff supporting influenza vaccination, as well as the perceived importance of the influenza programme by managers, was found to be important factors increasing vaccination uptake rates (Edelstein & Pebody, 2014; Stead *et al.,* 2019b). The first study also highlighted that nurse managers had a fundamental role in facilitating access to the vaccine and were considered good role models, influencing and encouraging vaccination. In addition, a recommendation by the ward manager was identified as an important factor in a previous study (Boey *et al*., 2018).

Reports have consistently highlighted that the workplace can create an enabling environment for employees to receive the vaccine (To *et al.,* 2016). The provision of organised vaccination programmes and adequate free time for vaccination, as well as convenient vaccine accessibility and exposure to occupational health posters, are all associated with enhancement of vaccination uptake (Hollmeyer *et al.,* 2009; Looijmans-van den Akker *et al.,* 2009b; To *et al.,* 2016). However, despite the presence of a variety of posters displayed in the workplace, nurses in the first study expressed that they were ineffective and mostly ignored. Although access to the vaccine through peer vaccinators was reported to facilitate vaccine acceptance, this service was not available to nurses working weekends and night shifts. Although peer vaccinators have been shown to increase HCWs' vaccination uptake rates, this influence was not observed among nurses in a study conducted in the UK (Edelstein, 2014). Ensuring the service is designed to match the needs of HCWs is central to achieving high vaccine uptake (Mounier-Jack *et al.,* 2020).

The first study also found that, although only a minority of participants in the questionnaire cited organisational pressure as a reason for vaccine refusal, such

pressure was emphasised in the focus group discussions. The current strategy for promoting vaccination was considered very dictatorial, with nurses feeling pressurised to accept the influenza vaccine. It is important that managers acknowledge the rights of nurses to decline the vaccine. Several studies argue that it is up to the individual HCW to decide whether to accept or reject the influenza vaccine, and this decision should be respected (Willis & Wortley, 2007; Rhudy *et al.,* 2010; Yassi *et al,*. 2010; Lehmann *et al.,* 2014; Prematunge *et al.,* 2014; Quach *et al*., 2013; Quinn, 2014; Lorenc *et al.,* 2017). The findings from the first study also highlighted that nurses perceived the current strategy focused on increasing seasonal influenza vaccine uptake rates, but only to promote patient safety. Nurses also felt they were blamed if patients or staff were sick with influenza. In the first study, nurses viewed threats of punitive action by management as a bullying tactic. According to a qualitative systematic review, where management actively promoted vaccination, there was sometimes a perception that it was driven by an agenda to increase productivity or promote patient safety, not out of concern for the HCWs' own wellbeing (Lorenc *et al.,* 2017). This review highlighted that participants felt that the institutional policies focused solely on increasing vaccination uptake rates and that the resulting pressure on HCWs reflected a broader shift in relations between management and staff, at the expense of the staff (Lorenc *et al*., 2017). Guidance should be provided to middle management on how to support their staff to get vaccinated, while avoiding unhelpful coercion and pressure (Mounier-Jack *et al.,* 2020).

The HBM was the framework underpinning this research. This thesis confirmed that nurses' vaccine decision-making process is based on the constructs of the HBM. However, the model is limited due to it being cognitively-based and therefore does not consider the emotional components of behaviour (Champion & Skinner, 2008). It has been acknowledged that including an emotional construct might help explain relationships among HBM constructs (Rogers & Prentice-Dunn, 1997). Fear is a stimulus that results in a change in health behaviours (Jahanlou *et al.,* 2013) and is considered an essential part of a health-related behaviour (Witte, 1992). For instance, by adding fear to a model that predicts mammography,

relationships between HBM constructs and fear that might be useful predictors have been reported (Champion *et al.,* 2004; Champion *et al.,* 2005). These results found that fear was significantly predicted by perceived risk, benefit and self-efficacy and that fear, together with barriers, predicted actual behaviour (Champion & Skinner, 2008). The current study also found that nurses' perception of threat was heavily influenced not only by fear of influenza but also fears about the influenza vaccine. Nurses' fears about the vaccine were major barriers to their accepting of it, and fear of influenza was positively associated with their accepting it.

Jahanlou *et al* (2013) developed an extended training model that was based on the HBM, and which included two models of fear. They chose models of fear because most studies use perceived threat to design interventions while failing to distinguish between perceived threat and fear arousal. Jahanlou's model assumes that knowledge and understanding are not adequate for creating behavioural change but that feeling fear is also required (Jahanlou *et al.,* 2013). The most persuasive communications are those that provoke fear, while enhancing perceptions central to the HBM (Rogers & Prentice-Dunn, 1997). The concept of perceived threat, defined as a combination of perceived susceptibility and severity in the HBM, has great relevance for many health-related behaviours, and a common direction in research involving the HBM is to determine HBM's usefulness in combination with other models and frameworks (Champion & Skinner, 2008).

The second study in this thesis (study two, chapter five) established nurses' views in relation to mandatory influenza vaccination policy. The findings demonstrate that, although nurses' views regarding mandatory vaccination policy were mixed, the majority of nurses did not support it (Flanagan *et al.,* 2020b). Results from Australia also showed mixed responses among HCWs when asked whether they would support a mandatory influenza vaccination policy (Seale *et al.,* 2012). Despite these mixed views, findings from other studies have reported that 39% (Harrison *et al.,* 2016) and 70% (Wicker *et al.,* 2010) of HCWs would approve of mandatory vaccination policy to improve vaccine uptake rates. However, the study

by Wicker *et al.* (2010) found differing attitudes towards, and perceptions of, mandatory vaccination policy among the various occupational groups, with physicians demonstrating the highest rate of acceptance and compliance compared to nurses (55.4% for physicians and 43.3% for nurses) (Wicker & Rabenau, 2010).

The second study found similar findings to published research (Looijmans-Van Den Akker *et al.,* 2009a; Rhudy *et al.,* 2010; Quinn, 2014; Pless *et al.,* 2017; Stead *et al*., 2019a) in that nurses believed mandatory vaccination would be a violation of their autonomy and freedom of choice. However, the findings also suggest that giving nurses the option to sign a form and *"opt-out"* of having the vaccine would be more acceptable to them as they would still be given some choice regarding vaccine acceptance (Flanagan *et al.,* 2020b). Despite this, studies suggest the perceptions of declination from programmes are also mixed (Seale *et al.,* 2012; Quach *et al.,* 2013; Khodyakov *et al.,* 2014; Hill *et al.,* 2015; Stead *et al.,* 2019a; National Institute for Health and Care Excellence (NICE), 2018).

The use of a signed declination form for those refusing vaccination has been recommended as a method to improve HCWs' influenza vaccination rates (Pearson *et al.,* 2006; Greene *et al.,* 2008; Lytras *et al.,* 2016; Talbot *et al.,* 2016). It can be viewed as a compromise between voluntary and mandatory vaccination policy (Ribner *et al.,* 2008). Interestingly, Ribner *et al* (2008) evaluated the impact of using a declination form and found that among the occupation groups who signed such a form, nurses had the lowest rate of declining the vaccine. They also found that, although the use of declination forms was one of several measures implemented, it led to a 55% increase in the overall acceptance by HCWs of influenza vaccination (Ribner *et al.,* 2008). However, others have reported that these measures have not always resulted in an increase in vaccination uptake rates (Gazmararian *et al.,* 2007).

A potential advantage of using a declination form is that obtaining statements from HCWs who decline the vaccine for reasons other than medical contraindications can assist healthcare facilities to identify the HCWs who might require targeted

education or other interventions to overcome barriers to vaccine acceptance (Ribner *et al.,* 2008). In addition, some experts believe that programmes that employ the "carrot" rather than the "stick" approach, while respecting the rights of patients and employees, may be more successful in increasing rates of vaccination (American College of Occupational and Environmental Medicine (ACOEM), 2005). However, some hospitals and healthcare facilities have required unvaccinated staff to wear masks during the influenza season. According to Edmond (2019), this practice is not an evidence-based one for influenza, and masking unvaccinated workers is most likely to be punitive and coercive rather than a well-reasoned strategy for reducing influenza transmission (Edmond, 2019).

Although Edmond highlights that the use of face masks is not evidence-based practice for influenza, there have been widespread recommendations for HCWs to wear them as a result of the threats posed by the current coronavirus (COVID-19) pandemic. On 21st April 2020, the National Public Health Emergency Team (NPHET) decided to extend the use of surgical face masks in healthcare settings, and recommended that face masks be worn by HCWs when they are providing care and are within two meters of a patient, regardless of the person's COVID-19 status. It also recommended that all HCWs wear surgical face masks for all encounters of 15 minutes or longer with fellow HCWs in the workplace where a distance of two meters cannot be maintained (Health Protection Surveillance Centre, 2020a). Although HCWs show varying levels of compliance with the use of face masks, the masks' effectiveness is also dependent on compliance and correct usage - one systematic review has cited low compliance as the likely cause of the low effectiveness of masks that some studies have demonstrated (Cowling *et al.,* 2010). The current use of HCWs wearing face masks during the COVID-19 pandemic may affect influenza transmission in healthcare facilities this coming season.

Many studies robustly support the effectiveness of mandatory policies in improving vaccination rates (Babcock *et al*. 2010; Gaughan, 2010; Rakita *et al.* 2010; Hollmeyer *et al.,* 2013; Pitts *et al.,* 2014; Lytras *et al.,* 2016; Bechini *et al.,* 2020). Making vaccination a mandatory condition of employment is likely to be the most

controversial, but also the most successful, method for increasing influenza vaccine uptake rates (Finch, 2006; Lugo, 2007; Isaacs & Leask, 2008; O'Neal, 2010; Sullivan, 2010). The study reported here found that most nurses believed that implementing mandatory vaccination for seasonal influenza would negatively affect vaccine acceptance and cause resistance among staff. This finding was also reported in a recent UK study revealing that mandatory vaccination would antagonise those nurses who currently accept the vaccine (Stead *et al*., 2019a). Although some studies report mandatory programmes to be beneficial in directly shaping behaviour, providing opportunities to engage with HCWs and shifting norms around vaccination at an organisational level (Seale *et al.,* 2012; Khodyakov *et al.* 2014), other studies have found these programmes ineffective due to the logistical challenges and resistance to them among HCWs (Leask *et al.,* 2010; Seale *et al.,* 2012; Lorenc *et al.,* 2017). A recent systematic review suggests that better results in HCWs vaccination uptake were obtained by combining interventions in various areas (Bechini et al. 2020). Moreover, it is argued that, if voluntary vaccination programmes can increase vaccine uptake to over 50% among relevant HCWs, mandatory vaccination programmes are not necessary (Van Delden *et al.,* 2008).

The issue of mandatory vaccination has divided both HCWs and experts. Mandatory vaccination is consistent with the ethic to do no harm (Caplan, 2011). Advocacy for mandatory policy begins with recognising the impact of the disease and sharing goals of enhancing patient and staff safety, with the latter goal outweighing the HCWs' right to refuse the vaccine (Behrman & Offley, 2013). In contrast, disagreement in relation to mandatory policy centres on evidence of efficacy and ethical concerns (Behrman & Offley, 2013). According to Wicker *et al.* (2010), the obligation to 'do no harm' is not coercion (Wicker & Rabenau , 2010), and should be a fundamental ethical principle for all HCWs (Rea & Upshur, 2002). However, coercion, whether financial or emotional, truly constitutes a violation of both ethical and legal rights (Diodati, 2002), and, according to Yassi *et al.* (2010), vaccination is best done in a cooperative spirit as part of a safety culture, without punitive measures.

The low vaccine uptake due to voluntary vaccination policy has caused debate in many countries as to whether mandatory vaccination programmes should be implemented. In 2018, the faculties of Occupational Medicine, Pathology and Public Health Medicine in Ireland made a recommendation to introduce mandatory seasonal influenza vaccination for certain categories of HCWs on the basis of a risk assessment framework (Royal College of Physicians in Ireland, 2018). They highlighted that the health of the patient population as a whole takes priority over the personal choices of the individual HCW (Royal College of Physicians in Ireland, 2018).

Despite the influenza vaccine being safe and effective, the variability of its effectiveness raises concerns about implementing mandatory vaccination. The primary goal of any infection prevention program is to prevent transmission of ILI from HCWs to patients and colleagues. It should also aim to reduce to the lowest extent possible the number of HCWs who are present at work while infected (Edmond, 2019). Although only 10% of ILI cases are due to influenza viruses, both influenza and non-ILI can be clinically indistinguishable (Edmond, 2019). This fact calls into question the benefits of implementing mandatory vaccination for influenza. Despite high rates of presenteeism among HCWs, hospital infection prevention programmes place little emphasis on keeping from work those employees who are ill, instead basing their influenza prevention efforts primarily on attempting to achieve high rates of compliance with influenza vaccination (Edmond, 2019). Interestingly, the prevalence of presenteeism is higher among physicians than nurses (63% for physicians, compared with 47% for nurses) (Chiu *et al.*, 2017). According to Edmond (2019), a small reduction in presenteeism delivers an outcome equivalent to mandating vaccination, and therefore the use of soft power rather than a dogmatic approach is more likely to result in a more complaint workforce with other behaviourally-based infection prevention interventions (Edmond, 2019). Findings suggest that mandatory policies would not be easily adopted, and recommendations might work better if they focused on specific HCW groups (Galanakis *et al.*, 2014). There is also evidence that sustained

voluntary vaccination programmes can lead to high vaccination rates in the absence of mandatory vaccination programmes (Salgado *et al.,* 2004; Centers for Disease Control and Prevention, 2005).

Healthcare decisions for individual patients and for public health policies in general should be informed by the best available research evidence, and systematic reviews play a vital role in the decision-making process (Gopalakrishnan & Ganeshkumar, 2013). Using evidence from reliable research to inform healthcare decisions can ensure best practice and reduce variations in the quality of healthcare delivery (Green, 2005). Systematic reviews objectively summarise large amounts of information and can identify gaps in research (Gopalakrishnan & Ganeshkumar, 2013).

Following the conclusions from study one and study two, the final study in this thesis followed a detailed protocol (Flanagan *et al.,* 2020c) and conducted a systematic review to evaluate the effectiveness of interventions on seasonal influenza vaccination uptake among nurses. The EPOC taxonomy of health systems interventions informed this review, ensuring that methodologically rigorous study designs were included. However, only one study met the inclusion criteria and evaluated the effectiveness of a multiple component intervention program on the seasonal influenza vaccination uptake by occupational category (Rothan-Tondeur *et al.,* 2011).

HCWs consist of a large, heterogeneous workforce that includes a variety of professional groups who respond to vaccination campaigns in different ways (Bouadma *et al.,* 2012; Friedl *et al.,* 2012; Edelstein & Pebody, 2014). Doctors, for example, are more likely to accept the influenza vaccine because it is a professional responsibility (Simeonsson *et al.,* 2004; Bouadma *et al.,* 2012); nurses see influenza as a personal choice rather than a nursing intervention (Rhudy *et al.,* 2010).

A number of systematic reviews have evaluated the effectiveness of interventions on all HCWs' influenza vaccine uptake; however, these reviews did not evaluate

the effectiveness of these interventions by occupational category (Lam *et al.*, 2010; Hollmeyer *et al.*, 2013; Lytras *et al.*, 2016; Rashid *et al.*, 2016; Bechini *et al.*, 2020). Although the implementation of mandatory vaccination programmes has not been evaluated through methodologically rigorous study designs (Rashid *et al.*, 2016), evidence from observational studies suggests that mandatory vaccination is the most effective single intervention at increasing HCWs' influenza vaccine uptake rates (Hollmeyer *et al.*, 2013; Pitts *et al.*, 2014; Lytras *et al.*, 2016; Bechini *et al.*, 2020). With the exception of mandatory vaccination policy, results from three previous systematic reviews (Hollmeyer *et al.*, 2013; Rashid *et al.*, 2016; Bechini *et al.*, 2020) conclude that combined interventions are more effective at increasing vaccine uptake rates among HCWs.

Lam *et al* (2010) conducted a systematic review that identified twelve studies evaluating interventions to increase HCWs' influenza vaccine uptake rates in LTCFs, hospitals and primary care. None of the most common interventions reported - education, promotion or improving access to the vaccine - reached the recommended vaccine uptake level (Lam *et al.*, 2010). Lytras *et al.* (2016) found that interventions such as increased access and awareness were the most effective interventions. This review also recognised that, although educational interventions were not effective overall, they may be useful among particular groups of HCWs (Lytras *et al*., 2016).

As previously noted, intervention programmes that use a number of combined components have been shown to increase vaccine uptake rates among all HCWs (Hollmeyer *et al.*, 2013; Bechini *et al.*, 2020; Rashid *et al.*, 2016). However, despite the benefits of multiple component interventions, it is hard to separate the benefit of one intervention from the others (Jenkin *et al.*, 2019).

The one study that was included in the third paper in this thesis found that, while multiple component interventions were effective at increasing the influenza vaccine uptake rate of all HCWs, nurses were particularly receptive to them (Rothan-Tondeur *et al.*, 2011). This was in comparison to a single intervention programme

conducted the year previously with the same population (Rothan-Tondeur *et al.,* 2009). Despite the effectiveness of the intervention observed in the included study in this third study, the vaccine uptake rate remained low in the intervention group (49%) (Rothan-Tondeur *et al.,* 2011).

Despite only one study meeting the inclusion criteria in this systematic review, an initial review of the literature had identified three other cRCTs that potentially met the inclusion criteria (Rothan-Tondeur *et al.,* 2009; Abramson *et al.,* 2010; Looijmans-van den Akker *et al.,* 2010). However, it became apparent at full text screening that, although these trials included in their studies nurses along with all other HCWs, they provided baseline vaccination rates for all HCWs and not by occupational groups (i.e., for nurses separately) before the study had begun. The authors of all these three studies were contacted by email and information on nurses' baseline vaccination rates were requested. However, due to the length of time since the studies were conducted, the authors no longer had access to the data they had requested. The lack of access to nurses baseline vaccination rates in these studies was disappointing as each occupational group had provided details about the effect of the intervention programmes implemented in each of these studies.
Two of these studies (Abramson *et al.,* 2010; Looijmans-van den Akker *et al.,* 2010) assessed the effect of multi-component intervention programmes, and one study (Rothan-Tondeur *et al.,* 2009) assessed that of a single component intervention programme, on HCWs' vaccination uptake rates. The intervention programme Rothan-Tondeur *et al.* (2009) implemented was a single educational intervention that provided top-down scientific information and a sense of altruism to staff working in geriatric facilities. Although this single intervention programme was ineffective in increasing the vaccination uptake rates of all HCWs, the results found that vaccination rates differed according to occupation groups with physicians more likely than other HCWs to be vaccinated. There was no statistically significant difference between the proportion of vaccinated nurses in the intervention and control group and the proportion of revaccinated nurses. However, there was a statistically significant difference in the proportion of revaccinated physicians in the intervention group ($p<0.05$). This finding strongly supports the plea for

targeting physicians and other HCWs separately with influenza campaigns, especially since Friedl *et al.* (2012) claim that doctors accept the rationale of evidence-based data more easily than other HCWs do.

Looijman *et al.* (2010) conducted a cRCT involving 33 nursing homes to assess the effects of a systematically developed, multifaceted intervention programme. This programme consisted of three main components: an outreach visit to the nursing home by the researcher, who provided all required materials and background information (component A) plenary one-hour information meeting organised twice in each nursing home by a specialised nurse (component B); and the appointment of preferably a physician as local program coordinator (component C). Although the results of this study found a significantly higher, though moderate increase, in vaccine uptake rates of HCWs (25% in the intervention group and 16% in the control group; p=0.02), the vaccination uptake rate for nurses in the intervention group and control group was 52.5% and 49.3%, respectively (p=0.11). Despite most of the study participants being nursing assistants, this multifaceted intervention programme was not effective for the nurses in the study, although it was effective for all the HCWs (nurses, doctors and nursing assistants). Vaccine uptake at the nursing home level did show a large variation in effect between individual homes and part of this variation may be explained by the nursing home's compliance with the various elements of the programme (Looijmans-van den Akker *et al.*, 2010).

Abramson *et al.* (2010) evaluated the effect of a multiple component intervention in 27 primary care centres in Israel. The intervention included a lecture session to the staff given in the clinic by a family physician, reminders and relevant literature distributed by e-mail, and recruitment of a key figure from the local staff (physician or nurse) who personally approached each staff member. The overall vaccine uptake for all HCWs in the intervention and control groups was 52.8% and 26.5% respectively. When these vaccination uptake rates were compared to the HCWs' vaccination uptake for the previous season, an absolute increase of 25.8% and 6.6% was observed in both the intervention group and control group. Variables that were independently and positively associated with vaccine uptake were having been

vaccinated during the previous season, and being a nurse or physician. The vaccine uptake for nurses in this trial was high, and reported to be 60.6% (20/33) in the intervention group compared with 25.7% (9/35) in the control group (p=0.04). This intervention was not associated with an increase in vaccination among nursing assistants or pharmacists (Abramson *et al.*, 2010). This finding might be due to lecture attendance being significantly higher among physicians and nurses, and vaccine uptake was significantly higher (P = .009) among lecture participants (66% among participants, compared with 30% among non-participants).

The findings from the third study, a systematic review, identified a gap in evidence as only one study met the inclusion criteria. Therefore, high-quality, methodologically-rigorous research studies, focused on evaluating influenza campaigns or interventions, are needed, and should include a comparable control group. Intervention programmes should be evaluated in each occupational category of HCW to identify their effectiveness in each one. In the review it was not possible to recommend which intervention(s) were effective at increasing seasonal influenza vaccine uptake among nurses as only one study met the inclusion criteria.

Although multiple component interventions appear to be more effective than single component interventions at increasing influenza vaccination uptake rates among nurses, vaccine acceptance remains complex and these findings suggest HCWs' response to interventions vary not only among the various categories of HCWs but also among individual healthcare facilities.

7.4 Summary of discussion

By considering the findings from all three studies in this thesis, it was possible to contribute to the literature by gaining a breadth of understanding of nurses' vaccination practices. This understanding was achieved by identifying the barriers and facilitating factors that influence nurses' vaccination behaviours, with the objective being to inform the development of more effective campaigns that will improve and sustain nurses' vaccination uptake rates. The findings suggest that there are multiple factors that act as barriers to, and facilitating factors for,

vaccination among nurses and that, in the absence of mandatory vaccination policy, multifaceted interventions are necessary to tackle this vaccination gap.

Understanding why nurses engage in health behaviours such as vaccination is complicated and multifactorial, consisting of both internal and external factors (Corace & Garber, 2014). Although improving nurses' knowledge is a first step, it is not sufficient on its own to change nurses' vaccination behaviours (Corace & Garber, 2014). According to a study by Stead *et al.* (2019b), healthcare facilities that achieve higher influenza vaccination uptake rates have consistently used more varied implementation methods or involved more staff categories in influenza campaigns. Previous studies also support the use of multifaceted approaches rather than isolated interventions (Looijmans-van den Akker *et al.,* 2010; Hollmeyer *et al.,* 2013; Rashid *et al.,* 2016; Bechini *et al.,* 2020).

There have been wide variations in nurses' vaccine uptake rates across different healthcare settings in Ireland. Such variations lend support to the idea that, as well as individual factors, organisational and implementation factors explain how some healthcare settings achieve higher vaccine uptake rates than others (Stead *et al.,* 2019b). For vaccine interventions to be effective, implementation programmes to change vaccine behaviour should be built upon a coherent theoretical base and target all determinants of influenza uptake (Looijmans-van den Akker *et al.,* 2011). According to Corace & Garber (2014), it is important to apply well-validated behaviour change theories such as the HBM that have successfully guided other health behaviour interventions.

Incorporating the constructs of the HBM to develop and implement future influenza vaccination campaigns that target the needs of nurses could change the negative attitudes and beliefs associated with their vaccination behaviours. The use of the HBM in this thesis identified modifiable attitudes and behaviours that influence nurses' vaccination behaviours. These findings provide the foundations for future campaigns by producing empirical evidence to support policy makers in developing future vaccination programmes for the largest profession in the health service.

Although it is the responsibility of healthcare facilities to protect both patients and staff, it is imperative that they rely on best evidence. This evidence includes theories and models of behaviour change to help design and implement interventions to enhance vaccination coverage (Corace & Garber, 2014).

A systematic review carried out in 2016 aimed to evaluate the effectiveness of interventions based on psychological theories of behaviour change to improve HCW influenza vaccination rates. It found that, although many studies have used psychological frameworks to predict HCWs' vaccination behaviour, none of them evaluated interventions to increase HCWs' vaccination rates based on a psychological theory of behaviour change (Corace *et al.,* 2016). Successful influenza vaccination programmes are multifaceted and involve implementation at strategic, organisational, logistical and personnel levels (Stead *et al.,* 2019b). However, it is essential to recognise the heterogeneity among the various job categories of HCWs in designing these intervention programmes.

This thesis highlights the potential benefits of applying the HBM to inform interventions that target nurses' vaccine uptake rates. Given the success of these frameworks to predict vaccination behaviours, it is appropriate to apply these models to guide future vaccine interventions (Corace *et al.,* 2016). The seasonal influenza vaccine uptake among nurses has been a national challenge for many years in Ireland, and many healthcare facilities have been unable through voluntary vaccination programmes to reach the national targets set by the HSE. Despite calls for a mandatory vaccination policy, the evidence suggests that it is not necessary due to the ethical issues that are associated with it (Stewart, 2009; Wang et *al.,* 2017).

7.5. Strengths and limitations of this thesis

Although the strengths and limitations are addressed in each of the studies included in this thesis, the use of a mixed methods design was a strength as it guaranteed a rigorous and thorough examination of the topic under enquiry. This method enabled the collection of both quantitative and qualitative data in sequence and the pillar

integration process used to integrate the findings was suitable and novel for this topic. This is the first known mixed methods study to explore the barriers to, and facilitators of, vaccination among nurses working in the acute sector. The timely dissemination of findings and publication of work throughout this thesis confirmed a contribution to the body of literature. The KNIVQ used in the quantitative study was a valid and reliable instrument to assess nurses' knowledge, risk perceptions and health beliefs regarding influenza vaccination of nurses. These findings will inform the development and implementation of influenza vaccination campaigns to increase vaccine uptake rates among nurses.

Although the use of a non-probability sampling strategy was a limitation in this thesis, the large convenience sample size (n=462) in the quantitative study, and self-selected sample (n=35) in the qualitative study, were a strength. The generalisability of the results was limited to two hospital sites only, and the self-selected reporting of vaccine uptake among nurses was also acknowledged as a limitation. Four of the focus groups had a mixture of vaccinated and unvaccinated nurses, however, focus group five consisted of all unvaccinated nurses. This discussion may have been limited by having all unvaccinated nurses in the group and that a mixture of vaccinated and unvaccinated may have generated different views. The vaccination status of nurses was unknown in advance of the focus groups so having one focus group with all unvaccinated nurses was not planned.

The comprehensive and exhaustive search, the independent study selection, the risk of bias assessment and the data extraction procedures used were a strength in the systematic review conducted in this thesis. This review followed a detailed protocol and adhered to the selection criteria recommended in the EPOC taxonomy of health systems interventions. Despite this, and as a result of the rigorous approach used, many other study designs were excluded as they did not meet our pre-specified inclusion criteria. Studies that failed to report the outcome measure (i.e. vaccine uptake rate for nurses) or baseline vaccination rate for nurses before the study began were also excluded.

7.6 Implications for policy and practice

The implications of this thesis are extensive. The findings will assist future policy in strengthening current seasonal influenza vaccination campaigns by informing the development and implementation of tailored influenza vaccination campaigns to improve seasonal influenza vaccine uptake rates among nurses.

Future influenza campaigns and interventions should acknowledge that each category of HCW responds to interventions in a different way. There is also a need for a more targeted approach to improving vaccine uptake among unvaccinated nurses. Nurses working in ICU departments recognised the importance of vaccination against influenza to protect vulnerable patients. However, targeted programmes are needed for nurses working in geriatric and other facilities within hospitals where nurses do not see their patients as vulnerable and at risk of influenza infection.

It is essential that the personal benefits of vaccination for nurses are incorporated into future campaigns. Considering the important role of nurses in preventing influenza transmission, it should be mandatory that they receive evidence-based information about influenza and the vaccine. Mandatory training programmes should be provided to target nurses' risk perception and provide evidence-based knowledge about the safety of the vaccine. This approach is pertinent to tackling the fears and safety concerns that were identified as being a major barrier to vaccination. Nurses who deliver education and training in hospitals are also in a key position to provide evidence-based knowledge to nurses about influenza transmission, prevention and vaccination. Improving the delivery of direct communication to nurses is important to improve their vaccination uptake rates.

It is essential to equip nurse managers and medical professionals with the skills and knowledge to discuss influenza and the vaccine openly with colleagues in a professional manner. There should be a greater awareness of working conditions, rights and personal choices, while supporting nurses to accept the vaccine.

Furthermore, improving access to the vaccine through increasing the number of peer vaccinators for nurses working shift work and weekends is also required. Peer vaccinators should include all grades of nurses.

7.7. Summary of key recommendations

The following section discuss some important recommendations for the areas of policy, practice and education.

7.7.1 General recommendations: Policy

Vaccination policy remains voluntary in Ireland. General recommendations from this study is that vaccination policy remains voluntary. However, it is important that the current policy recognises the need for choice and autonomy of nurses and this should be central to future policy. It is also important that the current policy in relation to delivering influenza intervention programme target the personal benefit of vaccination. The literature highlights that HCWs have different attitudes to vaccination and that they also respond to generic interventions in different ways. Current practice is focused on the delivering of generic interventions through annual influenza campaigns. Multi-faceted, occupation-specific influenza campaigns based on the HBM should be prioritised to address dissemination of evidence-based information, accessibility and external cues to action. The need for strong leadership and collaboration across all areas are recommend to ensure consistency implementing these interventions.

7.7.2 General recommendations: Practice

Leadership: Strong leadership from management, senior clinicians and professional groups within the hospitals is recommended.

Communication: Effective communication messages are required and should be developed that addressed misconceptions of HCW, and address the inaccurate perception that influenza is a non-significant threat to themselves, their families and their patients.

Influencers: Senior leaders and respected role models (senior nursing colleagues, nurse manager and physicians) are recommended to act as influencers and promote and encourage uptake.

Improved access to the vaccine: Flexible opportunistic vaccination is recommended in order to increase access to immunisation in the workplace (wards/offices) versus the more traditional occupational health nurse's clinics. Increased availability throughout the day, night and at weekends ensuring that the vaccine is brought to the nurses themselves during weekends and shift work.

7.7.3 General recommendations: Education

Mandatory training is recommended to provide evidence-based knowledge and tackle the range of misconceptions about influenza and the vaccine. Training of local leaders and vaccination nurses and teams is also recommended for future vaccination programmes. Improved peer-to-peer education is also recommended to increase awareness and be positive influencers for nurses.

7.8 Implications for future research

This research has highlighted important empirical gaps in the barriers to, and facilitators of, the administration of the seasonal influenza vaccine. There is a need to understand the complexity of influenza vaccination behaviours among the various categories of HCWs and in the many healthcare settings. Obtaining a better understanding of these relationships in their individual settings can guide and inform the development of bespoke intervention for other areas. There is also a need for timely, high-quality studies that evaluate influenza interventions to improve nurses' seasonal influenza vaccine uptake rates.

Research is also required for influenza leads who are responsible for the planning and delivery of influenza campaigns in order to identify the challenges and experiences regarding the various approaches and the acceptability of these at local levels.

7.9 Implications for COVID-19

Maintaining the health of HCWs by vaccination is a major component of pandemic preparedness (Prematunge *et al.,* 2012). Seasonal influenza and COVID-19 share similar modes of transmission and clinical characteristics (Ding *et al.,* 2020). The current novel coronavirus (COVID-19) pandemic could affect the uptake rate of

seasonal influenza vaccination among HCWs (Wang *et al*., 2020), and the results of this study could also inform the development of interventions to encourage nurses to accept the vaccine against COVID-19.

A study conducted in Hong Kong in March 2020 during the current COVID-19 pandemic examined the impact of the COVID-19 pandemic on acceptance of the seasonal influenza vaccine. It found that, although there was a similar influenza vaccine acceptance rate among nurses between 2019 and 2020, more nurses changed from attitudes of vaccine refusal to vaccine hesitancy (i.e., they changed from "did not accept the vaccine" in 2019 to "undecided" for 2020) (Wang *et al.*, 2020). Despite the current COVID-19 pandemic having a potentially positive impact on nurses' acceptance of the influenza vaccine, challenges remain in sustaining post-pandemic influenza vaccine uptake rates. Attention will need to be paid to the strategies required to further encourage those with vaccine hesitancy to avail of vaccination for COVID-19 as well as for seasonal influenza.

Research has clearly demonstrated the utility and validity of the HBM constructs for seasonal influenza. A systematic review used the five constructs of the HBM to better understand the factors that directed HCWs' influenza vaccination behaviour during the previous influenza pandemic (H1N1) in 2009 (Prematunge *et al.*, 2012). Although its focus was on an influenza pandemic, this systematic review found that the majority of factors relating to HCWs' pandemic vaccination behaviours were consistent with the constructs of the HBM of perceived barriers, benefits, severity, susceptibility and cues to action. The results also highlighted that HCWs were more likely to accept the pandemic influenza vaccine if they believed the infection to be highly susceptible and severe, that the benefits of vaccination outweighed its perceived barriers, and when they were influenced by positive cues to action. These findings further support the use of the HBM as an appropriate theory for better understanding HCWs' influenza vaccination health behaviours in pandemic scenarios (Prematunge *et al*., 2012).

Table 7.1 Summary of key points

The key findings from this thesis include: • Nurses' knowledge about influenza and the vaccine impacts vaccine uptake rates; however, knowledge alone does not appear to be sufficient to increase vaccine uptake rates. • Nurses perceived level of risk is significant in the decision-making process regarding whether or not they accept or reject the vaccine. • The type and source of information nurses' access in relation to influenza and the vaccine can impact on whether they accept or reject the influenza vaccine. • Fear and concerns about the influenza virus and also the influenza vaccine can have a significant impact on nurses' vaccination practices. • The important role of close colleagues as well as senior nursing and medical colleagues can positively impact the future vaccine intentions of nurses. • Male nurses are more compliant and accept the influenza vaccine. • Easy access to the vaccine is essential. • Organisational pressure can negatively impact nurses' vaccination practices. The need for autonomy and choice when making an informed decision is essential to vaccine acceptance. • HCWs are a heterogeneous group and interventions need to be tailored to meet the needs of the different categories of HCWs. Although interventions with multiple components appear to have an impact on nurses' vaccine uptake rates, further studies needs are needed to evaluate the effectiveness of interventions by each group of health professionals.

7.10 Contribution to knowledge

This study is important and contributes to new knowledge in an area that has lacked in-depth research while also addressing a significant gap in the literature. To the best of the researcher's knowledge, this is the first mixed methods study that has investigated the factors associated with nurses' vaccination practices incorporating

the HBM. This study exposed a shortage of literature that focused on the barriers of and facilitating factors associated with nurses' vaccination practices and although there are some studies available, empirical literature on these barriers and facilitating factors to vaccination is limited among nurses, independent of other HCWs.

As part of the mixed methods approach, this study is the first known study to collect quantitative data that measures nurses' knowledge, risk perceptions and beliefs in relation to influenza and the influenza vaccine in Ireland and hence has established a baseline in this area.

Findings from this study highlighted the mixed views of nurses in relation to mandatory vaccination policy in the Irish context. The current strategies that target vaccination uptake rates in the hospital settings and the organisational pressure experienced by nurses in the absence of mandatory vaccination policy, is particularly important, and these issues need to be addressed at strategic and organisational level.

HCWs are not a homogenous group and that they have different attitudes to vaccination practices compared to other categories of HCWs. Nurses also respond to interventions that aim to increase influenza vaccine uptake rates differently. Specifically, study findings revealed that there are multiple factors associated with nurses' vaccination practices, and a variety of interventions is required to address this vaccination gap in the absence of a mandatory vaccination policy.

Findings of the systematic review in chapter six, revealed a gap in the evidence about the effectiveness of interventions for increasing influenza vaccination among nurses.

These findings have contributed to the international and national literature by advancing understanding on the multiple factors acting as barriers and facilitator to nurses' vaccination practices. An increased in knowledge about these factors that

influence nurses' vaccination practices are essential to inform and target occupation specific influenza intervention in order to increase the seasonal influenza vaccine uptake rates of the largest workforce in our health service.

7.11 Conclusion

The aim of this thesis was to identify the barriers and facilitating factors associated with nurses' vaccination practices. In order to provide a detailed account, a sequential explanatory mixed method was identified as the most appropriate method for this thesis. A detailed literature review on influenza and the influenza vaccine was presented, along with the methodology, methods and theoretical framework used in this thesis. Three journal articles – two which have been published and one that is currently under review - have all been included in the relevant chapters. The three studies represent a sequential investigation to identify the barriers and facilitating factors associated with nurses' vaccination practices. The findings from the three studies conclude that there are multiple modifiable factors that act as barriers to, and facilitating factor of nurses' vaccination practices. These findings can be used to provide evidence to policy makers to inform and develop effective interventions that will improve seasonal influenza vaccine uptake among nurses, the largest workforce within our health service in the absence of mandatory vaccination policy. It is essential that future interventions and campaigns consider the diverse needs of nurses independently of other HCWs, since HCWs are not a homogeneous group. Further research is required to identify the barriers and facilitating factors associated with vaccination practices of nurses in other healthcare settings.

To target influenza campaigns and improve nurses' seasonal influenza vaccine uptake, evidence suggests it is essential to understand the barriers and facilitating factors associated with their vaccination behaviours. This thesis has highlighted that there are multiple factors associated with nurses' vaccination practices, and a variety of interventions is required to address this vaccination gap in the absence of a mandatory vaccination policy.

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Appendices

Appendix 1: Ethical approval

) Committee

31st July 2017

Ms Paula Flanagan
Clinical Nurse Manager 11
Health Protection Surveillance Centre
Health Service Executive (HSE)
25-27 Middle Gardiner Street
Dublin 1

To: paula.flanagan@hse.ie

Dear Ms Flanagan

F - Ms. Paula Flanagan (HSE) – "To assess nurses' knowledge, risk perception, health beliefs and seasonal influenza vaccination behaviours in the acute sector in Ireland".

Thank you for your correspondence dated 24th July 2017, clarifying the points raised by the Committee (SREC).

I can advise that the SREC is now happy to approve this study.

Kind regards

Yours sincerely

Ethics (Medical Research) Committee

[redacted]

Clinical Research Ethics Committee
Room 59
[redacted]

8th June, 2017.

Ms. Paula Flanagan
Clinical Nurse Manager 2
HSE-Health Protection Surveillance Centre
25-27 Middle Gardiner Street
Dublin 1.

Ref: C.A. 1767 - To assess nurses' knowledge, risk perception, health beliefs and seasonal influenza vaccination behaviours in the acute sector in Ireland

Dear Ms. Flanagan,

I have considered and reviewed the above submission, and I am happy to confirm Chairman's approval to proceed.

Yours sincerely,

Chairman Clinical Research Ethics Committee.

c.c. Dr. Georgina Gethin, Head of School, Senior Lecturer,
School of Nursing and Midwifery, 3rd Floor, Aras Moyola, National University of Ireland, Galway.

[redacted] UNIVERSITY HOSPITAL,

Appendix 2: Application Agreement KNIVQ

Application Agreement for the King's Nurses' Influenza Vaccination Questionnaire (KNIVQ)

Party A (copyright owner): Jing Zhang, Alison E While, and Ian J Norman

Jing Zhang signs application agreement on behalf of the research group.

Affiliation: Second Military Medical University School of Nursing

Party B (questionnaire user): Paula Flanagan

Affiliation: NUI Galway.

Please fill in the following information of the supervisor if the questionnaire user is a student.

Party C (the supervisor): Georgina Gethin

Affiliation: NUI Galway

Party A, B (and C) sign this agreement for application of the King's Nurses' Influenza Vaccination Questionnaire (KNIVQ). The Parties agree, acknowledge and undertake on the terms set out below.

Term 1 Party A is willing to provide the KNIVQ to Party B for free use in order to promote the academic communication.

Term 2 Party B should inform Party A if any content in the KNIVQ is changed in the usage.

Term 3 Party A agrees that party B includes the KNIVQ in the dissertation of the appendixes. However, the full text of the KNIVQ should not be published in any publications without written permission from Party A.

Term 4 Party B should cite the KNIVQ correctly and acknowledge the work of Party A in the dissertation and publications.

Party A (signature) Party B (signature) Party C (signature)

Paula Flanagan

Date: 22/03/2017

Correspondence from Kings College London: permission granted to use KNIVQ in this study.

-----Original Message-----
From: CUSTOMER CARE [mailto:jane_zh301@hotmail.com]
Sent: Wednesday 12 April 2017 12:45
To: Paula Flanagan
Cc: alison.while@kcl.ac.uk
Subject: 答复: Request permission to use validated tool

Dear Paula,
Many Thanks for your email. That's fine to remove items related to H1N1 according to your study aims.
Best wishes
Jane

发件人: paula.flanagan@hse.ie [paula.flanagan@hse.ie]
发送时间: 2017年4月12日 10:37
收件人: jane_zh301@hotmail.com
抄送: alison.while@kcl.ac.uk
主题: RE: Request permission to use validated tool

Dear Professor Zhang,

Apologies I am only getting back to you now with the signed agreement form. Please find it attached.

As my research is focusing on nurses and seasonal influenza only, I have made some slight changes to the questionnaire such as removing the H1N1 specific questions for the purpose of my research. I have attached a copy of the changes for your attention.

Many thanks for granting permission to use your questionnaire for the purpose of my research.

Please do not hesitate to contact me if you require further information.

Many thanks,

Kind regards,

Paula Flanagan

From: ZHANG Jane [mailto:jane_zh301@hotmail.com]

Sent: Friday 20 January 2017 01:57
To: Paula Flanagan
Cc: While, Alison
Subject: 答复: Request permission to use validated tool

Dear Paula

Sorry for late response. Herewith the application agreement file and the questionnaire. Please return me the signed agreement form. And please let me if any question.

Best wishes

Jane

Jing Zhang

MB MSC PhD RN
Associate Professor
School of Nursing
Second Military Medical University
Shanghai 200433, China
Tel: +86 21 81871508
jane_zhang@smmu.edu.cn<mailto:jane_zhang@smmu.edu.cn>

发件人: While, Alison
<alison.while@kcl.ac.uk<mailto:alison.while@kcl.ac.uk>>
发送时间: 2017年1月16日 7:29:29
收件人: paula.flanagan@hse.ie<mailto:paula.flanagan@hse.ie>
抄送: Jane Zhang
主题: Re: Request permission to use validated tool

Dear Paula

Thank you for your email. I am copying in my colleague, Jane, who will send you an agreement form for the use of the tool and the questionnaire.

As Jane lives in China, you may find it cheaper and more convenient to talk to me about our sampling approach although it is described in our published papers. Essentially all RNs attending courses in one university were invited to participate in the anonymous survey. They could complete the survey while attending the university or return it later by mail or at the next visit to the university. The RNs were employed across the London/SE area.

Let me know if you would like to speak with me on the phone or via Skype.

Best wishes

Alison

Alison While BSc MSc PhD RN RHV CertEd Fellow of QNI Emeritus Professor of Community Nursing King's College London

Research: http://www.researchgate.net/profile/Alison_While/

From: paula.flanagan@hse.ie<mailto:paula.flanagan@hse.ie>
<paula.flanagan@hse.ie<mailto:paula.flanagan@hse.ie>>
Sent: 06 January 2017 13:36
To: While, Alison
Subject: Request permission to use validated tool

Dear Professor While,

My name is Paula Flanagan and I am a PhD student registered with the National University of Ireland, Galway. As part of my research I want to identify factors associated with influenza vaccination uptake rates among nurses' in Ireland, consequently, I am writing to you to request permission to use the instrument that you and your colleagues developed in 2010, to assess nurses' knowledge, risk perception, health beliefs and behaviours in relation to influenza vaccination.

I would really like to discuss with you the process by which you selected your sample of nurses' and was wondering if it would be possible to give you a call at your convenience.

I look forward to hearing from you.

Yours sincerely,
Paula Flanagan.
Infectious Disease Nurse Manager
HSE-Health Protection Surveillance Centre
25-27 Middle Gardiner Street
Dublin 1, D01 A4A3
Phone: 003531 87 65 300
Fax: 003531 85 61 299
Email: paula.flanagan@hse.ie<mailto:paula.flanagan@hse.ie>

Appendix 3: Questionnaire

Knowledge, Attitudes, Risk Perception of Influenza and Influenza Vaccination and the Relationship to Practice of Vaccination: Perceptive among Nurses

Please complete this questionnaire by ticking the box that best represents your answer.

If you feel that any of the questions are inappropriate, please do not feel that you have to answer them. If, after completing these questions, you want to add some more information, then please use the space provided on the back of the page. **All information will remain confidential to the research team.**

I do not wish to complete this questionnaire, and am returning it to you uncompleted.

ID NUMER

Section A: Knowledge about Influenza and Influenza Vaccination

The following statements are about your understanding of influenza and influenza vaccination.

Please tick the box which best describes your views.

1. Which of the following statements relating to Seasonal Influenza are true or false?

		True	False	Unsure
(1)	Seasonal influenza is an acute viral infection.			
(2)	Influenza circulates worldwide and can affect anybody in any age group.			
(3)	Seasonal influenza does not spread easily from person to person.			
(4)	Influenza causes annual epidemics that peak during winter.			
(5)	Influenza is not a serious public health problem.			
(6)	An epidemic can have an economic impact through lost workforce productivity, and strain upon health services.			
(7)	Influenza is never a serious disease.			
(8)	The most effective way to prevention influenza and its complications is vaccination.			
(9)	Vaccination gives some people influenza.			
(10)	Seasonal influenza vaccines are unsafe.			
(11)	Vaccination may have serious adverse effects.			
(12)	Seasonal influenza vaccine may cause Guillain-barré Syndrome (GBS).			
(13)	Groups at high risk of complications of seasonal influenza are:			
	A. Children younger than 2 years;			
	B. Adults aged 65 or older;			
	C. People of any age with certain medical conditions.			

		Recommended	Not recommended	Unsure
(14)	Which groups are recommended to have the annual seasonal influenza vaccination?			
	a. Nursing-home residents;			
	b. Elderly individuals living at home;			
	c. People with chronic medical conditions;			
	d. Pregnant women;			
	e. Health care workers (HCWs);			
	f. Others with essential functions in society;			
	g. Children aged six months to 2 years.			

Section B. Perceptions of the Risk of Influenza

The following questions are about the extent to which you agree or disagree with a series of statements. **Please tick the box which best describes your views.**

2. To what extent do you agree or disagree with the following statements?

		Strongly Agree	Agree	Disagree	Strongly Disagree	Undecided
(1)	Without seasonal influenza vaccination, I am sure I will get the influenza this year.					
(2)	I get sick more easily than other people of my age.					
(3)	I get influenza easily.					
(4)	Seasonal influenza never causes death.					
(5)	If I had seasonal influenza, I would have to stay in bed.					
(6)	If I had seasonal influenza, I would have to take sick leave.					
(7)	If I had seasonal influenza, I would pass it on to my family.					
(8)	If I had seasonal influenza I would pass it on to my patients.					

Section C: Views on Health Locus of Control

The following questions are about the extent to which you agree or disagree with a series of statements. Each item below is a belief statement about your medical condition with which you may agree or disagree. This is a measure of your personal beliefs; obviously, there are no right or wrong answers. **Please tick the box which best describes your views.**

3. To what extent do you agree or disagree with the following statements?

		Strongly Agree	Moderately Agree	Slightly Agree	Slightly Disagree	Moderately Disagree	Strongly Disagree
(1)	If I get sick, it is my own behavior which determines how soon I get well again.						
(2)	No matter what I do, if I am going to get sick I will get sick.						
(3)	Having regular contact with my doctor is the best way for me to avoid illness.						
(4)	Most things that affect my health happen to me by accident.						
(5)	Whenever I don't feel well, I should consult a medically trained professional.						
(6)	I am in control of my health.						
(7)	My family has a lot to do with my becoming sick or staying healthy.						
(8)	When I get sick, I am to blame.						
(9)	Luck plays a big part in determining how soon I will recover from an illness.						
(10)	Health professionals control my health.						
(11)	My good health is largely a matter of good fortune.						
(12)	The main thing which effects my health is what I do myself.						
(13)	If I take care of myself, I can avoid illness.						
(14)	Whenever I recover from an illness, it's usually because other people (for example, doctors, nurses, family and friends) have been taking good care of me.						
(15)	No matter what I do, I'm likely to get sick.						
(16)	If it's meant to be, I will stay healthy						
(17)	If I take the right actions, I can stay healthy.						
(18)	Regarding my health, I can only do what my doctor tells me to do.						

* Wallston K.A. et al (1978).

Section D: Practices regarding Influenza Vaccination

The following questions are about your practice regarding influenza vaccination with a series of statements. **Please tick the box which best describes your views.**

		Seasonal influenza
4.	Have you been vaccinated in the last 12 months?	Yes ☐ No ☐
5.	Have you ever recommended vaccination to any of your patients in the past?	Yes ☐ No ☐
6.	Do you intend to receive vaccination next flu season?	Yes ☐ No ☐
7.	Will you recommend vaccination to your patients in the future?	Yes ☐ No ☐ Unsure ☐
8.	How many times have you been vaccinated against seasonal influenza in the last 5 years?	_____ Times

Section E: Factors about vaccination Practices (i.e. personal reasons why you did or did not get the vaccine)

9. Please give 3 reasons why **you** might have the vaccination

For

A.
B.
C.

10. Please give 3 reasons why **you** might not have the vaccination

Against

A.
B.
C.

Section F: About yourself

11. What is your place of work? ***(please circle)*** UCHG Beaumont hospital

12. Please indicate your grade ***(please circle)***

Staff nurse CNM 1 CNM 2/CNS CNM 3 Senior management (e.g. ADON/DON)

14. Are you employed: **(please circle)** full time Part time

13. What is your sex? Male ☐ Female ☐

15. What is your age group? ***(please circle)***

20-29yrs 30-39yrs 40-49yrs 50-59yrs 60-64yrs 65yrs and older

16. Please state the full name of the training day/module/course you are taking?

_____

17. What is your highest educational qualification?

DipHE Bachelor Degree PGDip Masters

Other (please specify)_____

18. What is your speciality?

☐ Ambulatory care ☐ Mental health ☐ Surgery ☐ Older people
☐ Paediatrics ☐ Maternity ☐ Medicine (please state)_____

Other speciality _____

19. What year did you qualify? _____year

20. Is more than 10% of your time on the job spent in direct patient contact? Yes ☐ No ☐

21. I consent to the processing of my personal information for the purpose explained to me. I understand that such information will be handled in accordance with the terms of the Irish data protection Act (1988, amended 2003). Yes ☐

Is there anything else you would like to say about seasonal influenza?

_____
_____
_____
_____

Date form completed: _____/_____/_____

Thank you very much for your help in completing this questionnaire.

For more information about this research, please contact:

Paula Flanagan, HSE-Health Protection Surveillance Centre,

25-27 Middle Gardiner Street, Dublin 1.

paula.flanagan@hse.ie

Appendix 4: Letter sent to the training facilitator(s) in each hospital

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

hpsc

Health Protection Surveillance Centre

25-27 Middle Gardiner Street
Dublin 1, Ireland

Ph +353 1 **876 5300**
Fx +353 1 **856 1299**
E hpsc@hse.ie

www.hpsc.ie

xxxxxxxxxxxxx

10th July 2017

Re: Research project – *"to assess nurses' knowledge, risk perception, health beliefs and seasonal influenza vaccination behaviours in the acute sector in Ireland"*

Dear xx,

Many thanks for agreeing to facilitate the distribution of my research project through your in-service training programme and I am delighted to inform you that the hospital research ethics committee has granted approval for this study.

As mentioned previously over the telephone I am employed as an infectious disease nurse manager in the HSE-Health Protection Surveillance Centre (HPSC). Since September 2016, I have been registered as a PhD student with the National University of Ireland, Galway. As part of my PhD research studies I plan to explore and further understand the factors associated with influenza vaccination among nurses' in Ireland. Although the influenza vaccination uptake rates among all health care workers are low, I am particularly interested in **qualified nurses only** as they have been identified as having the lowest vaccination uptake rate compared to other health professionals employed in the health service.

Participation in this study will consist of qualified nurses completing a paper based questionnaire. I understand the time constraints and challenges front line nursing staff is currently facing and I envisage the questionnaire will take no longer than 10 minutes. I am also happy to attend the training day and deal with any queries from participants should they arise.

All data collected as part of this research will be treated completely confidential. The data will also be anonymous and no participant will be identifiable unless nurses agree to participate in focus group discussion. The data will be stored in a password protected database in HPSC. Data security and confidentiality will be maintained at all times in HPSC, which is accredited for Information Security Management ISO 27001. Access to the data will be restricted to the researcher only.

This research is essential and the results will inform policy and practice in relation to the challenges relating to influenza vaccination among nurses' in Ireland.

Over the coming weeks, I will contact you directly and arrange a convenient time to meet to discuss the upcoming training sessions suitable to distribute the survey. As previously mentioned, I am more than happy to attend these training sessions to administer the surveys personally to ensure minimal disruption, and to avoid adding to your workload on the day. Please do not hesitate to contact me if you require any further information. My email address is paula.flanagan@hse.ie and I may also be contacted on 01-8765300 (or 087 9264702).

I would like to thank you for your co-operation and assistance with this project.

Yours sincerely,

_____

Paula Flanagan Infectious Disease Nurse Manager /PhD student NUIG

Appendix 5: Participant information leaflet

INFORMATION LEAFLET

My name is Paula Flanagan and I am currently registered as a PhD research student in the National University of Ireland, Galway. I am employed as an infectious disease nurse manager in the Health Protection Surveillance Centre (HPSC) and I am conducting a research study to understand the factors associated with influenza vaccination among nurses in Ireland.

Title of study "To assess nurses' knowledge, risk perception, health beliefs and vaccination behaviours in the acute sector in Ireland"

What are the aims of this research and why is it important?

The aim of this study is to understand those factors that are barriers to and enablers of seasonal influenza vaccine uptake among nurses. This research is important as nurses have a consistent low uptake of influenza vaccination when compared to other health professionals. They also are the largest staff category employed in the health service in Ireland and have significantly long duration of close patient contact. It is important to understand the factors that are associated with nurses who receive the vaccine and those who decline the vaccine. This information is important to inform policy and procedures at national and local level when developing interventions aimed at improving the influenza uptake rate among nurses.

Who can participate in the study?

All qualified nurses of all nursing grades, from newly qualified nurses to senior nursing grades with or without direct patient contact are eligible to participate in the study.

Confidentiality

The database will not contain any participants' identifiable details. Your name is not requested in the survey.

The data will be stored in an MS access database in the Health Protection Surveillance Centre (HPSC). Access to the database will be restricted to research personnel only. The database containing the data from the survey will be password protected. The data will also be anonymous and no participant will be identifiable. Data security and confidentiality will be maintained at all times in HPSC, which is accredited for Information Security Management ISO 27001. Access to the data will be restricted to the researcher only.

What if I do not participate?

Participation in this study is voluntary. If you partially complete the questionnaire and feel you no longer wish to participate there is no obligation to continue and submit it.

What will happen with the findings?

The findings of this study will be compiled in my PhD thesis. Manuscripts may also be published in peer review journals and the hospital or HSE may use these findings to inform policy and implement interventions in order to improve vaccination uptake rates among nurses.

Where can I find further information?
You can get more information from contacting myself, the researcher on 01 8765 300 or 087 9264702. My email address is paula.flanagan@hse.ie.

Thank you for reading this information leaflet and I hope you consider completing the survey for this valuable and important research study.

Appendix 6: Participant consent form

I consent to participate in the focus group discussions as part of this research project:

"To assess nurses' knowledge, risk perception, health beliefs and seasonal influenza vaccination behaviour in the acute sector in Ireland"

(Please tick the box if you wish to participate)

I consent to participate in focus group discussions ☐

Date: ____/_____/_____

If you are happy to participate please provide the following information:

Your name (Block letters): _____

Signature:_____

Your email address (if available):_____

Your telephone number: _____

The principal researcher will contact you directly in the near future and arrange a meeting for the focus groups discussions. (Audio recordings and transcriptions will be stored safely for the duration of this research).

Appendix 7: Topic guide for focus group discussions

Knowledge-Let's start with knowledge about flu. **Q** What type of information do you receive annually about flu and the vaccine? **Q.** How can knowledge about influenza and the vaccine be improved among nurses? **Q.** What resources or supports may encourage nurses to take the influenza vaccination	**Probes** Q Is there any area either about flu or the vaccine that you would like to receive more information on? How would you like it to be delivered? What are your thoughts on the seasonal influenza vaccination education campaign?
Vaccine let's talk about the flu vaccine, **Q** what are the concerns/issues about the flu vaccine among nurses? **Q** Where do nurses hear this? **Q** what factors about the vaccine are addressed yearly with the flu campaigns in your place of work?	How could these issues be addressed? What influences nurses in relation to this?
Site **Q.** Tell me about the annual campaigns in your work place and if you feel they are effective or not? **Q**. Could something be improved?	What do they address?
Q Sex **Q**. Male nurses were more likely to be vaccinated compared to female nurses yet they had lower levels of knowledge. What influences male nurses?	What else is different with male nurses?
Risk perception **Q.** Why do some nurses perceive themselves at greater risk of flu and complications than others?	Do nurses perceived level of risk vary each year? What influences this? Who's at more risk if you got flu?
HB **Q** Which, if any colleagues influence your decision about vaccination?	**Q** Who is in control of your health? Does this effect your decisions regarding vaccination?

Lastly, **Q.** Why do you think nurses have the lowest vaccination uptake rate compared to other health professionals? **Q.** Would you mind sharing your thoughts on mandatory flu vaccination? **Q.** would anyone like to add anything regarding your views on seasonal influenza vaccination…..	Probe nurses, drs, senior staff

Appendix 8: Letter sent to focus group participants

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

hpsc

Health Protection Surveillance Centre

25-27 Middle Gardiner Street
Dublin 1, Ireland

Ph +353 1 876 5300 Fx
+353 1 856 1299
E hpsc@hse.ie

www.hpsc.ie

Ms xxxxx

20th November 2018.

Re: Voucher for attending focus group discussion

Dear xxxx,

I am writing to thank you for participating and attending the focus group discussion on the 8th October in the Centre for Education, xxx hospital.

Four nurses attended this session, which was excellent and I really enjoyed meeting you all. I am so grateful that you took the time out of your busy day to participate and facilitate me in getting closer to the end of my PhD project!

Please find enclosed a €25 one for all voucher for your participation.

As this focus group was in relation to influenza and as we are currently entering the influenza season, please finds the link to the health protection surveillance centre website where I work, there is loads of information about influenza and the vaccine. The information might assist you with any queries you may have in relation to the virus or the vaccine in the future (www.hpsc.ie).

Kind regards,

Paula Flanagan
Infectious Disease Nurse Manager

Appendix 9: Themes qualitative focus group analysis

Theme 1-Vaccine fears and concerns

This theme captures nurses' fears and concerns in relation to the seasonal influenza vaccine. Vaccine fears and concerns were identified as a significant barrier to vaccination among nurses participating in the focus groups. There was a broad consensus across all focus groups with several nurses articulating multiple misconceptions about the vaccine. The belief that the vaccine doesn't work and contributes to influenza infection was a common misconception. In addition, many nurses voiced concerns about the safety of the vaccine with fear of side effects, vaccine content and long term consequences dominant throughout. The increase in narcolepsy cases that were reported after the 2009/2010 influenza pandemic was cited by nurses across a number of focus groups from both hospital sites and identified as a factor contributing to these fears and concerns expressed.

Theme 1 Vaccine fears and concerns

THEME	Sub-theme	Illustrative Quotes
Vaccine fears and concerns	It doesn't work	*"Getting sick…as a result of the vaccine"* [P5, FGD 2] *"Yeah….you'll hear people say I never had the flu until I got the flu vaccine"* [P1, FGD 1] *"And I think that's a factor when it comes into 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 think for me, I haven't had it and I have a hesitancy because I feel you know, em, will I be immune to it by the time I need it"* [P1, FGD 5] *"Or that it's for A and it's the B flu it's not going to be effective"* [P7, FGD 3] *"But I think as well to reinforce as well that it's not a live vaccine yes that that's so important that you cannot get the flu from the vaccine for example that's the message that needs to go out there that you cannot get the flu from it and I think if you throw enough mud some of its going to stick you know"* [P2, FGD 1]

	Is it safe?	*"I suppose I still feel I still don't know enough about it in the end of the day to take it"* [P1, FGD 5] *"A lot of people have fears that it's an active vaccine"* [P6, FGD 1] *"I think they have to give more information about the vaccine, I think there is a lack of information and there are two worries that people have, is it safe and will I get the flu? If they could even answer those even, keep it very… very short and very simple"* [P3, FGD 3] *"Em, I still have a concern about how safe is it and I know I have still taken it but em…"* [P2, FGD 5] *"You're putting a lot of stuff into your system every year"* [P2, FGD 2] *"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] *"There's still a lot of fear out there about the vaccine to be honest, in general like if you look at the swine flu vaccine, the pandemerix"* [P1, FGD 1] *"Well, back in the swine flu and I was pregnant and I had the jab then as well and I was the whole pregnancy like I was really…. really oh dear God, is there anything wrong you know what have I done but I had another one at home that had a touch of asthma and she had the jab and I thought it was, so, even though you are informed there is still the fear of the potential side effects because there is a chance that you're not going to get the flu you know. It's not guaranteed that you …you know"* [P3, FGD 2] *"H1N1 and narcolepsy where there were lots of stuff people are afraid that they are going to develop those side effects" [*P8, FGD 2] *"There might be long term complications that there might be a long term effect" [*P4, FGD 2]

		"We've had a few in with Guillian 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]

Theme 2-Risk perceptions

Nurses' experiences and views acted as both a facilitator and a barrier to their vaccination behaviour. Despite the majority of nurses acknowledging they were at risk of influenza infection some believed that because they were fit and healthy, they were not susceptible to influenza infection. This belief impacted negatively on nurses' decisions to accept the influenza vaccine. The majority of nurses expressed that having an underlying medical condition increased their risk of influenza infection resulting in vaccine acceptance.

There was broad consensus among nurses about their perceived level of risk of contracting influenza based on their area of work. Many nurses expressed that working with high risk patients poses a greater risk of contracting influenza infection leading to vaccine acceptance. Interestingly, not all nurses believed their patients were in an "at risk group".

Theme 2 Risk perception

Theme	**Sub-theme**	***Quote***
Risk perception	I'm fit, I'm healthy	*"I haven't had the flu vaccine, and it's not because I am afraid to get it or that I don't or what's in it, simply because I feel I'm relatively healthy, I haven't suffered flu's before, why would I get it this year, I've escaped the flu every other year. You might feel like a cold or miserable but like, it would be a cold I can't say I suffered a flu since I've really started in this hospital either so I just feel like what's the point I haven't had it before do I really need to have it this year you know"* [P3, FGD 5] *"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] *"Well I think your own personal self as well, I mean l 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]
	Nurses at risk	*"I suppose pre-existing medical conditions would be another factor as they're at higher risk"* [P6, FGD 2] *"I suppose if they 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"* [P5, FGD 3] *"Yeah that definitely does their own…nurses general health does make an impact because I know a few of my colleagues over the years that would have been having it for years because of their other issues"* [P2, FGD 5] *"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 think stress is a factor for getting it as well"* [P1, FGD 2]
	High risk patient care	*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] *"So I suppose we don't feel that we're kind of passing on…you know they're [rehab patients] well… they're more well, so….they're not at as high risk and that so ….I suppose, maybe. I didn't get it anyway I wouldn't get it anyway, I just wouldn't but if I was working say, in ICU or somewhere then you would have to - as you wouldn't want to give something to your patients"* [P2, FGD 2] *"Intensive care is high risk as opposed to maybe care of the elderly"* [P5, FGD 4] *"Like I work in dialysis and we have to vaccinate all our patients… all our patients for flu…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]

Theme 3-Organisational pressure

Nurses experienced organisational pressure in relation to accepting the influenza vaccine within the workplace. Overall, nurses expressed frustration regarding the threatening messages communicated to them by hospital management. Nurses described how they felt they were being forced to accept the vaccine and also expressed that they believed they are not given a choice to make an informed decision. This perception of choice appeared to be vital to vaccine acceptance among nurses participating in the focus groups.

The pressure experienced during the annual hospitals' influenza campaigns promoting vaccine uptake in order to protect their patients and prevent staff absenteeism from work emerged across all focus groups. Nurses felt they were being almost bullied into getting the vaccine and also felt they were to blame if patients developed influenza infection. In addition, they also expressed they have been threatened with unpaid sick leave if absent from work as a result of influenza infection. Some nurses also experienced pressure from their vaccinated work colleagues for not accepting the influenza vaccine as it impacted on patient work allocation.

Although annual vaccination programmes are voluntary in Ireland, some nurses cited that they felt influenza vaccination was almost compulsory in their area of work. The majority of participants did not believe the vaccine should be mandatory and voiced that mandatory vaccination would cause more resistance among nurses.

Theme 3 Organisational pressure

Theme	**Sub-theme**	***Quotes***
Organisational pressure	Brute force	***"****Like my staff is going down and we got a good result last year but that by sheer brute force"* [P3, FGD 4] ***"****I won't be dictated to…I don't think having the heavy guns coming at ya, telling you that you're supposed to have it"* [P2 FGD 5] *"Why are we forced to get it? I don't think no one should be forced to take it"* [P6, FGD 2] ***"****But I think as well working in [hospital name] there's, there is a lot of pressure put on you to get the vaccine so it's nearly in, I know it's not 100% mandatory but it nearly feels like…you go and get your vaccine or there will be consequences if you don't"* **[**P10, FGD 3]

		"There was a lot of pressure alright last year" [P2, FGD 2] **"***I think there's pressure on the peer to peers to actually deliver .....There's definitely competition amongst the directorates"* [P4, FGD 4] *"If you push people one way they will definitely dig in their heels and go the other"* [P4, FGD 1] *"It was a threat"* [P7, FGD 3] **"***...choice... it has to remain a choice..."* [P5, FGD 3] *"And 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 think it's also important that people don't feel pressurised into it and I think they're pretty good at that so if you don't want to have it on the ward and you have...because people have medical conditions they don't discuss in the peer to peer I think...they make it quite aware that you don't have to have it. So you can go downstairs and get it as well. So I think if it's just on the ward...I think that the balance is good"* [P7, FGD 3]
	Mandatory vaccination	*I definitely would be in favour of it, but like I said there would be huge issues with* [it] [P1. FG1] *"If it was to become mandatory I think you'd need to thread very, very carefully so I would say yes [to mandatory vaccination], cautiously but I think that you would have to have serious safe guards, I would say cautiously"* [P5, FGD 3] *"I think with the flu vaccine, it's a bit different so I think it shouldn't be mandatory for that reason because someone has to do it every year"* [P5, FGD 2] *"I think it sometimes is if the power is...sometimes out of you hand, there's sometimes more resistance so it can cause more problems".* [P6, FGD 1]

		"I don't know whether I'd actually agree with mandatory, in one…..if there was a little bit more education and it was a little bit more available I think the uptake would be significantly higher there are some groups of people that can't be vaccinated as well so ……but I do think if there was a little bit more joined up thinking first before we went down that road" [P6, FGD 1]
	Bully tactic	*"It's a bully tactic potentially you* know [all agree] *and a bit of guilting if you didn't believe in it but there is an argument for and against as such but, I think it sometimes is if the power is…sometimes out of you hand, there's sometimes more resistance so it can cause more problems"* [P3, FGD 1] *"Well there's the thought that if you do get sick…if you didn't take the vaccine and you did get sick…that they'll stop your wages"* [P4, FGD 3] ***"****Information came out last year that if you didn't have the flu vaccine and you were to get the flu…. you weren't covered if you were off sick"* [P3, FGD 3] *"I'm one of the ones who give the flu injection and em, I found last year that people were nearly been bullied into it …..in 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"* [P4, FGD 2]
	Guilt and Blame	*"There was a time as well, I don't know because I've left the area now but in ICU and there was a massive guilt if you hadn't had the vaccine going back to the time of the swine flu it was like…oh no, you can't look after the side room and you can't so there was an actually in house em, staff were pissed with each other because …why do I have to go to the side room again, just because you haven't got the vaccine…so that came about as well*" [P3, FGD 2] *"Yes I think so people are saying "why aren't you having it" and you know, you know you can be a carrier and you know that you re around really*

		sick patients and you know you're at risk and your patient is at risk and you know…" [P5, FGD 2] *"If you don't get it and your patients get it well then it's your fault"* [P4, FGD 2] **"***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*" [P1, FGD 5]

Theme 4-Information

This theme reflects nurses' experience in relation to the information they receive about the seasonal influenza virus and the vaccine. It also describes the main sources of this information.

Nurses highlighted that they receive information in relation to the influenza vaccine from internal and external sources. Internal sources of information include emails, management meeting, posters, colleagues and experts within the hospital.

There was overwhelming consensus that the information they received about the influenza virus and the vaccine was insufficient as the main focus was on encouraging vaccination uptake, availability and access to the vaccine. As a result of this paucity of information, nurses expressed that work colleagues were educating each other and often focused on negative factors associated with vaccination. Nurses also felt the influenza posters displayed in hospitals provided limited information and were mostly ignored. Although emails from management were reported as a popular source of information, it was highlighted that not all nurses have access to emails within the hospital.

Although HSELanD and talks from healthcare experts were both acknowledged by the nurses as valuable sources of reliable and accurate information, some nurses were unaware that information about influenza was available through HSELanD. They expressed the burden of too many courses to complete on HSELanD and stated if it's not compulsory then they don't have time to do it. The advantages of having short talks from experts about influenza and the vaccine were highlighted as it allowed nurses the opportunity to ask questions and have their concerns addressed.

External sources of information about influenza and the vaccine included the media, social medial and the internet. While some of these were identified as being helpful, others were views as negative and fuelling fears and concerns about influenza and the influenza vaccine.

Theme 4 information

Theme	Sub-theme	*Quote*
Information	Ineffective communication systems	*"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] *"Same in our department as well where the emails circulated and the posters …they were kind of ignored"* [P3, FGD 1] *"A lot of people don't read the posters….there's so many posters it's kind of hard to know what poster to be reading and I don't know, in work anyway I don't read up anything like when I'm at the bed space …that's where I am and when I'm at home that's where I am so that's unless someone's to tell me "[nurse name]" you have to do this, and you know you have to sign the sheet when you've done it I probably won't do it"* [P5, FGD 2] *"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] *"Yeah, it just flashers on the computer screen across the hospital…like you might see it you mightn't; you know it depends then you have to go in and click it"* [P3, FGD 4] *"I don't feel like I get any information"* [P4, FGD 4] *"I'd like to know more about the vaccine. What it is that I am actually putting into my own body"* [P1, FGD 5] *"Even if it was just a leaflet that was handed out to you before you got the vaccine, 5 minutes to read it I mean it's …you don't want a huge*

		amount of information but just the facts or even if they were on the posters that you could read them on your own leisure you know because they're putting the posters up on the ward anyway so it wouldn't take much to put that little piece of information at the bottom or leaflets underneath it that you could pick up, read and then make your decision on it" [P3, FGD 5]
	Rely on yourself	*"Yeah it's not, we are encourage to get it, like you said, you're encouraged to get it…to go 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] *"Well I'm on twitter and I get tweets about [hospital name] flu vaccine and about campaigns starting and other hospitals join in so that's great"* [P1, FGD 3] *"It's* [information] *through internet" [P*2, FGD 4] *"We are nurses but we are also reading the newspapers, listening to the radios listening to the discussions and debates and some of them don't come up with any greater information or at least any definite information people who are brought forward say, yeah you need to have it and why wouldn't you but then there's all the people who have concerns or are in the "unsure camp" are still there to be persuaded really"* [P2, FGD 5] *"The media will always distort facts, they won't lie about it but they'll definitely glaze over the real issues or the real information and kind of focus in on one area one particular rare side effect like narcolepsy with the h1n1 flu the percentages were, I can't remember because I got vaccinated because I was pregnant at the time so I got, I paid extra for the mercury free one but like the percentage of narcolepsy was I think it was .01% like it was very small but that's all the media focused on all the time and if I hadn't done*

		my own research I wouldn't have probably got it to be fair" [P5, FGD 3] *"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] *"But like in general you're supposed to do things for ourselves and not for for the influence of others (all agree) you know so I agree…going back to the whole informed….I didn't know about the HSE land [P3, FGD 2]* *"No I didn't know either [about HSELanD]" [P4, FGD 2]* *"It is HSE land, but you don't have to do it, do ya? I did it, but you don't have to do it"* [P3, FGD 4] *"Have some more information sessions before the campaigns even start…I don't know about getting infection control into it to be quite honest with you because you're told to look it up ….look it up…..look it up….they have no answers for you"* [P4, FGD 2]

Theme 5-Influencers

A number of individuals influence nurses' decisions regarding the vaccine. Key influencers included peers. Firstly, close colleagues and other nurses in the workplace were identified as strongly influencing nurses' decisions regarding the vaccine. The importance of seeking reassurance from colleagues was addressed prior to deciding to take the vaccine or not among nurses therefore highlighting a need to conform to the norms of their workplace. In addition, many felt experts were beneficial and ward managers were found to be key role models facilitating vaccination. The importance of peer vaccinators was evident as they are work colleagues, a familiar face and do not pressurise nurses to get vaccinated.

Theme 5 Influencers

Theme	**Sub-theme**	***Quote***
Influencers	Experts	*"I know last year I heard [consultants name] you know ….from the VRL speaking and for me, the way*

		he phrased it and the way he ….I 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] *"To be honest I 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 hospital …..we 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] *"We had a talk from that guy in the lab…what's his name….is it…Prof "X"…now if he was giving the talk now" [*P6, FGD 1] *"Yes, now you'd listen to him* [Prof X] *….if he was giving the talk you'd listen to him….. you wouldn't take antibiotics after listening to him unless you totally need them*" [P3, FGD 1] *"You see he's* [Prof X] *someone reliable*" [P5, FGD 1] *"This year they have put the information around how many …you know…do we realise it causes so many deaths it causes and what's a myth and what's not a myth but I don't remember it last year*" [P3, FGD 4] *"It's valuable people [nurses] are actually getting the right information rather than talking to each other about the information and about you know ….and when I got the flu ….and I had it….or this….you know there's this that and the other ….you think oh God, you're worried and you read the information and if you knew it was all above board and all factual then it would be probably better*" [P5, FGD 2] *"I think as well last year the peer to peer was very good that if you've people that are saying…oh…do I need it…or what every they were there….they were always visible and they would go through the*

		education one to one they were you know… they were key as well for people suppose having lived…worked particularly last year or the year before you were kind of aware that there is education needed to explain it to ali the fears of people you know, with the peer to peer would put more knowledge into it at local level" [P6, FGD 3] *"So I feel if you give good information, eh the right access like more knowledge on this so that will help" [*P4, FGD 5] *"You want something short and snappy that is going to get the attention and say, look you mightn't be symptomatic but you can still spread the virus bang…bang….bang….look get your vaccine for yourself…. for you family…. for, you know" [*P1, FGD 1] *"That will definitely…all the nurses will definitely get the vaccine if you train them properly and tell them what's this?"* [P4, FGD 5] *"Okay, I would like to add is a good training session or an information session on that is at least for the nurses, in a medical professional…. we should be able to answer this like if a patient asked us what's flu and why should I get this vaccine, we don't know properly…. how will we tell them"* [P4, FGD 5]
	Other nurses	*" 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] *"In India, like personally speaking there is no like compulsory vaccination in the hospitals or anything against the flu like that like when we come here it's like a new thing, like we have to get the knowledge more about getting vaccinated. Even when we get the knowledge we'll discuss among the peer group how it is like if I have someone who came up with me, definitely I will ask her opinion but like how they speak definitely is going to influence them"* [P9, FGD 3]

		"The more of your colleagues that take the vaccine you are thinking I better take it as well like they're all taking it so I think it does" [P7, FGD 4] *"People [nurses] are educating each other regarding the flu vaccine and everything like, more people are thinking about the side effects of the vaccine more than the benefits so like we need to …so if I am speaking to someone regarding the vaccine they say more about the side effects…which make them not to go for the vaccination so like if you speak to someone like in the ward level it should be like more educative like why should I get the flu vaccine and tell that this kind of side effects is common but still like eh, like it won't be very serious like, that's what I felt like when I came here*" [P9, FGD 3]
	Ward managers	*"In a sense, I suppose if a manager is very pro a vaccine and makes the time or tries to facilitate you as much as possible that would influence the uptake whereas if a manager was very much kind of like…. just get on with it"* [P6, FGD 1] *"Even last year I know I was in and there was last year and I wanted to get it and so did two of my colleagues and our CNM just said, off you go to occ health I'll make sure your patients are covered there was no issue and we came back dripping with lanyards, and pens and…you know, there was definitely no problem"* [P5, FGD 3] "*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]

		"None of the medical guys would ever say to us get the flu.. get the jab that you need to get the jab or anything like that, never…. some of them don't get it you know so they don't, it's more your manager….the manager that's the one that says why haven't you got it like as a group ourselves we wouldn't say like…why are we not getting it you know" [P4, FGD 2] *"Well, it wasn't until last year….it wasn't until we attended it was …em….it was… one of our….like our ADON meetings with …with….with the CNMs and eh…. where it was…. it was I suppose highlighted to us that the importance of it and I suppose dispelled a lot of myths as well"* [P2, FGD 1]

Theme 6-Accessibility

This final theme refers to nurses' views in relation to issues surrounding access to the vaccine. The importance of access in relation to nurses' vaccination uptake was addressed with the need to increase access to peer vaccinators for nurses working shift work. There was also acknowledgement from senior nurses who expressed the difficultly they experience releasing nurses from the wards to attend vaccination clinics.

There was overwhelming consensus among all nurses that the peer vaccinators significantly improve access to the seasonal influenza vaccine and they were identified as an effective component of the annual influenza campaigns. This highlights the importance of convenience and easy access to the vaccine for nurses. Despite the advantages of peer vaccinators, nurses expressed a number of limitations with the service. Many felt peer vaccinators only captured nurses who worked 9-5pm and therefore, do not capture nurses who work night shifts or weekends. Although the experience of nurses in relation to occupational health was generally positive, the restricted vaccination clinic times was identified as a barrier and an inconvenience in accessing the vaccine.

Theme 6 Accessibility

Theme	Sub-theme	*Quote*
Accessibility	Challenge: Shift work	*"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] *"Like say you're constantly on nights and then you're not going to come in in the afternoon when your peer person can do it the vaccine or when occ health is open"* [P5. FGD 4] *"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 couldn't really access it because then, I was working on the wards and I was doing a lot of nights and then…I just didn't get it…like, you know. I really don't think many on my ward last year got it"* [P4, FGD 4]
	Challenge: Leaving the unit	*"Getting to occ health, it's a long way" [*P10, FGD 3] *"Getting off the ward is a big problem" [* P7, FGD 3] *"So to let people go to a flu clinic is another….just…. impossibility, if you look at the time… eh, it goes up in the morning time and then when it comes to around the time nobody can go to it" [*P4, FGD 1] *"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]
	Facilitation: Stay on the unit	*"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*

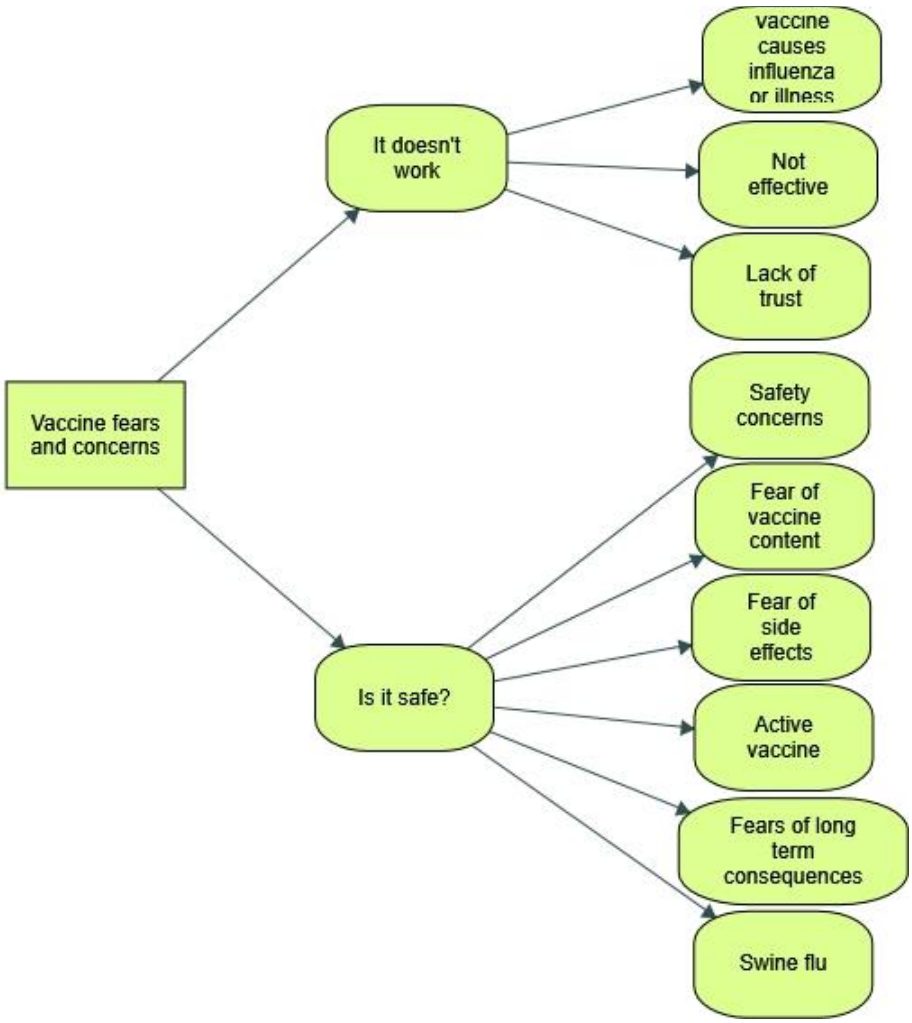
		that's 5 done out of 25 so that has been very beneficial I have to say" [P2, FGD 3 *"So maybe if it's [peer vaccinators] out of the hours of 9-5 or you know, at the end of shifts or the long day shifts, maybe there might be more people that would take it up" [P6, FGD 2]* *"Weekends and nights so they are trying I mean they are trying their best but it's just to catch everybody" [P1, FGD 5]* *Yes, they link in with CNMs on the wards, they're a familiar face and they ring up and say, "#2", 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]*

Summary

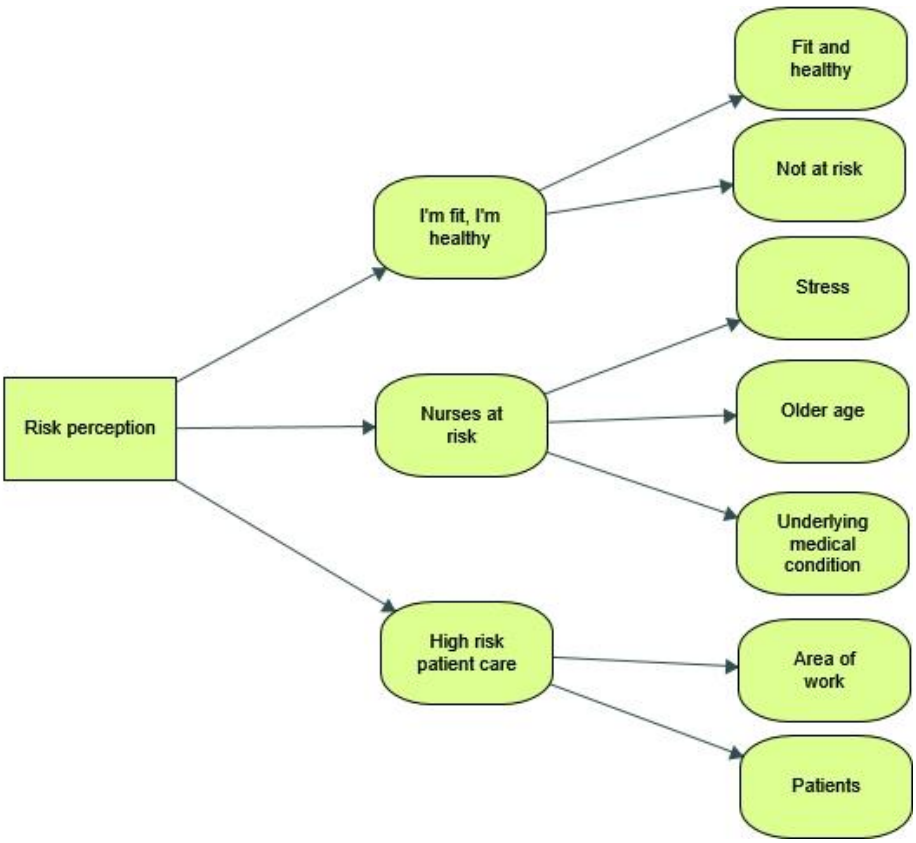
This report has provided an overview of the qualitative phase of this study. These findings expand and support the findings from the questionnaire survey distributed in phase one and completes the sequential explanatory study design. The results explored, elaborated and interpreted why certain factors were associated with vaccination behaviours of nurses by providing a deeper understanding and more in-depth overall understanding of the phenomena of interest.

Appendix 10: Audit trail, qualitative phase of study one

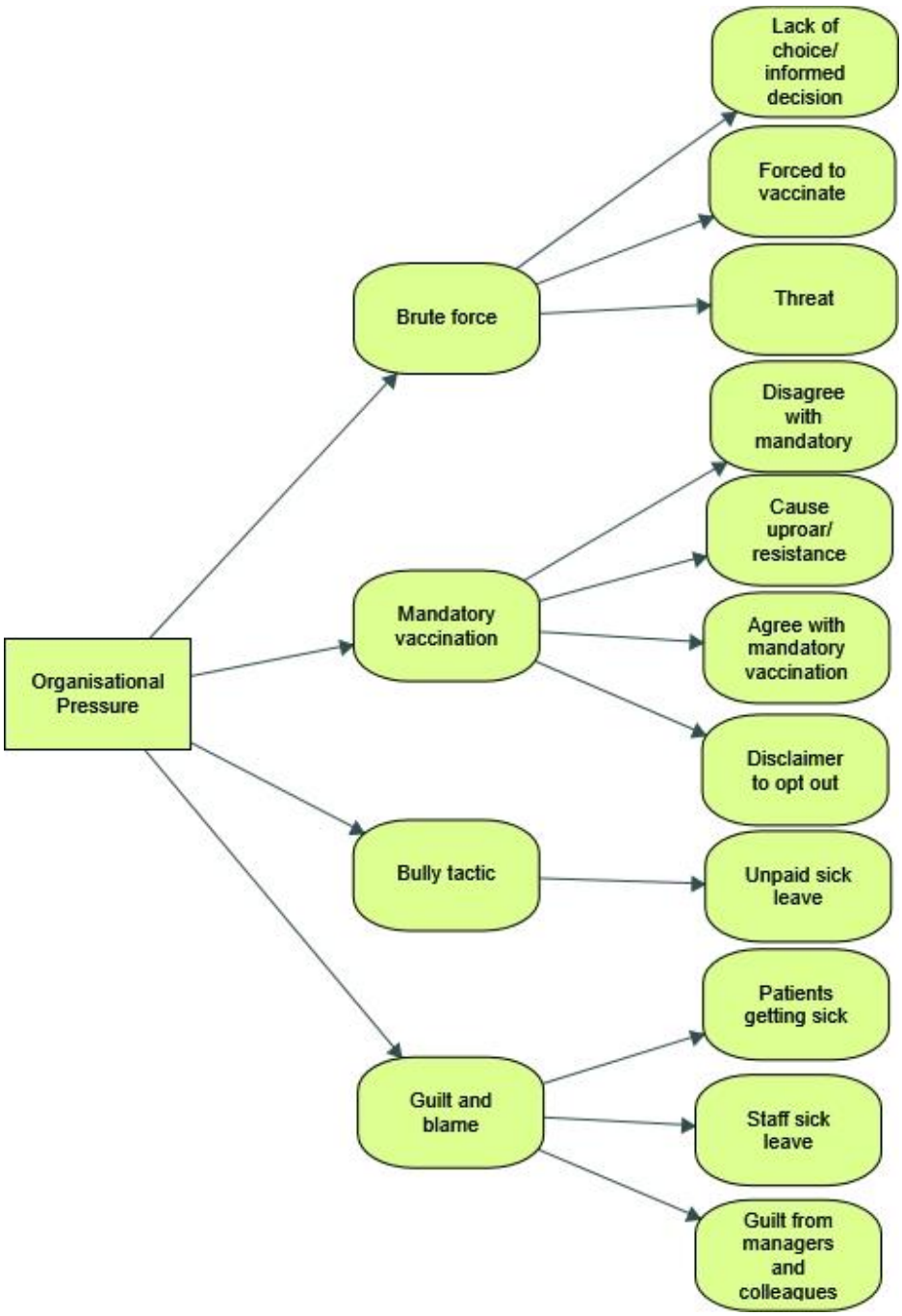
Theme 1 Vaccine fears and concerns



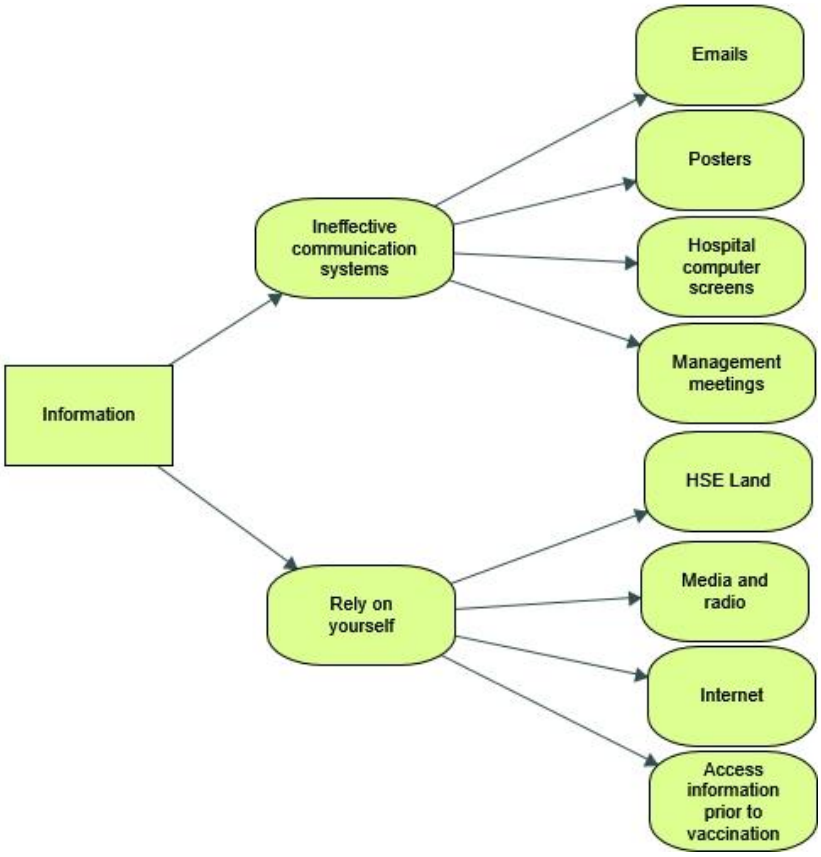
Theme 2 Risk perceptions



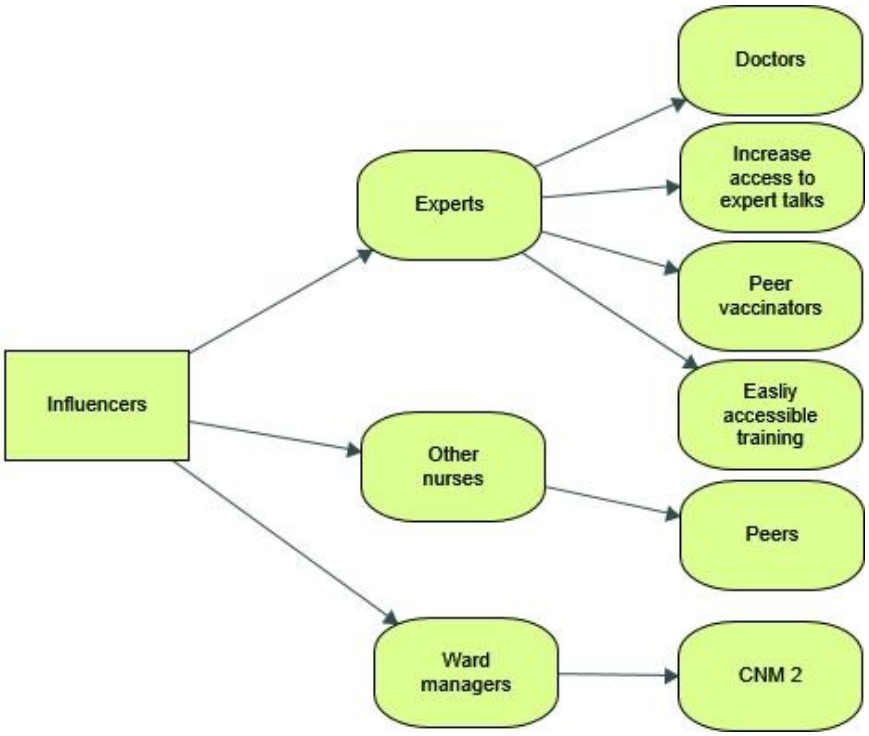
Theme 3 Organisational pressure



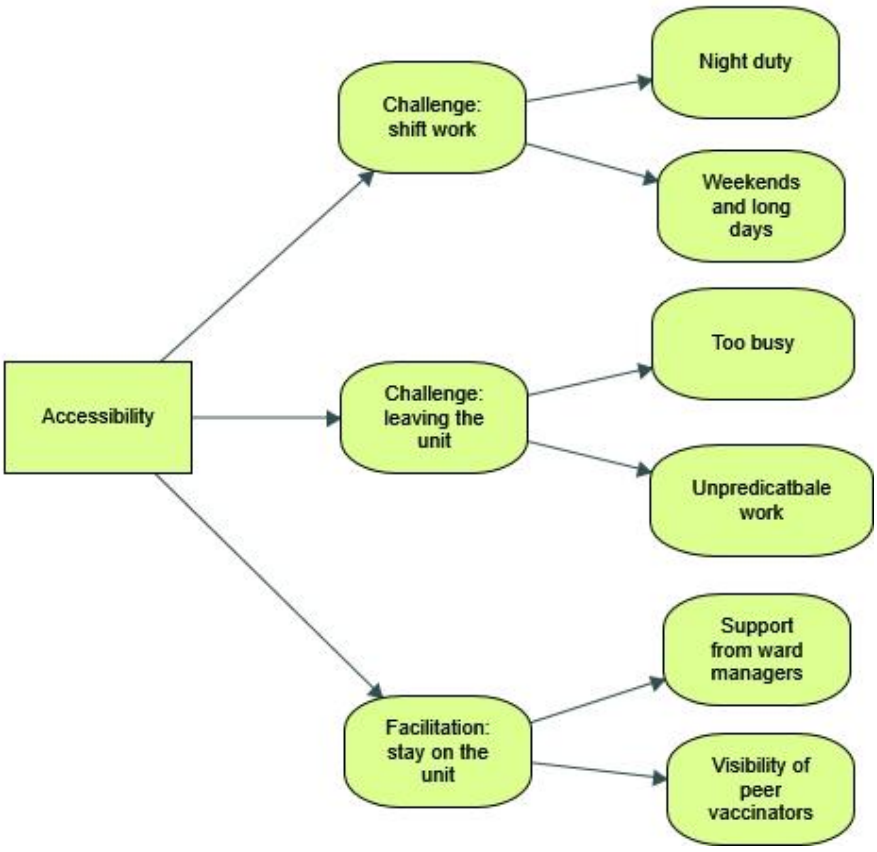
Theme 4 Information



Theme 5 Influencers

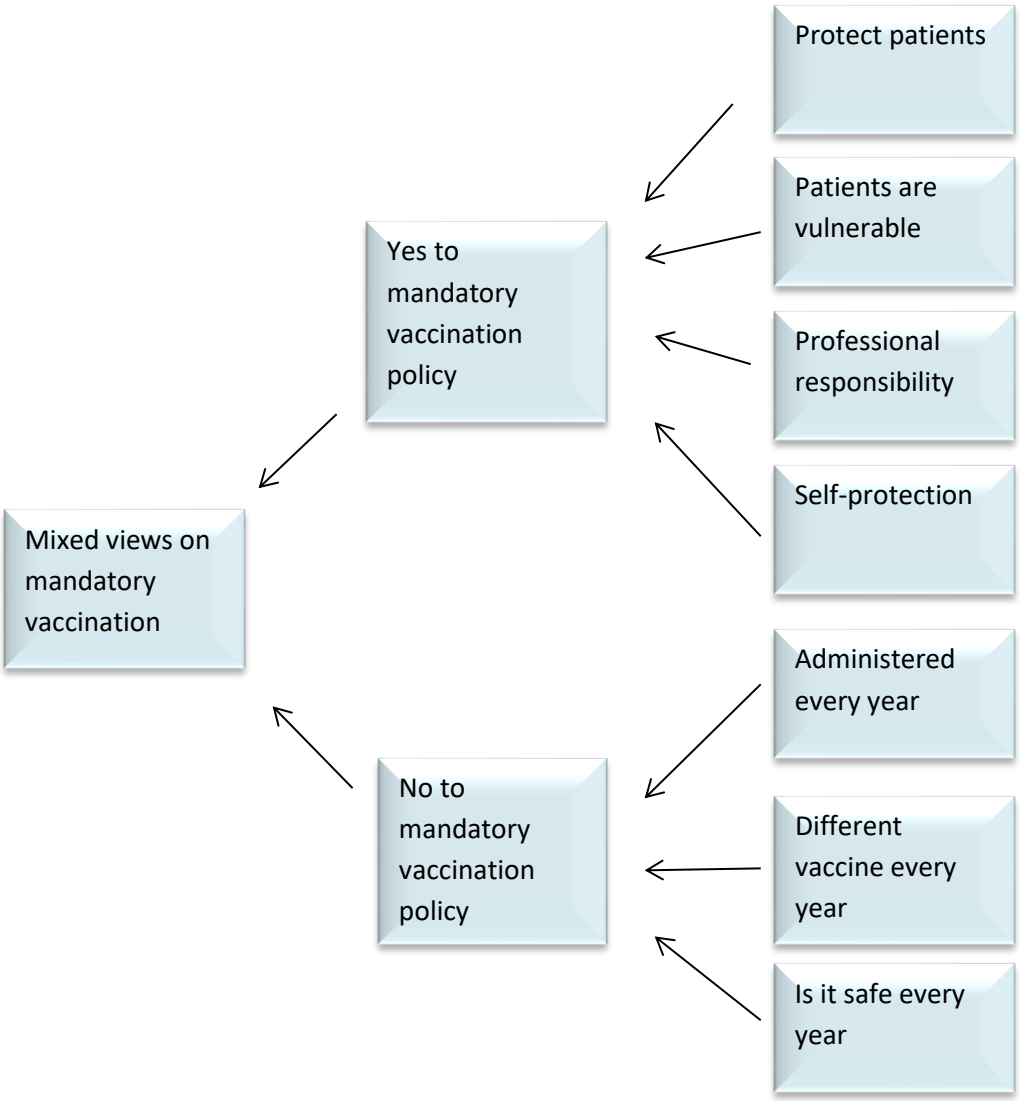


Theme 6 Accessibility

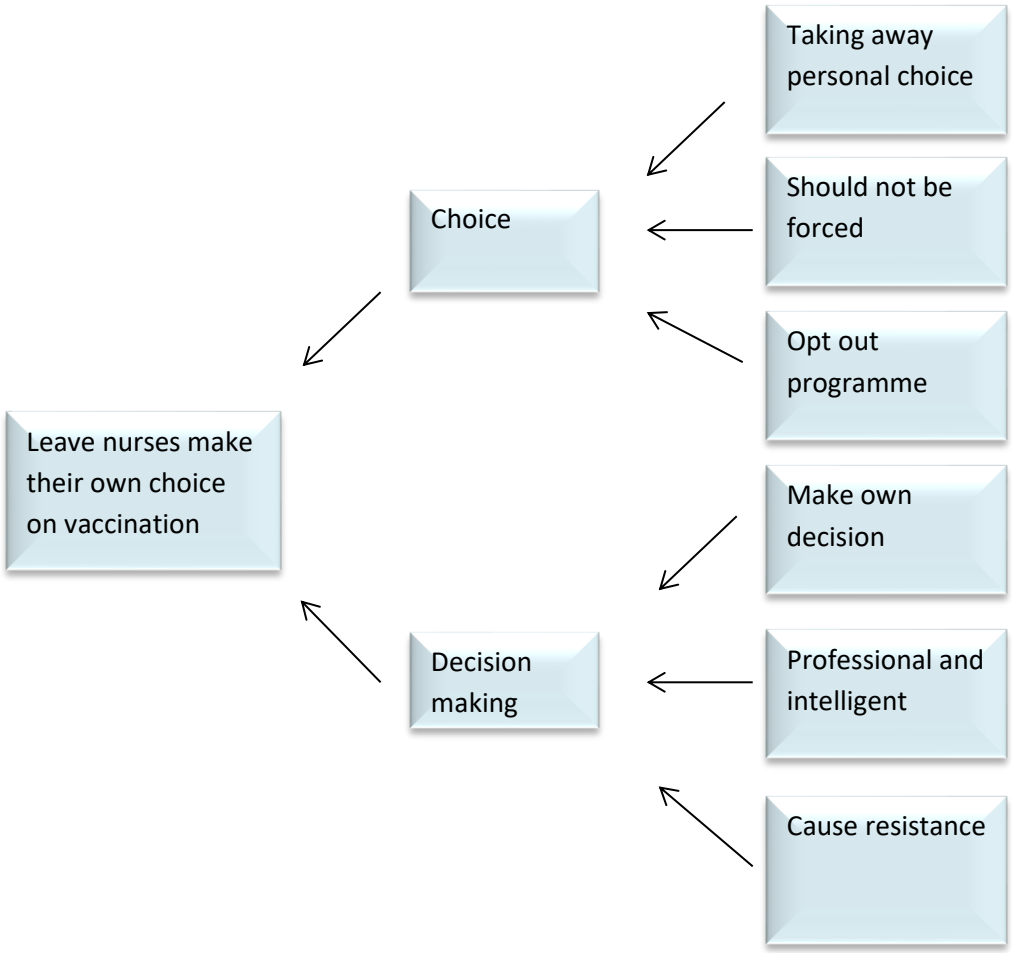


Appendix 11: Audit trail, study two

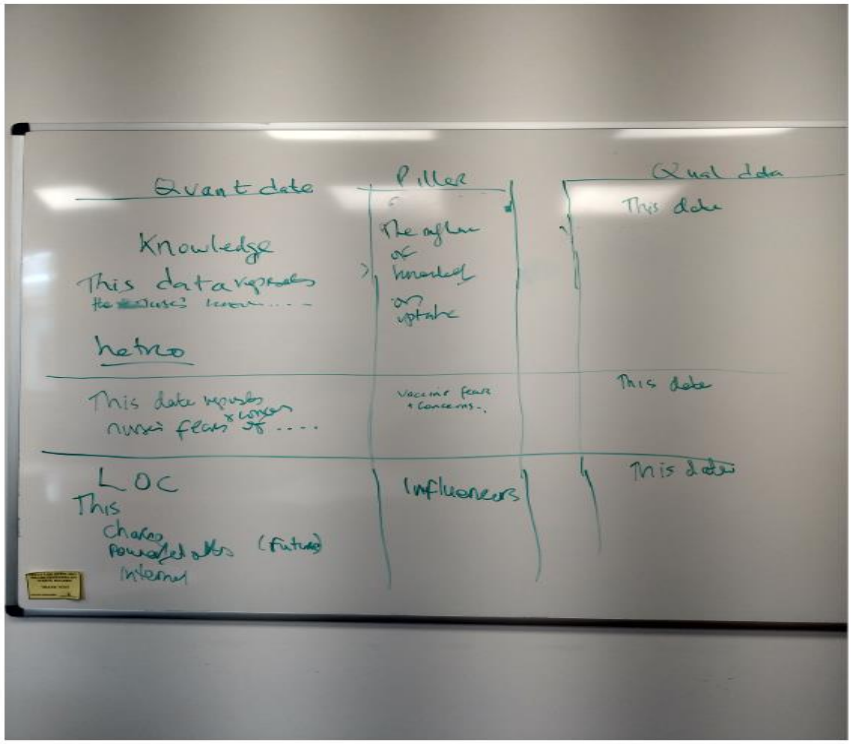
Theme one: Mixed views on mandatory vaccination

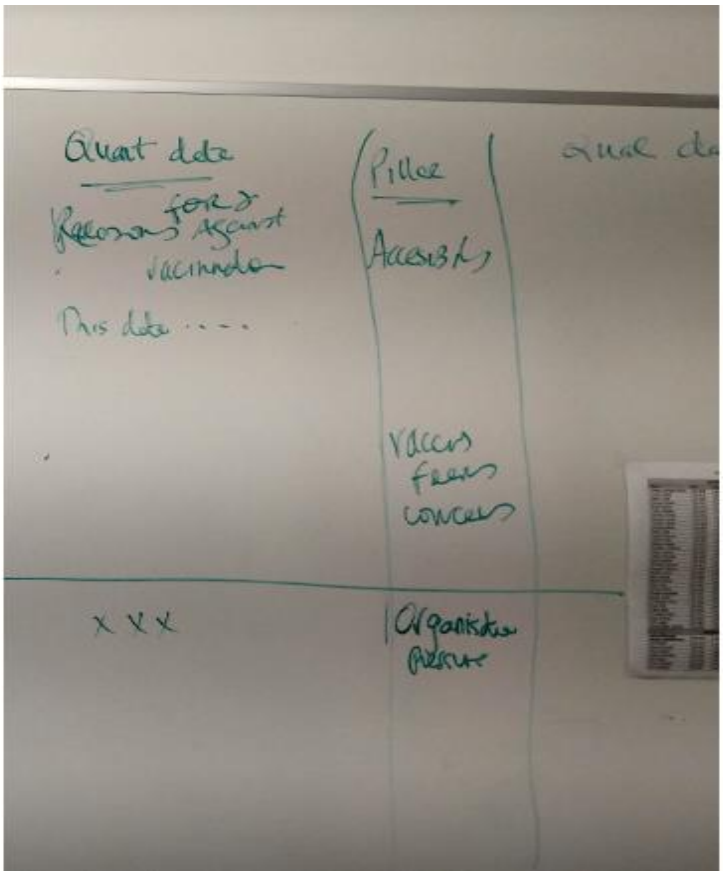


Theme two: Leave nurses make their own choice on vaccination



Appendix 12: Data integration brainstorming session


Quant data
Pillar
Qual data
Knowledge
This data
hetro
This data
Vaccine fears + Concerns..
This data
LOC
This
Influencers
This data


Quant data
Pillar
Accessibility
Vaccines
fears
concerns
x x x
Organisation
pressure

Appendix 13: Systematic review search strategy

Cinahl search

S1	(MH "Influenza+")	18,423
S2	TI influenza	12,261
S3	AB influenza	10,193
S4	TI seasonal influenza	624
S5	AB seasonal influenza	1,076
S6	TI flu	5,006
S7	AB flu	2,594
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	26,926
S9	(MH "Immunization+")	24,198
S10	(MH "Vaccines+")	41,338
S11	TI vaccination	10,077
S12	AB vaccination	16,572
S13	TI immunisation	1,145
S14	AB immunisation	9,693
S15	AB immunization	9,693
S16	TI immunization	4,121
S17	TI vaccine*	16,755
S18	AB vaccine*	20,672
S19	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18	67,175
S20	S8 AND S19	11,905
S21	(MH "Influenza Vaccine")	9,487
S22	TI "influenza vaccin*"	3,152
S23	AB "influenza vaccin*"	3,210
S24	TI "seasonal influenza vaccin*"	242
S25	AB "seasonal influenza vaccin*"	372
S26	TI "flu vaccin*"	972
S27	AB "flu vaccin*"	466
S28	TI "influenza immunisation"	41
S29	AB "influenza immunisation"	57
S30	TI "influenza immunization"	207
S31	AB "influenza immunization"	286
S32	S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31	11,239
S33	S20 OR S32	13,465
S34	(MH "Health Personnel+")	511,853
S35	TI "health care personnel"	199

S36	AB "health care personnel"	946
S37	AB "healthcare personnel"	740
S38	TI "healthcare personnel"	202
S39	TI "healthcare workers"	1,593
S40	AB "healthcare workers"	3,960
S41	(MH "Nurses+")	210,092
S42	TI nurse*	169,996
S43	AB nurse*	195,798
S44	(MH "Nursing Staff, Hospital")	18,240
S45	TI "nursing staff"	1,933
S46	AB "nursing staff"	8,445
S47	TI "nursing personnel"	470
S48	AB "nursing personnel"	1,019
S49	S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48	716,477
S50	**S33 AND S49**	**2,782**

Embase search

'influenza'/exp	89,614
influenza:ab,ti	109,100
'seasonal influenza':ab,ti	5,570
'flu':ab,ti	19,119
#1 OR #2 OR #3 OR #4	143,836
'vaccination'/exp	170,453
'immunization'/exp	290,175
'vaccine'/exp	336,957
'vaccination':ab,ti	151,830
'immunisation':ab,ti	11,809
'immunization':ab,ti	105,547
vaccine*':ab,ti	265,494
#6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12	534,252
#5 AND #13	49,821
'influenza vaccine'/exp	36,266
'influenza vaccination'/exp	16,240
'influenza vaccin*':ab,ti	20,795
'seasonal influenza vaccin*':ab,ti	2,278
'flu vaccin*':ab,ti	2,047
'influenza immunization*':ab,ti	1,432
'influenza immunisation*':ab,ti	229
#15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21	43,270
#14 OR #22	55,965
'health care personnel'/exp	1,505,073
'health care personnel':ab,ti	2,977
'healthcare personnel':ab,ti	1,928
healthcare worker*':ab,ti	12,081
health care worker*':ab,ti	14,976
'nurse*':ab,ti	322,139
'nurse'/exp	173,938
'nursing staff'/exp	69,824
'nursing staff':ab,ti	17,955
'nursing personnel':ab,ti	3,148

#24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33	1,661,844
#23 AND #34	7,422

Scopus search

TITLE-ABS-KEY (influenza)	149,316
TITLE-ABS-KEY ("seasonal influenza")	6,925
TITLE-ABS-KEY (flu)	30,994
(TITLE-ABS-KEY (influenza)) OR (TITLE-ABS-KEY ("seasonal influenza")) OR (TITLE-ABS-KEY (flu))	168,765
TITLE-ABS-KEY (vaccination)	232,590
TITLE-ABS-KEY (immunization)	213,080
TITLE-ABS-KEY (vaccine*)	402,050
TITLE-ABS-KEY (immunisation)	213,274
(TITLE-ABS-KEY (vaccination)) OR (TITLE-ABS-KEY (immunization)) OR (TITLE-ABS-KEY (vaccine*)) OR (TITLE-ABS-KEY (immunisation))	556,992
((TITLE-ABS-KEY (influenza)) OR (TITLE-ABS-KEY ("seasonal influenza")) OR (TITLE-ABS-KEY (flu))) AND ((TITLE-ABS-KEY (vaccination)) OR (TITLE-ABS-KEY (immunization)) OR (TITLE-ABS-KEY (vaccine*)) OR (TITLE-ABS-KEY (immunisation)))	56,891
TITLE-ABS-KEY ("Influenza vaccin*")	41,614
TITLE-ABS-KEY ("Seasonal influenza vaccin*")	1,904
TITLE-ABS-KEY ("Flu vaccin*")	1,674
TITLE-ABS-KEY ("influenza immunisation")	1,483
TITLE-ABS-KEY ("influenza immunization")	1,480
(TITLE-ABS-KEY ("Influenza vaccin*")) OR (TITLE-ABS-KEY ("Seasonal influenza vaccin*")) OR (TITLE-ABS-KEY ("Flu vaccin*")) OR (TITLE-ABS-KEY ("influenza immunisation")) OR (TITLE-ABS-KEY ("influenza immunization"))	42,194

(((TITLE-ABS-KEY (influenza)) OR (TITLE-ABS-KEY ("seasonal influenza")) OR (TITLE-ABS-KEY (flu))) AND ((TITLE-ABS-KEY (vaccination)) OR (TITLE-ABS-KEY (immunization)) OR (TITLE-ABS-KEY (vaccine*)) OR (TITLE-ABS-KEY (immunisation)))) OR ((TITLE-ABS-KEY ("Influenza vaccin*")) OR (TITLE-ABS-KEY ("Seasonal influenza vaccin*")) OR (TITLE-ABS-KEY ("Flu vaccin*")) OR (TITLE-ABS-KEY ("influenza immunisation")) OR (TITLE-ABS-KEY ("influenza immunization")))	56,906
TITLE-ABS-KEY ("Health personnel")	164,995
TITLE-ABS-KEY ("Health care personnel")	131,647
TITLE-ABS-KEY ("Healthcare personnel")	1,998
TITLE-ABS-KEY ("Healthcare workers")	10,935
TITLE-ABS-KEY ("Health care workers")	15,037
TITLE-ABS-KEY (nurse*)	447,114
TITLE-ABS-KEY ("nursing staff")	78,234
TITLE-ABS-KEY ("nursing personnel")	3,379
(TITLE-ABS-KEY ("Health personnel")) OR (TITLE-ABS-KEY ("Health care personnel")) OR (TITLE-ABS-KEY ("Healthcare personnel")) OR (TITLE-ABS-KEY ("Healthcare workers")) OR (TITLE-ABS-KEY ("Health care workers")) OR (TITLE-ABS-KEY (nurse*)) OR (TITLE-ABS-KEY ("nursing staff")) OR (TITLE-ABS-KEY ("nursing personnel"))	698,429

((((TITLE-ABS-KEY (influenza)) OR (TITLE-ABS-KEY ("seasonal influenza")) OR (TITLE-ABS-KEY (flu))) AND ((TITLE-ABS-KEY (vaccination)) OR (TITLE-ABS-KEY (immunization)) OR (TITLE-ABS-KEY (vaccine*)) OR (TITLE-ABS-KEY (immunisation)))) OR ((TITLE-ABS-KEY ("Influenza vaccin*")) OR (TITLE-ABS-KEY ("Seasonal influenza vaccin*")) OR (TITLE-ABS-KEY ("Flu vaccin*")) OR (TITLE-ABS-KEY ("influenza immunisation")) OR (TITLE-ABS-KEY ("influenza immunization"))))) AND ((TITLE-ABS-KEY ("Health personnel")) OR (TITLE-ABS-KEY ("Health care personnel")) OR (TITLE-ABS-KEY ("Healthcare personnel")) OR (TITLE-ABS-KEY ("Healthcare workers")) OR (TITLE-ABS-KEY ("Health care workers")) OR (TITLE-ABS-KEY (nurse*)) OR (TITLE-ABS-KEY ("nursing staff")) OR (TITLE-ABS-KEY ("nursing personnel"))) View Less	4,150

Medline search

exp Influenza, Human/	47562
influenza.tw.	82645
seasonal influenza.tw.	3837
flu.tw.	10609
1 or 2 or 3 or 4	96551
exp Vaccination/	82087
exp Immunization/	170806
exp Vaccines/	222919
vaccination.tw.	110870
immunisation.tw.	8623
immunization.tw.	83784
"vaccine*".tw.	199267
6 or 7 or 8 or 9 or 10 or 11 or 12	404479
5 and 13	32092
exp Influenza Vaccines/	22107
"influenza vaccin*".tw.	14901
"seasonal influenza vaccin*".tw.	1564
"flu vaccin*".tw.	1025
influenza immunisation.tw.	145
influenza immunization.tw.	986
15 or 16 or 17 or 18 or 20	25186
14 or 21	33271
exp Health Personnel/	496168
health care personnel.tw.	2120
healthcare personnel.tw.	1205
healthcare workers.tw.	6757
health care workers.tw.	10002
exp Nurses/	86391
"nurse*".tw.	237189
exp Nursing Staff/	65043
nursing staff.tw.	10291
nursing personnel.tw.	2457
23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32	657488
22 and 33	2582

DARE and CENTRAL search

MeSH DESCRIPTOR Influenza Vaccines EXPLODE ALL TREES	201
("seasonal influenza vaccin*")	18
("seasonal influenza immuni*")	0
MeSH DESCRIPTOR Health Personnel EXPLODE ALL TREES	1130
("health personnel")	366
("healthcare personnel")	14
("healthcare workers")	58
("health care workers")	109
MeSH DESCRIPTOR Nurses EXPLODE ALL TREES	181
(nurses)	1100
("nursing staff")	205
("nursing personnel")	19
#1 OR #2 OR #3	203
#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12	2314
#13 AND #14	19

CENTRAL

“influenza vacc*” OR “influenza immune*” 23