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Seasonal influenza vaccination of healthcare workers: evidence synthesis

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Final report

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Abbreviations

CI	confidence interval
DFP	declination form programme
EPOC	Effective Practice and Organization of Care (Group)
HCW	healthcare worker
nRCT	non-randomised controlled trial
RCT	randomised controlled trial
RR	risk ratio

Executive Summary

Background

Healthcare workers (HCWs) involved in direct patient care are encouraged to receive the seasonal influenza vaccine, annually, in order to protect patients. In 2014-15, only 55% of frontline HCWs in England received the seasonal influenza vaccine, with wide variation between locations (from 42% to 76% at area team level). This means that there is considerable scope to improve uptake rates. To inform the commissioning of randomised controlled trials to evaluate the effectiveness of strategies to improve uptake, we undertook an evidence synthesis on seasonal influenza vaccination for healthcare workers (HCWs).

This report presents the findings from: (1) a synthesis of evidence about seasonal flu vaccination interventions: content and components, processes, and implementation; and (2) a systematic review of qualitative studies investigating HCWs' views, attitudes and perceptions about seasonal flu vaccination.

For the first component, we utilised an existing systematic review by Lytras et al. (2016) evaluating the effectiveness of interventions to increase flu vaccination, which we updated. Our synthesis focused on the content and components, processes, and implementation of the interventions, drawing on the authors' descriptions of their studies and on their interpretations of study findings. This synthesis provides a detailed picture of the types of intervention that have been evaluated, and highlights issues which may arise in implementing these interventions. Alongside, we present the effectiveness data reported by Lytras et al. (2016).

For the second component, we undertook a new systematic review of qualitative studies. This review provides information about HCWs' views, attitudes and perceptions relating to seasonal flu vaccination, generally, and to promotion programmes, specifically.

Findings

We identified 60 studies evaluating interventions to promote seasonal flu vaccination among HCWs. Of these, only 13 used a randomised controlled trial (RCT) design. The types of strategy, number of studies, strength of evidence and likely effectiveness are presented in the summary table, overleaf.

Most of the RCTs focused on increasing awareness, or on education. Few RCTs evaluated strategies to increase access, or incentives, and none assessed mandatory vaccination programmes. Most interventions combined several different elements and this is likely to be the most promising approach, as components are likely to work in different ways, and for different people. Most RCTs were conducted either in hospitals or in long-term care (e.g., nursing homes).

Three studies were conducted in the UK (two RCTs), mainly focusing on increasing awareness or education.

Most interventions appear not to have been based on any clear theoretical framework, or on any formative research or substantive engagement with HCWs themselves. Most non-mandatory interventions focused on individual beliefs, rather than on the social or institutional factors which may affect vaccination uptake. Data on implementation

indicate that it is important to ensure adequate resources and management support; to address HCWs' beliefs about vaccination; and to collect accurate data on vaccination coverage.

Summary table

Strategy or component	Total studies N[1]	RCTs N	Strength of evidence[2]	Effective?[3]
Increased access, such as mobile carts or workplace vaccination clinics	30	2	Weak	Somewhat effective
Increased awareness, such as letters, posters, or vaccination 'champions'	32	10	Strong	Somewhat effective
Education, such as lectures or formal training	21	8	Strong	Ineffective
Incentives, such as prize draws or gifts	13	2	Weak	Ineffective
'Soft' mandates, such as requiring HCWs to be vaccinated or sign a declination form	9	0	Very weak	Promising
'Hard' mandates, such as requiring HCWs to be vaccinated or wear a mask when in contact with patients	10	0	Very weak	Promising

We synthesised the findings from 25 qualitative studies. The data indicated a number of personal beliefs which may be barriers to vaccination, including perceived low risk of influenza, fear of side-effects of the vaccine, and scepticism about vaccine effectiveness. There were serious barriers to the acceptability of some interventions, particularly coercive mandatory policies, but also some educational or awareness-raising strategies.

Bringing together the findings from the quantitative and qualitative studies, it appears that HCWs have clear views about their needs and priorities in relation to seasonal flu vaccination, which were mostly not addressed by the evaluated interventions.

Key messages

- Promising interventions combine several components, including individual, social and environmental elements.
- Education alone is probably ineffective, but broader awareness-raising strategies appear promising.
- Increasing access to vaccination may be effective, but the evidence is weak with few RCTs.
- Both "soft" and "hard" mandates appear promising, but have yet to be evaluated using robust study designs, and may have limited acceptability.
- Interventions should ideally target everyone working in a healthcare context, but this may be practically difficult.

[1] Note that intervention categories are not exclusive.

[2] 'Strong' = more than two RCTs; 'weak' = two or fewer RCTs; 'very weak' = no RCTs

[3] 'Somewhat effective' = pooled relative risk (all studies) between 0.8 and 1, statistically significant, and significant in at least one RCT; 'ineffective' = pooled relative risk (all studies) not statistically significant; 'promising' = pooled relative risk statistically significant, but no RCTs.

- The culture and context of the organisation(s), within which interventions are implemented, may have an important influence on outcomes. Evaluators should seek to understand interventions within an organisational system.
- Very few interventions engaged with HCWs to understand their needs and priorities. Intervention developers/implementers should engage with HCWs to understand their views, conduct formative research and pilot interventions before full-scale evaluation.
- Mixed-methods research to understand the context, in which an intervention will be implemented, and HCWs' likely responses to an intervention, may be valuable.

1. Introduction

1.1. Background

Seasonal influenza epidemics have a substantial impact on public health and result in up to five million cases of severe illness worldwide, of which five to 10% result in deaths each year (World Health Organization fact sheet 2014). In particular, seasonal influenza places adults aged 65 years or older, children, pregnant women, and persons who have specific health conditions at a higher risk for serious illness and death (Mertz et al. 2013, Thompson et al. 2010, Thompson et al. 2004).

Annual influenza vaccination of healthcare workers (HCW) is recommended to help reduce the transmission of influenza to patients (Shefer et al. 2011, World Health Organization fact sheet 2014). This practice has been shown to significantly decrease all-cause mortality in patients (Ahmed et al. 2014). Vaccination has been shown to be effective and safe (Couto et al. 2012, Nichol et al. 1995) and can be distributed to a large group of people quickly. Additionally, lower rates of influenza among HCWs have the advantage of less illness-related absenteeism (Burls et al. 2006, Nichol et al. 1995).

Despite these benefits, the reported vaccination numbers in England are generally low among HCWs, and stay far below the target level of 75% (Department of Health and Public Health England 2016). In 2014-15, only 55% of frontline HCWs in England received the seasonal influenza vaccine, with wide variation between locations (from 42% to 76% at area team level; Public Health England 2015). This means that there is considerable scope to improve uptake rates.

Systematic reviews have assessed the effectiveness of strategies to increase vaccination coverage among HCWs and have found that a range of interventions is potentially effective, including awareness raising, increasing access, and mandatory policies (Lytras et al. 2016, Schmidt et al. 2013, Siemieniuk et al. 2014). However, these reviews report very limited information about the content of the interventions and the context in which they are implemented. Qualitative studies suggest that the views and attitudes of HCWs are likely to impact on intervention effectiveness, yet the findings from these studies have not been synthesised.

1.2. Project aims and structure

This project aimed to synthesise both the data available from intervention studies about the content of interventions, and the data available from qualitative studies about the views and experiences of HCWs regarding vaccination. The project was commissioned to inform the development of new evaluation research and includes two separate research syntheses:

1. a synthesis of data and information on the content and implementation of interventions; and
2. a systematic review of qualitative evidence.

The two parts were designed to be complementary, but are methodologically different. For this reason the methods and results are reported separately below.

For the first component, we utilised a previous systematic review by Lytras and colleagues (Lytras et al. 2016). We also updated the searches from their review, using the same

search strategy, to ensure that the evidence base was as up-to-date as possible. We did not carry out further analyses of the effectiveness data (the results of their meta-analysis are summarised on p.5 below). Rather, our review focused on synthesising data and information relating to the content and implementation of the interventions, drawing on study authors' descriptions of the interventions they implemented, and on their interpretation of study findings. The synthesis aimed to provide a more detailed picture of interventions evaluated to date than is available from published review-level evidence, and some indicative pointers regarding issues which may arise in implementing such interventions.

The second component was a full new systematic review of qualitative evidence relating to influenza vaccination for HCWs, which provides an overview of the views and experiences both of the HCWs who are targeted by the intervention, and those who implement interventions designed to increase vaccination among HCWs. This includes both general perceptions and attitudes towards vaccination, and perceptions of vaccination programmes specifically.

In the final chapter, we synthesise the findings from both reviews, and make suggestions for future evaluation research.

2. Review of intervention studies

2.1. Methods

2.1.1. Search for existing systematic reviews

A search of MEDLINE was carried out to identify good-quality, recent systematic reviews evaluating the effects of interventions to increase the uptake of flu vaccination in healthcare workers. This search returned 86 records, of which twelve were potentially relevant. One review, published in 2016, with searches carried out in 2015, was considered to be the most up-to-date, comprehensive and methodologically robust.[4] Building on this review by Lytras et al. (2016), we updated their search (from the beginning of 2015) using the same strategy, and applying the same inclusion/exclusion criteria. We retrieved the full texts of studies included by Lytras et al. (2016) and of the new studies meeting the review inclusion criteria. As the original review reported limited information about intervention content and implementation, or about setting, we extracted these data, where available. The analyses reported below combine the data from the update search with the data extracted from the primary studies, included in the Lytras et al. (2016) review. As far as was possible, we followed the same methods and approaches to ensure consistency.

2.1.2. Searching

Lytras et al. (2016) searched PubMed and Scopus using the following strategy: "vaccin* AND (influenza OR flu) AND ("healthcare worker" OR "healthcare workers" OR "health personnel" OR "physician" OR "physicians" OR "nurse" OR "nurses" OR "health staff" OR "doctor" OR "doctors" OR practitioner OR practitioners OR "health worker" OR "health workers")". The searches were carried out in April 2015. We used the same search strategy and updated the searches (from January 2015), in May 2016.

2.1.3. Screening

An initial sample of 10% of titles and abstracts was screened by two reviewers, independently, and differences resolved by discussion. The remaining 90% was screened by a single reviewer. The following criteria were applied:

1. Is the study an outcome evaluation (including randomised controlled trials (RCTs), non-randomised controlled trials (nRCTs), controlled before-and-after (before-after) studies, and uncontrolled before-after studies)?
2. Does the study measure the uptake of vaccination for seasonal influenza?
3. Does the study concern vaccination for healthcare workers?

No language restrictions were applied. The full texts were retrieved for all records meeting these criteria and screened by two reviewers, independently, with differences resolved by discussion.

2.1.4. Quality assessment and data extraction

In the original review, the Cochrane Effective Practice and Organisation of Care (EPOC) risk of bias criteria were used to assess study quality. However, the full results of quality assessment were not reported in the published review. We quality-assessed the studies

[4] We would like to acknowledge the assistance of Theodore Lytras in clarifying queries about the methods of his review.

located by the update search, using the same criteria. However, this tool is arguably not well suited to the study designs included, as the tool for interrupted time series studies was used for all uncontrolled studies (none of which were strictly interrupted time series studies). In addition, the tool does not clearly include study design as a dimension of quality. As most studies in the review used uncontrolled designs, it was study design which was the major threat to validity, so the tool was found to not give an accurate sense of the real limitations of the data. For these reasons, the results of the quality assessment are not reported here.

The following data were extracted for all studies:

- Country of study
- Setting (i.e. type of healthcare organisation(s))
- Population (i.e. groups of healthcare workers targeted by the intervention, and/or from whom data were collected)
- Intervention content, components, and whether based on theory
- Whether the intervention was based on formative research or engagement with the study population
- Any process data (e.g., survey data on reasons for declining vaccination)

In addition, the discussion sections of all the studies were examined and coded for information on the facilitators and barriers to implementation, and limitations of the research. Data on the intervention content, theory and formative research were extracted by one reviewer and checked in detail by a second reviewer; other data were extracted by one reviewer only. Where multiple reports of the same study were available, data were aggregated for the purposes of analysis. (Hence, in the results chapters, studies are referred to by study identifiers rather than references to reports. The report references can be found in Table 2 and Table 9).

2.1.5. Analysis

The categorisation of the intervention type and components followed that used by Lytras et al. (2016). Table 1 below, reproduced from Lytras et al. (2016)'s review, gives their definitions of the categories.

Table 1. Intervention categories and effectiveness findings (reproduced from Lytras et al. 2016)

Component	Description / examples
Increased access	Any measure to make vaccination easier and more convenient, such as: free vaccine (without cost); extended vaccination hours; vaccination at the workplace using mobile carts; peer vaccination; vaccination fair.
Increased awareness	Non-educational measures to advertise any aspect of vaccination: posters, pamphlets, flyers, letters, reminders, newsletters, badges, etc. Also: personal advocacy (vaccination "champions"), provision of feedback regarding vaccination goals.
Education	Formal educational interventions such as: presentations, lectures, video projections, meetings, questionnaires, etc.
Incentives	At the individual level (gifts, perks, raffles, etc.) or at the group level (vaccination fair with free drinks, bonus/reward for meeting vaccination targets, etc.).
"Soft"	Declination forms; vaccination mandates with no severe consequences

mandate	for unvaccinated HCWs, or without enforcement.
"Hard" mandate	Mandatory vaccination as a condition for employment, or with severe restrictions for unvaccinated HCWs (such as forbidding patient contact or having to wear a mask).

It should be noted that in both Lytras et al. (2016)'s meta-analysis, and in our analysis below, the categories are not exclusive: rather, all interventions were coded with every component they contained. As set out below, most interventions included components from more than one category, so there is substantial overlap between them. (Issues with the use of this framework are discussed further on p.25 below.)

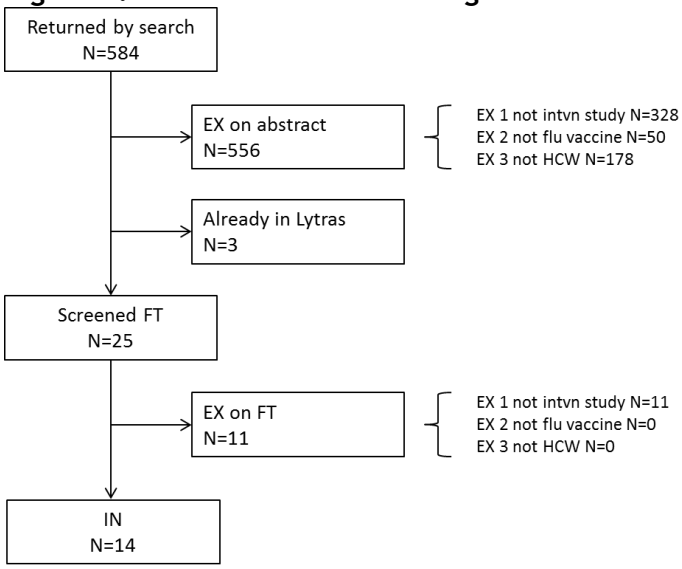
As shown in Table 2 below and discussed further at the end of this chapter (p.27), most studies included in Lytras et al. (2016)'s meta-analysis used single-group (uncontrolled) designs, which cannot provide conclusive evidence of effectiveness. The results of the meta-analysis should thus be interpreted with caution.

We also carried out an informal thematic analysis of the textual data on intervention content and the information extracted from the discussion sections of the papers.

2.1.6. Flow of literature through the review

Figure 1 shows the flow of literature relating to the update search. We identified 584 records, and of these, fourteen studies met the inclusion criteria. Added to the original 46 studies, this gives a total of 60 studies in the full analysis.

Figure 1. Flow of literature through the review



2.2. Characteristics of the studies

The characteristics of the 60 studies are presented in Table 2. The data presented here are categorical, i.e. they indicate how the settings, populations and intervention type were categorised, rather than giving a full description of the characteristics; full descriptive information can be found in the evidence tables in Appendix B. The UK-based studies (N=3) are highlighted with shading.

Table 2. Characteristics of the intervention studies

Identifier	Country	Setting	Type of HCW targeted	Intervention type	Study design
Abramson et al. (2010)	Israel	Primary care	All with patient contact	Increased awareness Education	cluster RCT
Ajenjo et al. (2010)	USA	Hospital	All employees	Incentives Soft mandate	one-group
Awali et al. (2014)	USA	Hospital	Not specified	Hard mandate	one-group
Babcock et al. (2010)	USA	Hospitals, extended care facilities, day care centres, physician groups, home care	All employees, volunteers, contracted staff	Hard mandate	one-group
Camargo-Ángeles et al. (2013)	Spain	Hospital	Not specified	Increased awareness	one-group
Chambers et al. (2015)	Canada	Hospitals, long-term care facilities, health authorities	Not specified	Education	cluster RCT
Chamoux et al. (2006)	France	Hospital	Not specified	Increased access Increased awareness Education	one-group
Chittaro et al. (2009)	Italy	Hospital	Clinicians and ancillary staff	Increased access Increased awareness	one-group
de Juanes et al. (2007)	Spain	Hospital	Clinicians and ancillary staff	Increased access	one-group
Dey et al. (2001)	UK	Primary care, nursing homes, health authorities	Clinicians and ancillary staff	Increased awareness Education	cluster RCT

Doratotaj et al. (2008)	USA	Hospital	Clinicians	Increased awareness Incentives	RCT
Drees et al. (2015)	USA	Hospital	All employees	Increased access Incentives Hard mandate	one-group
Frenzel et al. (2016)	USA	Department within hospital	All employees	Increased access Increased awareness Hard mandate	one-group
Goodliffe et al. (2015)	Canada	Hospital	All employees, volunteers, contracted staff	Increased access Increased awareness	one-group
Guanche Garcell et al. (2015)	Qatar	Hospital	Clinicians and ancillary staff	Increased awareness Education Soft mandate	one-group
Harbarth et al. (1998)	Switzer-land	Department within hospital	Not specified	Increased access Education	controlled before-after
Hayward et al. (2006)	UK	Nursing home / long-term care	Not specified	Increased awareness	cluster RCT
Heinrich-Morrison et al. (2015)	Austra-lia	Hospital	Clinicians and ancillary staff	Increased access Increased awareness Incentives	one-group
Honda et al. (2013)	Japan	Hospital	All employees	Increased awareness Soft mandate	one-group
Hood and Smith (2009)	USA	Hospitals, physician network, home care, and health authorities	Not specified	Increased access Increased awareness Soft mandate	one-group
Iten et al.	Switzer-	Hospital	Not	Soft mandate	one-

(2015b)	land		specified		group
Kimura et al. (2007)	USA	Nursing home / long-term care	All with patient contact	Increased access Increased awareness Education	cluster RCT
Ksienski (2014)	Canada	Hospitals, primary care, extended care, nursing homes, health authorities	All employees, volunteers, contracted staff, students	Hard mandate	one-group
Kuntz et al. (2008)	USA	Hospital	All employees	Increased access Increased awareness Education	one-group
LaVela et al. (2015)	USA	Specialist centre	Clinicians and ancillary staff	Soft mandate	one-group
Lee and Fong (2007)	Singa-pore	Hospital	All employees	Increased access	one-group
Lehmann et al. (2016)	Nether-lands	Specialist centre	All employees	Increased access Education	RCT
Leibu and Maslow (2015)	USA	Hospitals, home care, transportation services, clinical practice offices	All employees, volunteers, contracted staff, students	Hard mandate	one-group
Leitmeyer et al. (2006)	Ger-many	Hospital	Clinicians	Increased awareness Education	one-group
Lemaitre et al. (2009)	France	Nursing home / long-term care	Not specified	Increased awareness	cluster RCT
Llupià et al. (2010)	Spain	Hospital	Clinicians and ancillary	Increased access Increased	one-group

			staff	awareness Incentives	
Looijmans-van den Akker et al. (2010)	Nether-lands	Nursing home / long-term care	Clinicians and ancillary staff	Increased awareness Education	cluster RCT
Lopes et al. (2008)	Brazil	Hospital	Not specified	Increased access Increased awareness Education	one-group
Marwaha et al. (2016)	Canada	Hospital	All employees, volunteers, students	Increased access Increased awareness Incentives	one-group
Nace et al. (2011)	USA	Nursing home / long-term care	Not specified	Education	cluster RCT
Nicholson et al. (2009)	USA	Hospital	All employees, volunteers, contracted staff, students	Increased access Increased awareness	one-group
Ohrt and McKinney (1992)	USA	Department within hospital	Clinicians	Increased awareness	RCT
Pan et al. (2015)	Taiwan	Hospital	Not specified	Increased access	one-group
Podczervinski et al. (2015)	USA	Specialist centre	All employees	Increased access Incentives Hard mandate	one-group
Porras-Povedano et al. (2015)	Spain	Hospital	All employees	Increased access	one-group
Quan et al. (2012)	USA	Hospital	All employees, volunteers, contracted staff, students	Increased access Soft mandate	one-group
Rakita et al. (2010)	USA	Hospital	All employees,	Hard mandate	one-group

			volunteers, contracted staff, students		
Ribner et al. (2008)	USA	Hospitals, nursing homes, outpatient centres	All employees	Increased access Incentives Soft mandate	one-group
Rodríguez-Fernández et al. (2016)	Spain	Paediatric hospital	All employees	Education	one-group
Rothan-Tondeur et al. (2011)	France	Long-term care facilities, rehabilitation centres	All with patient contact	Increased awareness Education Incentives	cluster RCT
Sadlier et al. (2015)	Ireland	Hospital	Clinicians and ancillary staff	Increased awareness Education	one-group
Samms et al. (2004)	USA	Hospital	Not specified	Increased access Increased awareness Incentives	one-group
Sartor et al. (2004)	France	Hospital	All employees	Increased access Increased awareness	one-group
Seale et al. (2011)	Austra-lia	Hospital	All employees	Soft mandate	one-group
Shah and Caprio (2008)	USA	Department within hospital	Clinicians and ancillary staff	Increased access Education	one-group
Shannon (1993)	USA	Hospital	Not specified	Increased access Increased awareness Incentives	one-group
Slaunwhite et al. (2009)	Canada	Hospitals, primary care, palliative care unit	Not specified	Increased awareness	cluster RCT

Smedley et al. (2002)	UK	Hospital	Clinicians and ancillary staff	Increased access Increased awareness	one-group
Smith and Van Cleave (2012)	USA	Unclear	All employees, volunteers, contracted staff, students	Hard mandate	one-group
Stuart et al. (2014)	Austra-lia	Department within hospital	Not specified	Hard mandate	one-group
Tannenbaum et al. (1993)	Canada	Nursing home / long-term care	All employees	Increased awareness Education	controlled before-after
Tapiainen et al. (2005)	Switzer-land	Paediatric hospital	Not specified	Increased access Education	one-group
Thomas et al. (1993)	USA	Nursing home / long-term care	All employees	Increased access Education Incentives	one-group
Venci et al. (2015)	USA	Hospital	Not specified	Increased awareness Education	one-group
Zimmerman et al. (2009)	USA	Hospital	All employees	Increased access Incentives	controlled before-after

2.2.1. Study design

Table 3 shows the breakdown of study designs (46 included in Lytras et al. (2016)'s review and 14 identified in the update search). Of these, 13 are RCTs, three controlled before-after studies, and 44 single-group studies. This means that the validity of the intervention evidence overall is limited (see p. 27 below).

Table 3. Intervention study designs

Study design	Lytras et al. (2016) N	Update search N	Total N
RCT	11	2	13
controlled before-after	3	0	3
single-group before-after	32	12	44
Total			60

When broken down by intervention strategy an interesting trend emerges (see Table 4). While the majority of studies in all categories are uncontrolled designs, there is a notable

difference, in the number of RCTs conducted, between the intervention categories. All of the RCTs either included an increased awareness or educational component, and five studies contained both. Only four RCTs examined the effects of interventions that also included other components; two examining increased access and two examining incentives. To date, soft or hard mandates have not been evaluated using RCT or controlled study designs.

Table 4. Study design by intervention type

Intervention type	**RCT**	**controlled before-after**	**single-group**	**Total**
Increased access	2	2	26	30
Increased awareness	10	1	21	32
Education	8	2	11	21
Incentives	2	1	10	13
Soft mandate	0	0	9	9
Hard mandate	0	0	10	10

2.2.2. *Settings and populations*

In terms of setting, most studies were conducted in hospitals or acute care units (N=42) or long-term care facilities, such as nursing homes (N=7), with only one conducted in primary care (Table 5). Nine included multiple service types; most of these focused on single healthcare organisations (generally in North America) delivering a range of services, including, for example, hospitals, physician groups, long-term care facilities and/or home care services.

Table 5. Settings

Setting	**N**
Hospital / acute care	42
Primary care	1
Nursing home / long-term care	7
Multiple service types	9
Unclear	1

However, if the settings are broken down and tabulated against the study type (Table 6), it appears that hospitals have been relatively less well served by RCTs, with proportionally fewer (N=3) than other settings. The RCT evidence in any single type of setting is limited.

Table 6. Setting by intervention type

Setting	**RCT**	**controlled before-after**	**single-group**
Hospital / acute care	3	2	37
Primary care	1	0	0
Nursing home / long-term care	5	1	1
Multiple service types	3	0	5
Unclear	1	0	1

In terms of population, most studies defined their population broadly and defined 'HCWs' as including all staff, not just clinicians (Table 7). However, relatively few (N=9) explicitly reported including non-employees who may have patient contact (such as students, volunteers or contractors), and many referred generically to 'HCWs' and did not describe the population.

Table 7. Populations

Population definition	N
All with patient contact	3
All employees	16
All employees + others (students, volunteers, contractors)	9
Clinicians	3
Clinicians + ancillary staff	11
Not specified	18

Three studies were conducted in the UK (Dey et al. 2001, Hayward et al. 2006, Smedley et al. 2002). These studies are discussed in more detail on p.18 below. The majority of studies were conducted in North America (N=37), about a third in other European countries (N=18), and nine in other countries.

2.3. Intervention content

The following sections summarise the data on intervention content, using Lytras et al. (2016)'s intervention categories/framework. The different types of strategy included in each category are described, along with the overall goals.

2.3.1. Increased access

Increased access includes any type of measure to make vaccination easier and more convenient. This could include, for example: reducing the cost of vaccines; offering vaccination at workplace sites, or increasing the locations or opening hours of existing workplace services; or mobile carts which offer vaccinations to HCWs in wards or other worksites. Thirty studies fell into this category, including two RCTs and two controlled before-after studies; the remaining 26 studies were single-group. Lytras et al. (2016)'s meta-analysis found that interventions including increased access were effective, although with a fairly modest effect size (relative risk 0.88 (95% CI 0.78 to 1.00)).

Of these 30 studies, 13 examined the effects of introducing or increasing the number of on-site mobile vaccination teams. These mobile teams moved around worksites offering vaccination to staff, using carts or vans equipped with supplies for vaccination. In many cases, they operated on extended hours, including night and weekend shifts. Many of the mobile cart teams also proactively approached staff with the offer of vaccination, rather than waiting for HCWs to approach them. Sixteen studies involved delivering vaccine in on-site workplace clinics and/or extending the operating hours of existing on-site services (six of which also implemented mobile teams). Six studies delivered vaccination at events such as training days (Shannon 1993), staff meetings (Hood and Smith 2009) or as part of

intensive ‘vaccine days’ or ‘fairs’ events, which often involved educational and incentive components along with the delivery of vaccination (Heinrich-Morrison et al. 2015, Kimura et al. 2007, Kuntz et al. 2008, Shannon 1993). One study involved sending HCWs pre-scheduled appointments for vaccination, as opposed to having them make an appointment themselves (Lehmann et al. 2016). Almost all studies in this category focused on improving accessibility rather than reducing cost, suggesting that cost is not seen as a major barrier (several studies mentioned that vaccine was provided free, but this was the case at both pre- and post-test and did not form part of the evaluated intervention).

Access interventions are intended to work in several ways. First, they aim to reduce barriers relating to the accessibility of services, for example, where there is no on-site service, or where existing services are physically located away from some HCWs’ workplaces, or not open at convenient times. Second, where interventions, such as mobile carts, involve proactively approaching HCWs, they may have a ‘nudge’ effect meaning that HCWs have to actively decline vaccination: that is, they act to change the default such that HCWs must choose to ‘opt out’, rather than ‘opt in’ to passively delivered services. Third, they provide a means to raise awareness of vaccination more generally, and can provide a physical focus for other strategies, such as education or incentives. This is particularly clear for the ‘vaccine days’, which combine awareness-raising strategies at a group level with the offer of on-site vaccination, but it also plays a role in some of the mobile cart and on-site clinic interventions.

2.3.2. Increased awareness

This category includes any measure to raise awareness, promote vaccination or provide information, other than formal education (which is the subject of the next section). It includes two main sub-categories: marketing strategies, such as posters, letters or emails; and personal advocacy strategies, such as vaccination ‘champions’, or selected members of staff who promote vaccination to their colleagues. There were 32 studies that included an intervention of this type, including 10 RCTs and one controlled before-after study; the remaining 21 studies were single-group. Lytras et al.’s meta-analysis found interventions that included increased awareness to be effective (relative risk 0.83 (95% CI 0.71 to 0.97)). Similar to increased access, this component was rarely examined in isolation. It was most often examined with increased access (15 studies) or with an educational component (11 studies).

All 32 studies in this category included some form of mass marketing strategy to raise awareness, including staff emails, posters, pamphlets, flyers, letters, reminders, newsletters, websites, and visits from researchers or infection control staff. Most studies used a combination of several different marketing modes. One focused specifically on social media (Venci et al. 2015). Four studies also used letters personally addressed to individual HCWs (Chamoux et al. 2006, Chittaro et al. 2009, Ohrt and McKinney 1992, Sartor et al. 2004). Very limited information was available, from most studies, on the actual content of the messages disseminated using these methods. In most cases, they appeared to focus on either stating basic information about influenza and vaccination, and/or on providing information about vaccine availability.

In addition to these methods, eight studies used vaccination champions who were recruited in targeted sites and then tasked with promoting vaccination and/or with

delivering vaccination themselves (Abramson et al. 2010, Goodliffe et al. 2015, Hayward et al. 2006, Kuntz et al. 2008, Marwaha et al. 2016, Nicholson et al. 2009, Samms et al. 2004, Slaunwhite et al. 2009). In some cases, the role involved providing information or addressing colleagues' concerns; some of the champions were also responsible for the co-ordination of vaccination campaigns at a local level. In some studies, champions seemed to have received little or no direction as to how to engage with colleagues, while in others, they received specific training and support. Most studies did not clearly report how the champions were selected and recruited; one study described how heads of department were asked to identify individuals who were committed to vaccination and trusted by their colleagues (Slaunwhite et al. 2009). As well as these efforts targeting HCWs, five studies (Abramson et al. 2010, Frenzel et al. 2016, Heinrich-Morrison et al. 2015, Kuntz et al. 2008, Marwaha et al. 2016) also included data systems designed to feed back information about vaccination coverage to managers or programme implementers.

The awareness-raising interventions, thus, cover a range of strategies. In the first instance they aim simply to make HCWs aware of the importance of vaccination and/or the availability of vaccination services, using media such as posters and emails which facilitate maximum exposure. In many cases, they are designed to operate alongside other campaigns, such as incentives or increased access. Many also aim to provide information or combat 'myths' about vaccination (and thus overlap considerably with the formal educational interventions). Most of these focus on one-way communication strategies. The 'champion' interventions, by contrast, emphasise advocacy and personal interaction, usually using HCW peers to make messages more credible; one study described champions as "*lever[ag]ing relationships*" (Goodliffe et al. 2015). While many of the champion programmes were conceptualised by Lytras et al. (2016) as providing information, it seems likely that the champions' work, in reality, was more diverse than this.

2.3.3. Education

This category includes formal education delivered as lectures, courses or presentations. Educational interventions were evaluated in 21 studies, including eight RCTs and two controlled before-after studies; the remaining 11 studies were single-group. Lytras et al. (2016)'s meta-analysis found that interventions including education were ineffective (relative risk 0.96 (95% CI 0.84 to 1.10)). Of the interventions including education, 11 also had an increased awareness component and just under half (eight studies) also increased access to vaccines.

Within these 21 studies, most interventions (13 studies) were based on some form of in-house training, including development through staff meetings or online courses. Six studies scheduled lectures from external speakers (Abramson et al. 2010, Chamoux et al. 2006, Kuntz et al. 2008, Lehmann et al. 2016, Lopes et al. 2008, Tannenbaum et al. 1993) and two held conferences on the topic (Harbarth et al. 1998, Thomas et al. 1993). Three studies included 'vaccine days' as described under 'increased access' above. Some educational interventions were delivered by researchers or external experts, and some by HCW peers. In most cases, education was delivered formally and face-to-face, often using PowerPoint presentations or similar. In at least one case, the intervention was delivered within an existing programme of staff seminars. One study evaluated a quality improvement programme, in which the education component was considered as part of a process of building 'quality improvement teams' within organisations (Nace et al. 2011).

One study focused on education for managers responsible for implementing vaccination programmes, rather than being directly delivered to HCWs (Chambers et al. 2015). As noted, there is considerable overlap between this category and increased awareness, with some educational interventions being relatively informal; the two categories are combined in some analyses below.

The main focus of the educational programmes was communicating information. As for the increased awareness interventions, very little information is available from the studies about the content of the messages, or the educational materials used, and what was reported, suggests that educational interventions mostly focused on stating facts about vaccination.

2.3.4. Incentives

This category includes any type of incentive, including gifts or promotional items given to individuals receiving vaccination, raffles or prize draws, and bonuses offered to departments or units for meeting vaccination coverage targets. Thirteen studies examined effects of the use of an incentive on vaccination coverage, including two RCTs and one controlled before-after study; the remaining 10 studies were single-group. Lytras et al. (2016)'s meta-analysis found the interventions including incentives to be ineffective, although with a non-significant trend towards increased vaccination (relative risk 0.89 (95% CI 0.77 to 1.03)). In almost all of these studies (11 studies), the incentives were considered as part of a multifaceted intervention. They were most often (9 studies) used in conjunction with increased access, but also examined as part of an intervention to promote awareness in six studies.

The types of incentives evaluated included individual-level incentives, such as raffle tickets and vouchers, and group-level incentives, including rewards for meeting certain targets. Twelve studies evaluated incentives at an individual level. Of these, four entered participants into lotteries or prize draws (Doratotaj et al. 2008, Llupià et al. 2010, Marwaha et al. 2016, Zimmerman et al. 2009) and eight offered small gifts, such as free food or drink, badges or t-shirts. (It should be noted that in four studies incentives were promotional in nature and might arguably have been appealing only to those who already had a positive opinion on vaccinations (Drees et al. 2015, Heinrich-Morrison et al. 2015, Ribner et al. 2008, Rothan-Tondeur et al. 2011).) Five studies focused on group-level incentives, in which all HCWs in a team or department received cash bonuses or other rewards if vaccine coverage met a certain percentage threshold (Ajenjo et al. 2010, Drees et al. 2015, Heinrich-Morrison et al. 2015, Podczervinski et al. 2015, Samms et al. 2004).

Incentive interventions aim to motivate HCWs to receive vaccination. They are usually used as part of a broader programme of vaccine promotion and very rarely appear to be used as a primary strategy. In some cases, incentives may also have a symbolic function, expressing recognition for HCWs' acceptance of vaccination. As noted, incentives, such as badges or t-shirts, may also serve to raise awareness of pro-vaccination messages. Group-level incentives may additionally aim to help HCWs promote vaccination among their colleagues, and to shift social norms at a department or unit level.

2.3.5. Soft mandate

This category includes programmes which state that all HCWs should receive vaccination, but do not enforce severe penalties. In practice, it referred mainly to declination form

programmes (DFPs), in which all HCWs were obliged to either receive vaccination or sign a declination statement. Nine studies examined these types of intervention, all were single-group. Lytras et al. (2016)'s meta-analysis found soft mandate interventions to be effective (relative risk 0.64 (95% CI 0.45 to 0.92)). Soft mandate interventions were most often used in conjunction with either increased access (3 studies) or increased awareness (3 studies).

Of the nine studies, most (seven) examined the use of declination form programmes (DFPs). Two studies (Iten et al. 2015a, Seale et al. 2011) stated that HCWs had to be vaccinated or wear a mask, along similar lines to the 'hard mandate' interventions described below, but did not state that this requirement was enforced stringently (one of these also implemented a DFP). One study (Seale et al. 2011) stated that vaccination was recommended but not mandatory. All of the studies that clearly described the intervention, involved DFPs, so these are the focus of the analysis (N=7 studies).

In the DFPs, the form itself generally involved the HCW signing a statement that they accepted the risks involved in declining vaccination and/or stating their reasons for declining. There is considerable variation in the stringency with which the DFP was actually enforced in the studies. Two explicitly stated that there were no penalties for non-participation (Ajenjo et al. 2010, Ribner et al. 2008). In four cases, the study report suggested that participation was mandatory, but did not clarify how and to what extent it was enforced, or whether data on compliance were retained (Guanche Garcell et al. 2015, Hood and Smith 2009, LaVela et al. 2015, Quan et al. 2012). Only one study clearly set out the process by which HCWs who had not accepted vaccination or filled out a form were made to comply with the policy: they received three written reminders, and finally, if they still did not comply, an interview with the hospital vice-president where they were required to either fill out the form or accept vaccination (Honda et al. 2013). This study also stated that HCWs who stated they had received vaccination elsewhere were required to submit written proof; no other study clearly reported this, suggesting that self-report of having already received vaccination might have been accepted.

Most studies combined a DFP with other strategies, as noted above, and authors generally conceptualised the programme as only one part of the overall intervention, rather than the primary strategy. One study described declination forms as a "*last resort*" to be used only where HCWs remained unconvinced by a prior awareness-raising programme (Hood and Smith 2009), and this framing of the DFP was implicit in other studies. This seems consistent with the generally relaxed attitude to the enforcement of DFPs. The study which most clearly described universal enforcement of the DFP (Honda et al. 2013) is one of only two in which the authors' description of the intervention strongly emphasised the DFP as primary (Honda et al. 2013, LaVela et al. 2015). This category might usefully be split into two. In one type of intervention, which comprises the majority of the studies in this section, the aim is primarily to reinforce awareness-raising strategies, to create an opportunity for education with HCWs who may be resistant to purely voluntary approaches, and to encourage HCWs to think about the implications of their choice to decline vaccination. In these cases, the perception that the programme is universally applicable is perhaps more important than whether non-adherent HCWs are actually chased up or not. In other cases, the DFP is the primary intervention, and is intended less to promote awareness than to change the cost-benefit profile of the decision by making

declination more difficult and complicated than acceptance. In these cases, the intervention relies more heavily on adherence with the DFP being enforced. As described below, some of the interventions categorised as hard mandates overlap with this second type of DFP.

2.3.6. Hard mandate

This category includes strongly enforced mandatory policies, which either require vaccination as a condition for employment and/or impose onerous requirements on HCWs who remain unvaccinated, such as having to wear a mask when in contact with patients. There were 10 studies in this category, all single-group. Lytras et al. (2016)'s meta-analysis found hard mandate interventions to be effective (relative risk 0.18 (95% CI 0.08 to 0.45)).

The mechanisms of enforcement in the hard mandate programmes varied slightly: formal warnings (Awali et al. 2014, Podczervinski et al. 2015, Smith and Van Cleave 2012); disciplinary procedures, such as performance evaluation and amendments to employee records (Drees et al. 2015, Frenzel et al. 2016, Ksienski 2014, Leibu and Maslow 2015, Podczervinski et al. 2015), meaning in one case that noncompliant HCWs were ineligible for raises or other financial incentives (Drees et al. 2015); suspension (Awali et al. 2014, Babcock et al. 2010, Podczervinski et al. 2015); and ultimately termination of employment (Awali et al. 2014, Babcock et al. 2010, Frenzel et al. 2016, Ksienski 2014, Podczervinski et al. 2015, Smith and Van Cleave 2012). Two studies did not mention any specific mechanisms of enforcement (Rakita et al. 2010, Stuart et al. 2014). Three studies stated unambiguously that continued non-compliance would result in termination of employment (Awali et al. 2014, Babcock et al. 2010, Ksienski 2014), and one that this was not the case (Drees et al. 2015); other studies suggested that it was a possible consequence but not that it would automatically occur. However, in one of these cases, the implementation of the punitive component of the policy was suspended by the Minister for Health shortly before it was due to come into effect, and was not actually applied in the study period (Ksienski 2014).

It was unclear, in some studies, who had ultimate responsibility for ensuring compliance. Three studies mentioned centralised collection of data on compliance, which were communicated to managers or supervisors (Babcock et al. 2010, Frenzel et al. 2016, Podczervinski et al. 2015); this was usually undertaken by employee health or infection control departments, but it was often unclear how the validity of the data was ensured. Two studies reported that compliance was the responsibility of unit supervisors or managers (Frenzel et al. 2016, Smith and Van Cleave 2012), and one that HCWs who witnessed violations of the policy were required to report them (Ksienski 2014).

Eight studies reported allowing exemptions on the grounds of documented medical contraindication or personal or religious belief (Awali et al. 2014, Babcock et al. 2010, Drees et al. 2015, Frenzel et al. 2016, Leibu and Maslow 2015, Podczervinski et al. 2015, Rakita et al. 2010, Smith and Van Cleave 2012). Five of these described the process for deciding whether to approve applications for exemption (Awali et al. 2014, Babcock et al. 2010, Leibu and Maslow 2015, Rakita et al. 2010, Smith and Van Cleave 2012): applications were reviewed by a special committee or by occupational health or human resources departments. In addition to medical or religious exemptions, two studies reported

allowing declination for other reasons – in other words, they functioned as DFPs with strong enforcement (Drees et al. 2015, Podczervinski et al. 2015). In one of these cases, HCWs who declined had to undergo a mandatory education module and one-to-one counselling session, taking over an hour, which was intended to function as a disincentive (Podczervinski et al. 2015). Four studies reported that HCWs were considered compliant if they had received vaccination elsewhere (Drees et al. 2015, Frenzel et al. 2016, Ksienski 2014, Smith and Van Cleave 2012), of which two reported requiring written proof (Frenzel et al. 2016, Smith and Van Cleave 2012) and one explicitly stated that proof was not required (Drees et al. 2015).

Eight studies reported that the policy required unvaccinated HCWs to wear masks whenever they were in contact with patients (Awali et al. 2014, Drees et al. 2015, Frenzel et al. 2016, Ksienski 2014, Leibu and Maslow 2015, Rakita et al. 2010, Smith and Van Cleave 2012, Stuart et al. 2014) and/or to be reassigned to low-risk units (Awali et al. 2014). In the other two studies (Babcock et al. 2010, Podczervinski et al. 2015), it appears that HCWs with an approved exemption could continue to work as normal. One reported that unvaccinated HCWs were encouraged, but not required, to wear masks (Babcock et al. 2010). The other stated that decliners were not required to wear a mask as this would have conflicted with an existing policy that disallowed masks to prevent employees from coming to work when sick, and could have had adverse effects on clinician-patient interactions (Podczervinski et al. 2015). In no case did compliance with the policy absolutely require receiving vaccination, at least if an approved reason for exemption could be provided, but most studies required HCWs to either be vaccinated or wear a mask.

Few studies of hard mandates reported other components, even in terms of raising awareness of the policy itself. Only three studies reported substantial communication with employees in advance of the programme deadline, using for example letters, emails and meetings (Babcock et al. 2010, Rakita et al. 2010, Smith and Van Cleave 2012); the content of the communication mostly focused on the content of the policy, but in some cases included broader educational messages (Rakita et al. 2010). In one study, the mandate intervention formed part of a broader programme focusing on increasing access using on-site clinics and mobile vaccination teams, and which also included a group-level incentive (Drees et al. 2015), but this was unusual. (Some studies involved separate non-mandatory programmes, with components such as awareness-raising and incentives, at different time points from the mandate intervention; these are distinct interventions and have been included under the relevant headings above, where relevant outcome data are reported, and are not included in this discussion.)

In most cases, hard mandates were conceived as a stand-alone intervention, and unlike most of the soft mandates, not designed to work with other interventions. This suggests that hard mandates form a class apart from the other categories considered above, and supplant voluntary policies focusing on education, access or incentives, rather than supplementing them. In some cases, they seem to have been implemented after voluntary programmes had already been tried and achieved limited gains in uptake. The hard mandate programmes were fairly consistent in their aims and mechanisms, although there were some variations. The treatment of exemptions and externally received vaccinations varied between the different interventions, and there may be some overlap between the

more latitudinarian hard mandates and the more stringent soft mandates. Most studies did report allowing medical or religious exemptions, but in most cases, these required review before they could be approved. HCWs with valid exemptions were generally still required to wear a mask in the presence of patients.

2.3.7. UK studies

Three studies were conducted in the UK. Dey et al. (2001) conducted a RCT in primary healthcare teams and nursing homes, in Bury and Rochdale Health Authority. The intervention, which started in 1999, involved a public health nurse visiting intervention sites and delivering an educational intervention on the benefits of vaccination. Hayward et al. conducted a RCT in private care homes (location not reported). The intervention, which was delivered over the 2003-4 and 2004-5 seasons, involved an occupational health service delivering vaccination on-site, and nurses acting as 'advocates' for vaccination. Smedley et al. (2002) conducted a single-group study in Southampton University Hospitals Trust. The intervention, which was conducted in winter 1999, included awareness-raising components, such as leaflets, staff briefings and an article in the staff newsletter, and involved delivering vaccination in occupational health clinics and on wards, with an out-of-hours service available.

Although there are not many UK studies, they were relatively robust, with two RCTs, and they represent a range of interventions and settings. The interventions mainly focused on education or raising awareness, with one (Smedley et al. 2002) also including increased access. The UK data are all at least 10 years old, with the most recent study published in 2006.

2.4. Data on implementation and context

As described above, we extracted information from the papers on the implementation and context of the intervention. This information came mainly from the discussion section of each paper and thus mainly represents the study authors' views and interpretations of their own findings. The analysis here is intended to provide further information which may be relevant to the implementation of the interventions or to the interpretation of the effectiveness findings. It does not as such constitute empirical data, and should be regarded as illustrative only.

Four main categories emerged from the authors' interpretations of their findings as important considerations for future research:

- infrastructure and resources within the setting of implementation
- facilitators and barriers of vaccine acceptance at personal level, and acceptability of the intervention to the HCWs targeted
- the types of HCWs included, and any differences between groups of HCWs
- facilitators and barriers of vaccine acceptance at organisational level

This section presents a summary of the findings under these headings; further quotes and illustrative detail are presented in Appendix F.

2.4.1. Infrastructure and resources

Overall, 17 studies highlighted the importance of having an appropriate infrastructure or resources to adequately increase vaccine coverage. This includes the financial resources,

staff time or other resources to deliver the programme; the logistics of setting up and maintaining programmes; the systems in place to support delivery or monitoring; and the integration of vaccine programmes or policies within the existing structure of healthcare organisations.

The first subsection considers issues which are relevant to all intervention types, followed by issues relating to specific intervention types or components.

2.4.1.1. Issues across intervention types

The main issue which emerges is the importance of tracking and monitoring data on vaccination to assess the impact of the programmes. Seven studies identified this as an important facilitator of intervention success and/or as a potential source of challenges (Guanche Garcell et al. 2015, Honda et al. 2013, Kuntz et al. 2008, Marwaha et al. 2016, Porras-Povedano et al. 2015, Quan et al. 2012, Rakita et al. 2010).

One study of an access and awareness intervention found that the vaccination status of over 40% of HCWs remained unknown at the end of the programme (Goodliffe et al. 2015). A particular challenge was that existing data systems may not accurately or comprehensively identify all HCWs within an institution, in which case substantial manual data management may be required to make up the deficiencies of the system (Kuntz et al. 2008, Marwaha et al. 2016). Tracking vaccination data may be particularly important for mandatory interventions.

Another general point is the 'synergy' between different components or modalities within multi-component interventions, such that the impact of the programme as a whole is, hopefully, more than the sum of the parts. More generally, the use of multiple components which address different determinants or populations may contribute to the effectiveness of multi-component interventions overall. This was mentioned explicitly as a facilitator of intervention success in six studies (Abramson et al. 2010, Chamoux et al. 2006, Drees et al. 2015, Honda et al. 2013, Heinrich-Morrison et al. 2015, Llupià et al. 2010), and seems implicit in many of the other multi-component interventions. In two cases (Drees et al. 2015, Heinrich-Morrison et al. 2015), this was based on theory (see p.27 below), while in other cases, it represented a more pragmatic approach to the combination of different components.

2.4.1.2. Increased access

Within interventions which aimed to increase access, infrastructure emerged as a consideration for studies, primarily for interventions involving the delivery of vaccination for large numbers of HCWs simultaneously at large-scale events ('vaccine days'). Studies varied in their estimation of how demanding these interventions were in terms of resource, with two suggesting they were relatively straightforward and not expensive (Heinrich-Morrison et al. 2015, Kimura et al. 2007), and one reporting that "*extensive resources*" were required (Kuntz et al. 2008).

In addition, two further studies of interventions including mobile carts, along with other components, suggested that substantial resources were required (Marwaha et al. 2016, Sartor et al. 2004).

Access was identified as an important driver of the success of multi-component interventions in two studies. One study suggested that increasing awareness was a less important part of multi-component interventions than increasing access (Kimura et al. 2007). Another study reported that convenience and short waiting times were key to increasing vaccination (Quan et al. 2012).

2.4.1.3. Incentives, increased awareness and education

A small proportion (9 out of 41) of studies of interventions including incentives, awareness or education highlighted infrastructural issues which often related to other components of the intervention.

In one study, where an educational guide was distributed to the sites involved, the authors mentioned the need to improve departmental and interdepartmental cooperation for effective programme delivery (Chambers et al. 2015). One study, which included a raffle as an incentive, mentioned that the difficulty of the entry process may have been a barrier to participating in the raffle (Doratotaj et al. 2008).

One study mentioned the importance of consistency in messaging (Babcock et al. 2010). However, two studies suggested that the specific content of educational material may make little difference, and that the important factor was the commitment to raising awareness in itself (Abramson et al. 2010, Slaunwhite et al. 2009). On similar lines, one study identified the key driver of success as "*faster, more effective transmission of messages during the vaccination campaign*" (Llupià et al. 2010), and the collaborative involvement of HCWs in delivering messages, rather than the specific content of the messages themselves.

2.4.1.4. Soft mandates

Several of the studies of soft mandate interventions commented on the infrastructure necessary to implement the intervention. Two of the studies mentioned a significant amount of staff time being needed to plan and implement the campaign (Honda et al. 2013, Quan et al. 2012). Honda et al. (2013) paid particular attention to this need. By contrast, one study suggested that the cost of the intervention in terms of staff time was relatively low: less than one person-week for the whole season (LaVela et al. 2015).

Tracking vaccination coverage was found to be particularly important for the soft mandate studies, since accurate information on which HCWs had received vaccination was required to identify non-compliers. Three studies indicated the importance, and difficulty, of maintaining an appropriate tracking procedure (Honda et al. 2013, Quan et al. 2012, LaVela et al. 2015).

One study recommended integrating the new programme into existing programmes to minimise the logistical support needed (LaVela et al. 2015).

2.4.1.5. Hard mandates

Infrastructure was highlighted as being important in studies of hard mandates (Babcock et al. 2010, Leibu and Maslow 2015, Rakita et al. 2010). Two themes in particular emerged for the hard mandates, in addition to those already mentioned in the other intervention categories. Firstly, that the interventions were costly both in terms of money and staff time. This seemed to be a particular issue for validating exemption requests and dealing

with those that were considered invalid (Babcock et al. 2010, Leibu and Maslow 2015, Rakita et al. 2010). In some cases, hard mandate programmes also faced resistance or legal challenges from unions (see p.24 below).

2.4.2. Facilitators and barriers to vaccine acceptance: personal

A number of potential barriers and facilitators (personal and organisational) of vaccination acceptance were discussed in the studies. Twenty-six studies reported on the attitudes, beliefs or knowledge of the participating HCWs, and how they might have influenced study findings, alongside implications for future research.

2.4.2.1. All interventions: Facilitators

One study found that vaccination was more likely to be accepted if participants had accepted a vaccination in a previous year (Abramson et al. 2010). Convenience was a facilitating factor in several studies, particularly for physicians and for interventions which included a mobile cart or other on-site vaccination team (Drees et al. 2015, Lee and Fong 2007, Lopes et al. 2008, Sartor et al. 2004, Quan et al. 2012, Zimmerman et al. 2009).

Positive beliefs and attitudes to the vaccine were also reported by authors as being important factors for getting vaccinated. One study (Leitmeyer et al. 2006) reported that both a belief in the effectiveness of the vaccine and in the risk of influenza needed to be present for HCWs to accept vaccination.

2.4.2.2. All interventions: Barriers

Barriers to receiving a vaccination, at the personal belief level, included:

- medical or religious reasons (including egg allergies);
- anxiety about needles or side-effects;
- belief in their own resistance to influenza or in alternative medicine such as homeopathy;
- time constraints and inconvenience; and
- belief in the ineffectiveness of the vaccine or that influenza is a mild condition.

The relative importance of these factors appeared to vary between studies: for example one study found that the main barrier was fear of side-effects (Awali et al. 2014), and one that it was *"HCWs' confidence in their own host-defense mechanisms against influenza"* (Harbarth et al. 1998). However, study authors tended to emphasise the general importance of personal beliefs as potential barriers, with 12 studies making recommendations regarding this. Some studies also reported that applications for exemptions for medical reasons reflected beliefs that the study authors considered to be incorrect, such as declining vaccination on the grounds of being pregnant (Babcock et al. 2010, Ribner et al. 2008).

One study mentioned that HCWs' reasons for declination mainly focused on self-protection and not on the protection of patients or colleagues (Leibu and Maslow 2015).

2.4.2.3. Soft mandates

Some facilitators and barriers were more specific to the studies which included mandates. In the context of declination form programmes (soft mandates), two studies noted that a declination form had the added benefit of allowing the campaign implementers to engage

directly with staff and pinpoint which staff had misguided beliefs, allowing them to be more efficiently targeted (Ribner et al. 2008, LaVela et al. 2015).

Two studies reported that soft mandate programmes were generally acceptable to HCWs (Honda et al. 2013, LaVela et al. 2015), although limited supporting information was presented; one attributed the success of a declination form programme to its being "*culturally … acceptable*", but again did not expand on this idea (Honda et al. 2013). (The limited information on HCWs' reception of these programmes contrasts with the strong emphasis, in five studies, on management support: see p.23 below.) One study reported that the declination form programme was seen as coercive by some HCWs (Ribner et al. 2008).

2.4.2.4. Hard mandates

Few hard mandate studies addressed HCWs' perceptions in any depth. One noted that there was a number of staff who did not object to the vaccine itself, but did object to it being part of a mandatory policy (Babcock et al. 2010). One study reported that relatively few employees had actually left as a result of the policy (Rakita et al. 2010). Two studies mentioned the importance of education or communication with HCWs about the mandate policy and its implications (Frenzel et al. 2016, Rakita et al. 2010). Finally, one study reported that the adoption of a mandate policy "*brought a great deal of public attention to the issue of nosocomial influenza*", suggesting potential benefits to such policies beyond the impact on HCWs' behaviour (Ksienski 2014). As described below, one mandatory programme faced legal challenges from unions (Ksienski 2014).

2.4.3. Types of HCW

Fourteen studies reported differences between types of HCWs, in their attitudes towards flu vaccinations and their response to the intervention. This suggests that different categories of HCWs may have different reasons for refusal of vaccines. In general, physicians seemed to be more concerned with practical barriers (such as time and convenience for established physicians and cost for medical students), but had fewer misconceptions about vaccines and influenza (Honda et al. 2013, Leitmeyer et al. 2006, Ohrt and McKinney 1992). In contrast, nursing staff were most often reported as being sceptical of vaccination and concerned about coercive interventions (Leitmeyer et al. 2006, Ribner et al. 2008, Tapiainen et al. 2005).

The authors of several studies recommended targeting different occupational groups with different strategies (de Juanes et al. 2007, Rothan-Tondeur et al. 2011, Sartor et al. 2004, Smedley et al. 2002, Zimmerman et al. 2009). The authors in one study reported that doctors may be less receptive to educational messages coming from other groups, and recommended that using doctors in campaigns would help to get round this (Smedley et al. 2002).

However, in relatively few cases were differences between groups of HCWs discussed with respect to design or implementation of the intervention being evaluated. In one case, an awareness campaign using email found that support staff, unlike physicians and administrative staff, did not have their own email accounts, which limited the reach of the intervention (Llupià et al. 2010). One study reported challenges in accessing volunteers (Marwaha et al. 2016). One study reported that implementers had discussed

the scope of the intervention (a hard mandate) and decided to include all HCWs, not only those with direct patient contact (Rakita et al. 2010).

2.4.4. Facilitators and barriers to vaccine acceptance: organisational

2.4.4.1. Leadership

The authors in 14 studies indicated that leadership, particularly senior leadership (institutional and managerial), was an important consideration when conducting their interventions. In particular, strong leadership appeared to be important for hard mandates (Smith and Van Cleave 2012).

Despite the emphasis given to leadership, few studies indicated what they believed this entailed or why it was important. Of the studies which did explore this aspect, a number of different themes emerged. One study suggested it was a result of cooperative working and due to the supportive, involved approach of the management (LaVela et al. 2015). Another study indicated that the effective leadership was less down to social pressure but more due to the management's emphasis on the importance of vaccination coverage (Honda et al. 2013). Two studies reported that role modelling by leaders appeared to be effective in motivating staff: they believed that the effectiveness of leadership was in providing an example to other staff by receiving the vaccination themselves publicly (Hood and Smith 2009, Sartor et al. 2004). For studies involving hard mandates, resistance from staff pressure and strong endorsement of the programme were the key leadership qualities that were emphasised (Rakita et al. 2010).

While what exactly constituted supportive leadership was not always consistent across studies, how to enlist this support was uniform. The authors indicated that support was two-way and that to enlist support from people in leadership positions, they needed to be engaged and kept informed from the beginning (Frenzel et al. 2016, Kuntz et al. 2008).

Despite the emphasis on the benefits of leadership support, it should be noted that one study indicated that a lack of managerial involvement may actually have proven beneficial. This study made use of champions and the authors felt that management *not* being involved might have made staff more responsive (Abramson et al. 2010).

2.4.4.2. Peer influence and group effects

Eight studies indicated peer influence as an important facilitator to vaccination acceptance. The type of peer influence ranged depending on the techniques used. In several studies, the authors reported that peer vaccinators were a successful strategy (Kuntz et al. 2008, Lee and Fong 2007, Samms et al. 2004). The benefits of peers were also believed to extend to the transmission of information. Many authors attributed their positive results to involving the HCWs in the distribution of information and promoting the vaccination amongst their peers (Llupià et al. 2010, Slaunwhite et al. 2009).

One study made use of champions to promote the campaign and distribute vaccines (Slaunwhite et al. 2009). Champions took part in a short training course before starting the campaign and the evaluation found increased vaccination coverage after the intervention. However, many of the champions did not attend the training but still promoted the campaign effectively.

Another aspect of peer-group interaction which may facilitate acceptance of the programmes was approval obtained through being shown to be part of an important group. A number of studies used interventions that highlighted staff members and departments for being vaccinated or having good coverage. One in particular used a web page with photographs of staff who had been vaccinated and the authors attributed this as contributing to increasing the vaccination rate (Llupià et al. 2010).

In another study, success of the programme was attributed to social approval. Wristbands and special posters were given to departments with good coverage, with the aim of helping vaccinated HCWs feel part of a group and to be proud of that group membership (Rothan-Tondeur et al. 2011).

2.4.4.3. Staff turnover

A further perceived barrier to implementation and coverage was high levels of staff turnover. Although this was only identified in two studies, it is likely that this was a factor in many more. One study indicated that the turnover of programme managers and implementers made it difficult to collect data and implement the interventions (Chambers et al. 2015), while the second study indicated that staff turnover was a barrier to vaccination coverage itself (Nace et al. 2011).

2.4.4.4. Organisational culture

Five studies identified organisational culture as potentially acting as a barrier or facilitator to implementing a vaccination programme. It was most often reported as a barrier in programmes with a mandatory element where it could conflict with the organisation's underlying ethical stance or existing policies (Drees et al. 2015, Honda et al. 2013). However, one study reported that an incentive approach was against organisational culture, indicating that cultural barriers to implementation are not confined to a mandatory approach (Hood and Smith 2009).

Organisational culture could also act as a facilitator to implementation. One study used a promotional and incentive-based approach and indicated that the residing organisational culture of patient safety could have benefited the programme (Llupià et al. 2010).

Similarly, two other studies were positive about the mediating effect of organisational culture (Chambers et al. 2015, Rakita et al. 2010). While they acknowledged the potential for culture and politics within an organisation to be a barrier, they recommended that implementers make vaccination part of the organisation's culture. In this way, a potential negative can become a facilitator and help to sustain the intervention over time.

2.4.4.5. Hard mandates

Organisational facilitators and barriers specific to hard mandates were the involvement of unions and legislation. One study stated significant resistance from unions to their policies and resulting litigation on behalf of staff members (Ksienski 2014). In this case, the resulting litigation overthrew the policy which meant the intervention needed to be altered. Another study highlighted that not only could litigation result in difficulty in implementing the policy, it may also result in increased cost and this should be considered before implementing the policy (Rakita et al. 2010).

The necessity for communicating early with unions was a common theme amongst these studies. It is apparent that for the studies implementing hard mandates that the authors considered early engagement of unions and legal advice not only a facilitator, but also vital for successful implementation (Rakita et al. 2010, Smith and Van Cleave 2012).

2.5. Discussion

In this section, we briefly discuss broader issues with the intervention data and make suggestions as to their interpretation.

2.5.1. Limitations of the approach to synthesis

Our synthesis was based on an existing systematic review (Lytras et al. 2016), which we updated using similar methods. While the review was generally methodologically sound, it did have some limitations. The searches used were not maximally sensitive, and it is likely that a search using more sensitive terms and syntax, and a wider range of sources, would locate additional studies. Also, as discussed below (p.27), the meta-analysis combined studies with different designs, including uncontrolled studies, which has limitations.

We adopted the same framework as Lytras et al. (2016) to categorise interventions and also to discuss and interpret the data. The framework itself, although similar to those used in other reviews and overviews in this field, has some limitations. Many of the categories subsume quite heterogeneous interventions, and some approaches (e.g., vaccination champions) lost specificity in the analysis. Also, most interventions used a range of different components, so there was considerable overlap in practice. In our analysis, we have attempted to bring out the features that are relevant to specific components, but are aware of the limitations.

The framework itself appears pragmatic, largely atheoretical and possibly designed *post hoc*. While this approach is a potentially useful way to describe the evidence base, it has limitations when it comes to informing the design or implementation of new interventions. In the final chapter (pp.61-65), we make some suggestions for how a more theoretically informed approach, drawing on the work of Susan Michie and colleagues (Michie et al. 2014) could help to conceptualise future intervention research in this area.

Much of the synthesis reported here draws on information about implementation and context which mainly consists of the study authors' views and interpretations, rather than empirical data. Such information is open to bias and should be considered to be indicative only, and interpreted with caution. As discussed below (pp.53-54), there are some divergences between the information from the intervention studies and the qualitative data, which suggest that the former provides only a partial picture of issues regarding implementation. Study authors' opinions provide useful information on their own understanding of their findings, but should not be conflated with research evidence.

2.5.2. Generalisability

As noted above, only 3 of 60 intervention studies were conducted in the UK, with a majority (N=31) coming from the USA. This raises questions as to how generalisable the findings may be to the UK context. The USA, in particular, represents a more privatised and decentralised policy system, where healthcare organisations' policy choices are only restricted by legal or regulatory constraints and by market conditions. More generally,

there may be differences between national (or even state- or province-level) settings regarding, for example:

- the contractual status of different groups of HCWs
- employment legislation
- legislation regarding liability for patient safety
- the role of trade unions and professional bodies
- social norms and expectations regarding HCWs' behaviour
- social norms regarding employer-employee relations in general, and the acceptable limits of employer behaviour

Differences at more local scale (e.g., between hospitals, or even departments) should also be taken into account. In some cases, different settings appear to vary widely in their baseline rates of vaccination, and possibly also in HCWs' perceptions of vaccination. The context and history of relationships within institutions should also be taken into account (this, and the other factors mentioned here, is discussed further in the qualitative review).

Barriers to generalisability may vary depending on the intervention. In the case of interventions which focus on individual HCWs' behaviour, such as increasing access or increasing awareness, there are probably fewer challenges in generalising across national contexts. It is harder to generalise the data on interventions operating at a policy level. In this context, this is mainly an issue for the mandatory interventions. All the stringently enforced hard mandates, but one (Ksienski 2014), and most of the soft mandates, were implemented in the USA. This is in line with the policy discourse around vaccination, which has prioritised mandatory solutions in the USA to a much greater extent than in other countries. It seems likely that the barriers to implementation of such interventions in the UK in terms of acceptability, political feasibility or legality would be considerably higher than those found in most US contexts.

All these issues mean that in this field, the impact of interventions is likely to depend on contextual factors to a very considerable extent. Results from the intervention literature cannot be taken to apply to a given context of practice in a straightforward way.

2.5.3. Limitations of the primary studies

2.5.3.1. Validity of outcome measures

A concern which is briefly mentioned by Lytras et al. (2016) is that of the reliability of tracking vaccination coverage. In the combined sample of 60 studies, most of the studies measured coverage by directly tracking vaccinations carried out within the system (where vaccination was offered in-house or by a pre-specified external supplier). In other cases, vaccination status was measured by self-report (14 studies). Only seven studies attempted other methods of data collection by either requiring documented proof of vaccination or using GP claim forms. Five studies did not provide enough information about their outcome measures to determine how the data were collected.

In total, 45 studies appear to have used direct recording to track vaccination coverage. Of these, eleven supplemented these data with other methods, five using self-report methods and six requiring proof of vaccination. This meant that over half of the studies (34 studies)

used direct recording alone. The most obvious implication of data collected through direct recording is that they do not accurately take into account employees receiving vaccination elsewhere. This is particularly important for the 26 uncontrolled studies using this method alone, as the reported increases in uptake may reflect a shift from staff receiving vaccination elsewhere to receiving vaccination within the system. Also, for the uncontrolled studies, the reported increased uptake could be due to the increased attention and accuracy of recording vaccinations due to the interventions rather than an effect of the intervention *per se*.

The use of self-report measures is also a threat to the validity of the data. In total, 14 studies recorded participants who stated that they had received a vaccination outside of work as vaccinated, without requiring any documented proof. It is debatable how accurate these data are as participants may have lied for social desirability reasons or out of fear of possible consequences. This may be particularly true for hard mandate interventions.

2.5.3.2. Intervention study designs

As discussed above, the intervention studies used a range of designs, and the majority were uncontrolled pre-post studies. Such designs are open to bias and should not be taken as conclusive evidence of effectiveness. The findings of Lytras et al. (2016)'s meta-analysis should be interpreted with caution, as they combine pre-post comparisons from uncontrolled studies with intervention-control comparisons from controlled studies, and may therefore over-estimate the effectiveness of those interventions with fewer controlled studies (particularly the mandate interventions).

Most of these uncontrolled interventions were observational in design. That is, interventions were not implemented by researchers but were studied in naturalistic contexts. While it was not always clear, it appears that most of the intervention data (as regards vaccination uptake) were routinely collected and retrospectively analysed from time points before and after the intervention to provide indicative evidence of effectiveness. In some cases, these data covered a timespan of several years and included multiple different combinations of components at different time points, making interpretation challenging (e.g., Frenzel et al. 2016, Quan et al. 2012).

A further difficulty with retrospective, uncontrolled designs is that they are often not well-defined with respect to the content of the pre-post comparison. Interventions rarely take place in a vacuum. In virtually all the studies some form of vaccination programme was already underway at the first (baseline) time point, and the post-data measured the increase after this was either supplemented or replaced by some other programme. That is, the comparison is with some existing programme and not with a no-intervention control. Thus, the findings of Lytras et al. (2016)'s meta-analysis represent a range of diverse comparisons, and the impact of differing pre-test conditions cannot be determined.

2.5.3.3. Use of theory

As already noted, most interventions used a range of components. The choice of which components to include in an intervention, and what content to include in educational or awareness-raising programmes, appears to have largely been made in a pragmatic way. Only eight studies (including four RCTs) reported any use of theory to inform the

development of their interventions. These studies reported basing interventions on theories of:

- knowledge translation or intervention mapping (Chambers et al. 2015, Looijmans-van den Akker et al. 2010);
- social networks or diffusion of innovations (Drees et al. 2015, Llupià et al. 2010, Slaunwhite et al. 2009);
- marketing or social marketing (Drees et al. 2015, Heinrich-Morrison et al. 2015, Marwaha et al. 2016);
- behaviour change, including the transtheoretical model (Drees et al. 2015), behavioural economics (Drees et al. 2015), and 'nudging' (Lehmann et al. 2016); and
- 'human-centred design' (Marwaha et al. 2016).

However, in many cases the description of theory was brief and not clearly connected to the intervention content. Only in two cases did the study authors clearly set out how the theory influenced the combination of components for the intervention. Drees et al. (2015) described how their intervention combined components from all five domains of Schwartz and Cohen's framework for behaviour change: knowledge/attitudes, environment, peer pressure/feedback, regulation, and incentives. Heinrich-Morrison et al. (2015) described how their programme utilised the 'marketing mix' of price, promotion, placement and product.

The lack of theory in most of the evaluated interventions leads to challenges in interpreting the evidence, and applying it in practice. Even within the categories there is considerable variation in intervention content (as discussed above), and the multiple combinations of components and contextual factors adds further diversity to the evidence base. More adequate theoretical frameworks would help with interpretation and enable the evidence to inform the detailed design of future interventions. The development of such frameworks would also be valuable to inform the design of multi-component interventions, and their hypothesised mechanisms of change, as well as to encourage thinking about the underlying ethos of vaccination programmes. In the final section of the report (pp.61-65), we discuss Michie et al. (2014)'s Behaviour Change Wheel as a possible framework.

2.5.3.4. Use of formative research

A total of 13 studies reported some use of formative research or piloting which was designed to incorporate HCWs' views in the design of the intervention. Mostly this involved conducting closed-question surveys about the barriers and facilitators of vaccination uptake, and then using the results of these to inform education or awareness-raising programmes (Harbarth et al. 1998, Heinrich-Morrison et al. 2015, Hood and Smith 2009, Kimura et al. 2007, Leitmeyer et al. 2006, Looijmans-van den Akker et al. 2010, Rothan-Tondeur et al. 2011, Sadlier et al. 2015, Smedley et al. 2002, Tapiainen et al. 2005, Zimmerman et al. 2009). Two studies reported utilising qualitative data in the design of their intervention (Rakita et al. 2010, Rothan-Tondeur et al. 2011). One study reported piloting the intervention (Chambers et al. 2015), although there was limited detail on the process or results of the piloting; this intervention was also unusual in that it aimed to

improve practice at an organisational level, rather than to directly increase uptake among HCWs.

Thus, most studies did not involve HCWs in designing interventions, nor consult them as to their needs or priorities. Of those which did gather some information on the views of the targeted population, almost all used only closed-question surveys and focused on individual beliefs about vaccination. While such methods have some value, they rarely access broader perceptions on, for example, the organisational context of interventions, or the delivery of existing services. In addition, very few studies reported any piloting process, which would have allowed interventions to incorporate feedback on their implementation from participating HCWs. No intervention appears to have been explicitly informed by substantive engagement with HCWs.

The very limited consultation or engagement with HCWs in shaping the intervention is a major gap in the evidence. The predominantly 'top-down' ethos perhaps reflects the history of vaccination programmes in the general population, where resistance to vaccination has usually been dismissed as resulting from misinformation, irrationality or media sensationalism.

3. Review of qualitative studies

3.1.Methods

3.1.1. Searching

We searched MEDLINE, EMBASE and CINAHL in May-June 2016. The search strategy took the form:

(terms for HCWs) AND (terms for vaccination) AND (terms for influenza) AND (terms for views and qualitative research)

The full MEDLINE search strategy is presented in Appendix A. No date or language restrictions were applied to the search. We also screened the references from the effectiveness update search (described on p.3 above) and the studies from the Lytras et al. (2016) review of effectiveness for any qualitative data.

We searched Google using simplified forms of the search strategy and scanned the first 100 results. We also manually searched websites of key organisations including NHS Employers, CDC and WHO.

We scanned the lists of included studies of potentially relevant systematic reviews, identified by the search, and the reference lists of all included studies. We also carried out forward citation chasing on all included studies using Google Scholar (i.e. scanning titles and abstracts of studies which cited any included study).

3.1.2. Screening

An initial sample of 10% of abstracts was screened by two reviewers independently and differences resolved by discussion. Agreement on inclusion/exclusion for this sample was 99.4% (κ=0.66). The remaining 90% were screened by a single reviewer. The following criteria were applied:

1) Not primary data on views, attitudes or perceptions

Exclude any paper not presenting primary views data (retain systematic reviews including views data for reference scanning). Include any study design, including outcome evaluations and process evaluations of interventions, if some primary views data are reported. Exclude self-reports of vaccination uptake, adverse reactions to vaccination, or flu symptoms or absenteeism. Exclude cost-only studies. Exclude document analysis. Exclude purely descriptive studies or reports of authors' own views which do not also collect data from participants.

2) Not seasonal influenza vaccination

Include studies which consider seasonal influenza vaccination uptake as a topic of views data. Exclude all other outcomes/topics (including pandemic influenza vaccination).

3) Not vaccination of HCWs

Include views about vaccination for HCWs. Include studies of mixed populations which present separate data on HCW vaccinations. Exclude studies of HCWs' views about vaccinations for the general population. Exclude all other populations.

Include any type of HCW, including non-clinical staff and staff without direct patient contact.

4) Not qualitative data

Exclude survey data using closed questions only, data on quantitative determinants of vaccination, and any other quantitative data. Include any qualitative data including interviews, focus groups or ethnographic data.

5) Not English language

6) (full-text only) Not substantive qualitative data

Exclude studies which present only very brief and general summaries of qualitative findings, or which only report one or two relevant data points. Exclude studies which collect qualitative data but only report quantitative analyses.

All full-text studies were screened by two reviewers, independently, and differences resolved by discussion.

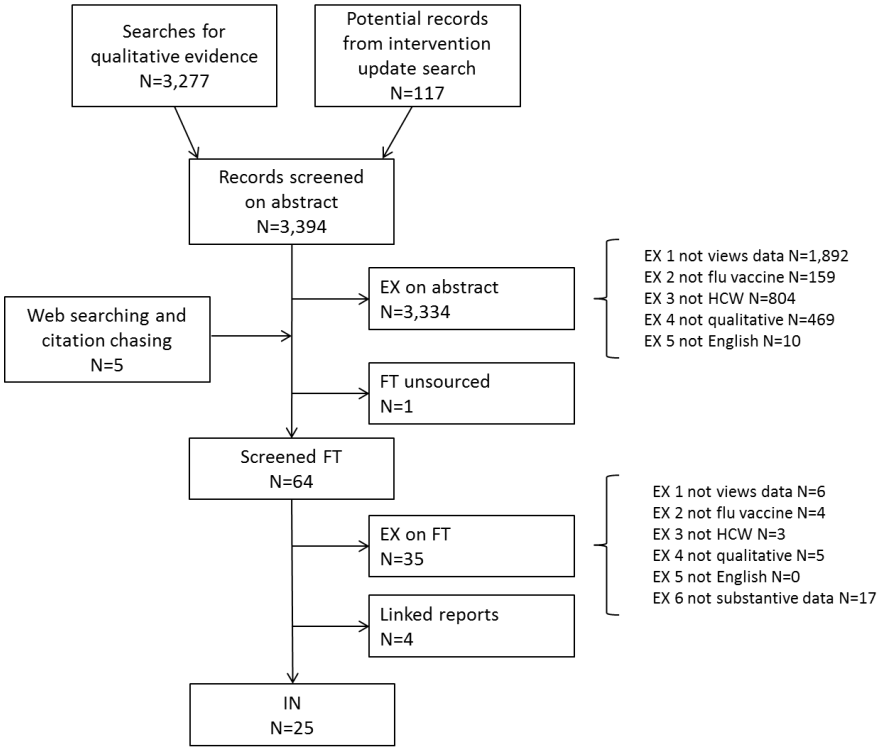
3.1.3. Quality assessment, data extraction and synthesis

Hawker et al. (2002)'s tool was used to assess study quality (see Appendix D). Quality assessment was carried out by one reviewer and checked in detail by a second reviewer. Data were extracted on the methodology and characteristics of the study, including: research question; sampling and recruitment; study population; data collection; and data analysis. In a second stage, qualitative data were coded from the findings of the studies, including quotes from participants and study authors' interpretations. Coding used a grounded, iterative approach, developing themes from the data and re-coding until thematic saturation was reached. Concepts and themes were 'translated' between studies in an iterative way, with an 'audit trail' between the themes and the text on which they were based being maintained through the use of software, and coding. The themes were then organised into an overall framework of categories. Data extraction, coding and synthesis were carried out by a single reviewer.

3.1.4. Flow of literature through the review

The flow of literature through the review is shown in Figure 2. The database searches returned 3,277 records, while 117 records were identified from the intervention search as being potentially relevant, and a further five identified through web searching and citation chasing. After screening, a total of 25 studies were included in the review, reported in 29 study reports.

Figure 2. Flow of literature through the review of qualitative evidence



3.2. Quality of the studies

The results of quality assessment are shown in Appendix E. The quality of the studies overall was mixed, with low scores particularly on the domains of sampling, ethics and bias, and transferability.

3.3. Characteristics of the studies

Table 9 provides an overview of the characteristics of the studies. Under 'population', studies described as including 'managers / implementers' (N=9) are those which only sought views from people delivering interventions, including infection control or occupational health staff, senior managers and administrators; some of these studies also included other stakeholders, such as representatives of professional bodies. The other studies (N=16), including those coded as 'various', asked HCWs about their own views.

Table 9. Characteristics of the qualitative studies

Identifier	Study aim	Population	Sample size	Country	Setting
Clarke (2007)	To explore the determinants of vaccine behaviour among healthcare workers, and their preferences regarding vaccine communication	Various	17	USA	Health department, private physician practices, Department of Human Services, university clinics, nursing

					home, schools, ambulance service
Hill et al. (2015, LaVela et al. (2015)	To explore the implementation of a declination form programme to increase influenza vaccination in HCWs	Managers / implementers	7	USA	Specialist unit (spinal cord injury centre)
Hwang and Lim (2014)	To understand the barriers and motivators towards influenza immunisation among primary care HCWs	Various	16	Singapore	Primary care
Isaacson et al. (2009)	To investigate the relationship between organizational culture and HCWs' influenza immunization behaviours	Various	32	USA	Primary care
Kalayil et al. (2015)	To evaluate a data collection initiative for standardising information on vaccination status of hospital personnel	Managers / implementers	59	USA	Hospital
Khodyakov et al. (2014)	To explore the implementation of the 2007 California regulations on influenza vaccination of hospital-based HCWs	Managers / implementers	26	USA	Hospital
Helms et al. (2011, Leask et al. (2010)	To explore the views of administrators and clinical leaders about (hypothetically) adding influenza to the mandatory vaccination policy for HCWs in New South Wales	Managers / implementers	58	Australia	Hospital
Lehmann et al. (2014)	To investigate HCWs' reasons for influenza vaccination or non-vaccination and views and experiences of vaccination, with a focus on social-cognitive determinants of behaviour	Various	123	Belgium, Germany, Nether-lands	Hospital
Lim and Seale (2014)	To explore the views of key stakeholders regarding influenza vaccination for HCWs	Managers / implementers	21	Australia	Hospital

Lindley et al. (2014)	To evaluate the implementation of a state-wide masking requirement policy for HCWs	Managers / implementers	18	USA	Hospital, nursing home, community health services, home care services
Manuel et al. (2002)	To investigate the health behaviour associated with influenza vaccination among HCWs	Various	16	Canada	Nursing home
Nowak et al. (2015)	To explore the public's and HCWs' knowledge, attitudes and beliefs relating to influenza vaccination	Various	215	USA	Unclear
Pianosi et al. (2013)	To understand the vaccination policies of institutions involved in training healthcare students, and the attitudes of key stakeholders towards a more co-ordinated system for vaccination of students	Managers / implementers	21	Canada	University
Pierrynowski Gallant (2007, Pierrynowski Gallant et al. (2009)	To understand how nurses decide whether or not to be vaccinated against influenza	Nurses	11	Canada	Long-term care, mental health, acute care, public health
Prematunge et al. (2014)	To investigate HCWs' motivators and barriers to pandemic and seasonal influenza vaccination	Various	3275	Canada	Hospital
Quach et al. (2013a, Quach et al. (2013b)	To explore programme managers' perceptions of strategies to improve influenza vaccination uptake among HCWs (main paper) and of processes to collect vaccination data (linked paper)	Managers / implementers	23	Canada	Acute care, continuing care, regional health authorities
Quinn (2014)	To understand nurses' views of influenza vaccination	Nurses	11	Ireland	Nursing home
Raftopoulos	To explore nurses' knowledge, attitudes and	Nurses	30	Greece	Hospital, public health

(2008)	beliefs regarding influenza vaccination				
Real et al. (2013)	To segment HCWs into groups relating to risk perception, safety beliefs and vaccination uptake	Various	29	USA	Hospital
Rhudy et al. (2010)	To understand factors influencing nurses' decisions about influenza vaccination	Nurses	14	USA	Hospital
Seale et al. (2012)	To understand current policy and practice on influenza vaccination for HCWs in Australian public hospitals	Managers / implementers	29	Australia	Hospital
Seale et al. (2016)	To explore HCWs' attitudes towards an online decision aid providing information about influenza vaccination	Various	41	Australia	Hospital
Seymour (2014)	To explore public health professionals' reasons for declining influenza vaccination	Various	10	USA	Public health
Willis and Wortley (2007)	To explore the attitudes and beliefs of vaccinated and unvaccinated nurses about influenza vaccination	Nurses	71	USA	Hospital
Yassi et al. (2010)	To explore HCWs' views on how to improve vaccine uptake	Various	83	Canada	Long-term care, acute care, community care

As can be seen from Table 9, most studies were carried out in the USA (N=11), followed by Canada (N=6) and Australia (N=4); three studies were conducted in European countries, including one in the Republic of Ireland. No studies were conducted in the UK. Seventeen studies included HCWs working in hospitals or acute care facilities, six in nursing homes or long-term care facilities, three in public health and two in primary care.

3.4. Barriers and facilitators

The thematic findings are presented below. They are organised in three sections: barriers to vaccination; facilitators of vaccination; and issues to do with specific interventions. As already noted, the studies include data from HCWs reporting data about their own views towards vaccination, and the views of managers or staff involved in delivering vaccination campaigns or programmes ('managers / implementers' in Table 9 above). The synthesis below includes both these groups of participants, and does not systematically distinguish between them, although they are separated where there appear to be substantive differences (particularly in the third section, which focuses on issues to do with interventions).

The barriers and facilitators data have been organised according to the categories in Table 10 below.

Table 10. Categories of barriers and facilitators themes

Barriers	Facilitators
Beliefs about the personal consequences of flu	
Perceived low risk of contracting influenza (n=14)	*Perceived high risk of contracting influenza (n=4)*
Lack of severe consequences (n=7)	*Self-protection (n=12)*
	Avoiding time off work (n=9)
Beliefs about risks to patients/others	
Low risk to patients (n=5)	*Protecting patients' health (n=14)*
	Protection of family members and others (n=9)
	Protection of population health (n=3)
Beliefs about flu vaccine	
Ineffectiveness of vaccine (n=14)	*Effectiveness of vaccine (n=5)*
Belief in other methods to prevent disease (n=11)	
Fear of side-effects (n=16)	
Fear of needles (n=6)	
Perceived contextual influences on decision-making	
Individual autonomy (n=9)	
Influence of peers (n=6)	*Influence of peers (n=9)*
Influence of management (n=3)	*Influence of management (n=6)*
Inconvenience (n=6)	*Setting an example (n=3)*
Lack of information (n=4)	
Unfairness and distrust within workplaces (n=3)	

Data relating to the interventions have been organised according to the same categories as in the review of intervention data (with education and raising awareness combined into a single theme), plus cross-cutting themes relating to: implementation of interventions generally; data collection and management; and differences between groups of HCWs. (In addition, several of the themes under 'barriers/facilitators' are relevant to the implementation of interventions, particularly those relating to 'influence of management' and 'unfairness and distrust'.)

3.4.1. Barriers: Personal consequences

3.4.1.1. Perceived low risk of contracting influenza (n=14)

Participants in 14 studies identified the perceived low risk of contracting influenza as a potential barrier to vaccination (Clarke 2007, Hwang and Lim 2014, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et

al. 2014, Quach et al. 2013b, Quinn 2014, Raftopoulos 2008, Rhudy et al. 2010, Seale et al. 2016, Seymour 2014, Willis and Wortley 2007). In most studies, this perception was not explored further, beyond participants simply stating that they were healthy or 'never get sick'.

> *I hardly ever fall ill, so I just never felt the need for [the vaccine].* (participant, Clarke 2007)

Participants in four studies reported the belief that they have a strong immune system due to working in healthcare and being exposed to infection on a daily basis (Nowak et al. 2015, Quinn 2014, Raftopoulos 2008, Willis and Wortley 2007).

> *Most nurses wouldn't take the flu vaccine because they feel they have an immunity built up themselves.* (participant, Quinn 2014)

Participants in seven studies reported a general perception that those at risk of influenza were older people or people with chronic illnesses, not healthy working-age adults (Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Quach et al. 2013b, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014). One study found low awareness that HCWs were a priority group (Nowak et al. 2015).

> *Health care professionals were often very knowledgeable about high-risk populations that should be vaccinated, but less likely to be aware or appreciate that they were among the high priority group.* (Nowak et al. 2015)

Data from two studies suggested that vaccination promotion campaigns may reinforce this perception by creating an image of at-risk groups which HCWs do not see as relevant to themselves (Quach et al. 2013b, Rhudy et al. 2010).

> *[W]hat people get from the advertisements is you really only need it if you're sick or in the nursing home or you have a lot of health issues.* (participant, Quach et al. 2013b)

Participants in two further studies suggested that vaccinating other high-risk groups, such as young children and older adults, should be a higher priority than vaccinating HCWs (Clarke, Hwang). In one study the authors expanded on this perception.

> *A small minority of interviewees commented that, in their view, it would be most prudent to immunize other at-risk groups (such as children or the elderly) before healthcare workers. […] In a more general sense, they framed vaccination not as a personal sacrifice to protect personal health, but a societal-level behavior in which responsibility did not lay squarely with one particular group of people (healthcare workers or otherwise).* (Clarke 2007)

Participants in three studies judged that they were at low risk due to the specific nature of their role, for example, working in a non-hospital setting or having limited patient contact (Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014).

3.4.1.2. Lack of severe consequences (n=7)

In seven studies, participants expressed a view that influenza was not a severe illness and was easily manageable for healthy adults (Clarke 2007, Hwang and Lim 2014, Nowak et al.

2015, Pierrynowski Gallant et al. 2009, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007).

> *I don't consider it a life-threatening situation.* (participant, Pierrynowski Gallant et al. 2009)

> *You know if I get the flu, what is the worst that can happen? I will be off work for a couple of weeks, is that really a big deal?* (participant, Rhudy et al. 2010)

In several cases, this was expressed as a view that participants could "*handle*" flu (participant, Nowak et al. 2015) or could still "*function*" (participant, Rhudy et al. 2010).

> *If your body is in good shape, you can heal yourself.* (participant, Nowak et al. 2015)

In two studies, participants contrasted influenza with diseases perceived to be more serious, such as hepatitis B, with the implication that vaccination for the latter was more important (Seymour 2014, Willis and Wortley 2007). Participants in two studies, talking of other people's views, suggested that influenza was often confused with the common cold (Hwang and Lim 2014, Pierrynowski Gallant et al. 2009).

3.4.2. Barriers: Beliefs about risks to patients/others

3.4.2.1. Low risk to patients (n=5)

Participants in five studies expressed the belief that they were unlikely to transmit influenza to patients (Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014). Some HCWs argued that the nature of their work meant that they did not come into contact with populations at a high risk of influenza (Pierrynowski Gallant et al. 2009, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014), for example, if they worked in mental health (Pierrynowski Gallant et al. 2009) or public health (Pierrynowski Gallant et al. 2009, Seymour 2014). Participants in two studies suggested that patients were more likely to catch influenza from other patients than from HCWs (Nowak et al. 2015, Pierrynowski Gallant et al. 2009).

3.4.3. Barriers: Beliefs about vaccine

3.4.3.1. Ineffectiveness of vaccine (n=15)

Participants in 15 studies reported the perception that the vaccine was ineffective in preventing disease (Hwang and Lim 2014, Leask et al. 2010, Lehmann et al. 2014, Lim and Seale 2014, Manuel et al. 2002, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014, Quach et al. 2013b, Raftopoulos 2008, Rhudy et al. 2010, Seale et al. 2016, Seymour 2014, Willis and Wortley 2007). Again, in many cases this belief was simply stated and not further explored. Participants in four studies observed that due to the mutation of the virus, and the possible mismatch of strains, the vaccine will not always be effective (Lehmann et al. 2014, Nowak et al. 2015, Rhudy et al. 2010, Willis and Wortley 2007); one study reported that this perception was more common among physicians than other HCWs (Nowak et al. 2015).

Few participants offered justifications for their scepticism about the effectiveness of the vaccine. Where they did, most referred to personal experience. Participants in three

studies reported personal experience of getting ill in years when they had been vaccinated (Hwang and Lim 2014, Lehmann et al. 2014, Pierrynowski Gallant et al. 2009). One study found that "*[t]here were participants who did not believe that influenza immunisation was effective as they could not perceive any significant physical change after having received the immunisation*" (Hwang and Lim 2014). Participants in one study reported that seeing vaccine failures in patients was a cause of scepticism about vaccine effectiveness (Manuel et al. 2002). Participants in one study cited information from the media (Pierrynowski Gallant et al. 2009).

However, participants in three studies mentioned the perception that the scientific evidence for the effectiveness of vaccination programmes was insufficient to convince HCWs to receive vaccination (Leask et al. 2010, Lim and Seale 2014, Quinn 2014). One study found that this was seen to be particularly the case for clinicians (Lim and Seale 2014). (See also the 'education / information' theme below.)

> *I don't think that in actual fact that there is sufficient evidence upon which to actually persuade the skeptics. I'm not saying the skeptics are those people that are anti-immunization; I think it's the skeptics that in actual fact are specifically the medical staff who are very analytical people, so therefore when you're actually trying to actually use evidence as a means of mechanism of influencing people, I think that sometimes the evidence is a little rubbery.* (participant, Lim and Seale 2014)

3.4.3.2. Fear of side-effects (n=16)

Participants in 16 studies mentioned fear of side-effects as a possible barrier to receiving vaccination (Clarke 2007, Hill et al. 2015, Hwang and Lim 2014, Isaacson et al. 2009, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quach et al. 2013b, Quinn 2014, Raftopoulos 2008, Rhudy et al. 2010, Seale et al. 2016, Seymour 2014, Willis and Wortley 2007). Again, in several cases this was stated only briefly and generically, and not further explored, or the possibility of adverse effects was simply stated: "*you don't know how you will react to the vaccination*" (participant, Lehmann et al. 2014).

In the studies that did explore participants' perceptions in more depth, several specific side-effects were mentioned. The most common was the belief that receiving the vaccine can cause influenza or influenza-like symptoms, which was mentioned in nine studies (Hwang and Lim 2014, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014, Seymour 2014, Willis and Wortley 2007). One of these studies found that *all* participants believed that influenza could be a side-effect of the vaccine (Quinn 2014). Participants also mentioned:

- Guillain-Barré syndrome (Clarke 2007, Quach et al. 2013b, Rhudy et al. 2010);
- harm to the foetus when pregnant women receive the vaccine (Hill et al. 2015, Quach et al. 2013b);
- discomfort and swelling at the injection site (Hwang and Lim 2014, Lehmann et al. 2014);
- oculo-respiratory syndrome (Pierrynowski Gallant et al. 2009);
- autism (Rhudy et al. 2010); and

- shingles (Rhudy et al. 2010).

Beliefs about the mechanisms causing side-effects were not explored extensively in the studies. Participants in three studies expressed a belief that some of the ingredients in the vaccine, such as preservatives, may be toxic (Prematunge et al. 2014, Quach et al. 2013b, Seymour 2014). In one study, participants believed that side-effects were caused by the vaccine containing live virus (Willis and Wortley 2007).

In most cases where the source of these perceptions was described, participants drew on their own personal experience of adverse effects (Hwang and Lim 2014, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007). In fewer cases, participants reported hearing about colleagues' experiences (Hwang and Lim 2014), observing those of patients (Quach et al. 2013b, Quinn 2014), or hearing reports of negative effects elsewhere (Seymour 2014). In one study, HCWs working in the accident and emergency department had treated patients with Guillain-Barré syndrome who had received the H1N1 vaccine, creating a fear of seasonal influenza vaccination (Quach et al. 2013b). There is some indication here of a gap between HCWs' own beliefs about side-effects, which were apparently mainly based on personal experience, and those of programme implementers, who tended to view 'hearsay' from colleagues, or negative media coverage, as more important determinants of HCWs' beliefs regarding side-effects: "*there's people that hear gossip that somebody got sick because they had the flu needle*" (participant, Quach et al. 2013b).

Some participants also expressed a broader set of beliefs to do with vaccines and immunity. Some saw vaccines as having potential adverse cumulative effects over the long term (Prematunge et al. 2014, Seymour 2014).

> *[Y]ou're getting extra drugs in your system, and I do think things add up. [...] I just prefer a society that doesn't think drugs, either to prevent or heal, before thinking of other ways.* (participant, Seymour 2014).

One participant in one study also expressed a preference for 'natural' immunity over that produced 'artificially' by vaccines (Seymour 2014). In other cases, participants expressed a desire to avoid over-medication or "*foreign substances*" (participant, Prematunge et al. 2014), where possible, and minimise the number of medical interventions they receive (Isaacson et al. 2009, Prematunge et al. 2014, Seymour 2014).

> *I just don't get the flu shot. I don't like medicine. If it's not broke, don't fix it. The flu vaccine, chemicals in my body, I don't want.* (participant, Isaacson et al. 2009)

Participants in two studies cited uncertainties about the scientific consensus on vaccine safety (Pierrynowski Gallant et al. 2009, Prematunge et al. 2014).

> *I know presently the literature indicates that there are no ill effects. But in so many instances with more research … I mean, they may be saying something different in a couple of years' time.* (participant, Pierrynowski Gallant et al. 2009)

The anticipated severity of side-effects varied, from relatively mild influenza-like symptoms to serious or even fatal illnesses. The latter were not cited very often in the data. However, even relatively less serious side-effects were sometimes perceived to have negative consequences, for example, if they led to time off work.

> *I'm not going to get a vaccine shot if it is going to take me out of my job, especially, where I'm at now, being sick can drastically affect my coworkers.* (participant, Rhudy et al. 2010)

Also, the experience of side-effects was cited as a barrier to vaccination even when participants were not confident that they were actually causally linked to receiving the vaccine.

> *My arm gets a little bit sore, but that, but I did, the very first time I got it, and it may have just been totally coincidence, and that really did put me off … It made me really consider it again.* (participant, Pierrynowski Gallant et al. 2009)

3.4.3.3. Belief in other methods to prevent disease (n=11)

Participants in nine studies expressed the belief that other methods were more effective than vaccination in preventing influenza (Clarke 2007, Hwang and Lim 2014, Lehmann et al. 2014, Manuel et al. 2002, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Quinn 2014, Raftopoulos 2008, Seymour 2014). These included medication (Raftopoulos 2008); infection control measures, such as masking and handwashing (Raftopoulos 2008, Seymour 2014); general health-promoting measures, such as diet and exercise (Clarke 2007, Seymour 2014, Manuel et al. 2002, Raftopoulos 2008); and natural remedies and alternative medicine (Hwang and Lim 2014, Pierrynowski Gallant et al. 2009, Quinn 2014, Raftopoulos 2008, Seymour 2014).

In five studies, participants suggested that vaccination was unnecessary to prevent transmission of influenza to patients if other infection control procedures were adequately followed (Lehmann et al. 2014, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007). Participants mentioned handwashing, use of gloves or masks, and not working when they had influenza symptoms.

3.4.3.4. Fear of needles (n=6)

Participants in six studies mentioned a dislike of injections as a possible barrier to receiving vaccination (Clarke 2007, Hill et al. 2015, Hwang and Lim 2014, Lehmann et al. 2014, Pierrynowski Gallant et al. 2009, Seymour 2014). In most cases, this was reported only tangentially and did not appear to be a major barrier, although one study reported that "*the biggest obstacle cited against vaccination was the underlying fear of experiencing pain or discomfort at the injection site in the immediate post-vaccination period*" (Hwang and Lim 2014).

3.4.4. Barriers: Perceived contextual influences on decision-making

3.4.4.1. Individual autonomy (n=9)

Participants in nine studies expressed a view that the decision to receive vaccination should be up to the individual, or that there was an ethical imperative to respect individuals' decisions to refuse vaccination (Lehmann et al. 2014, Pianosi et al. 2013, Prematunge et al. 2014, Quach et al. 2013b, Quinn 2014, Rhudy et al. 2010, Seymour

2014, Willis and Wortley 2007, Yassi et al. 2010). In five studies, participants identified this as a barrier to putative mandatory vaccination policies (Quach et al. 2013b, Quinn 2014, Rhudy et al. 2010, Seymour 2014, Yassi et al. 2010) (see further under 'mandates' below).

> *Yes, it has to be my own decision. I just heard that you can be obligated in particular work environments. But I don't think that that's okay. It has to be out of free will.* (participant, Lehmann et al. 2014)

In some cases participants felt a tension between the demands of patient protection and the ethical imperative to respect autonomy.

> *I have a real ethical problem with that. The nurse in me says it should be mandatory. But then the citizen in me says what happened to free choice? It's a conflict.* (participant, Quach et al. 2013b)

However, somewhat contrary to this, participants in one study (Quinn 2014) suggested that the ethics of care were bound up with the norms of professional conduct, which imply taking responsibility for one's own decisions, including the decision as to whether to accept vaccination.

> *I feel it would take away our own decision-making really, and our own expertise, and that, you know, as nurses, part of our work ethic really is to advise other people and that surely we are able to make a decision for ourselves and are qualified personnel* (participant, Quinn 2014)

Another participant in this study drew an analogy to patient care.

> *If we did this to a patient, we injected them with something against their wishes, it would be classed as abuse, a form of assault.* (participant, Quinn 2014)

3.4.4.2. Influence of peers (n=6)

Six studies mentioned that the influence of colleagues may be a barrier to vaccination (Hwang and Lim 2014, Lehmann et al. 2014, Manuel et al. 2002, Quach et al. 2013b, Seymour 2014, Yassi et al. 2010). As already noted, one study found that knowledge about side-effects was often gained from colleagues' experiences (Hwang and Lim 2014), although this finding was not confirmed by other data about side-effects. Programme implementers in one study had experienced cases where a small number of people had created a broader anti-vaccination culture.

> *I have whole departments that'll refuse to [get vaccinated]. And the lab people, I'm really having a hard time getting them onboard because they have a couple of people that are sort of anti-vaccine and have pulled up all sorts of stuff from the Internet.* (participant, Quach et al. 2013b).

One study of HCWs' views confirmed this, finding that "*group thinking as well as anti-vaccine co-workers were mentioned throughout the focus groups*" (Yassi et al. 2010), and one further study mentioned that unvaccinated HCWs tended to think most of their colleagues who were also not vaccinated (Lehmann et al. 2014). Finally, one study found that 'peer pressure' to be vaccinated may have adverse effects.

> *And it became more of a... 'Well no, I'm not going to do it because you guys want me to. So no, I'm not going to do it. I don't care what you say'.* (participant, Seymour 2014)

Two studies also mentioned that the experiences of family members may influence HCWs' attitudes (Manuel et al. 2002, Quinn 2014).

3.4.4.3. Influence of management (n=3)

Participants in three studies perceived that management were not interested in promoting vaccination (Isaacson et al. 2009, Lim and Seale 2014, Seale et al. 2012). In one organisation in one study, clinical staff received vaccination, but non-clinical workers in support roles reported that they were not offered vaccination.

> *Because we have insurance, they [the practice leaders] want us to go to our own doctors.* (participant, Isaacson et al. 2009)

Participants in two studies felt that management did not prioritise vaccination of HCWs, or put limited effort into promoting vaccination (Lim and Seale 2014, Seale et al. 2012).

> *No, I think most of them aren't doing enough and most of them think that they're saving money by not getting everybody vaccinated. […] generally there isn't very much management support for good immunization programs.* (participant, Lim and Seale 2014)

3.4.4.4. Inconvenience (n=6)

Participants in six studies mentioned that the inconvenience of accessing vaccination, or a lack of time to do so, may be a barrier (Clarke 2007, Lehmann et al. 2014, Pierrynowski Gallant et al. 2009, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014). In some cases, this was because workplace vaccination clinics were at inconvenient locations or times (Lehmann et al. 2014, Rhudy et al. 2010), for example, because schedules were designed for people working day shifts (Rhudy et al. 2010), while in other studies participants simply said they were 'too busy'.

Inconvenience does not appear to be a major barrier; participants in two studies mentioned that this could easily be overcome by proactively offering the vaccine at workplace sites (Pierrynowski Gallant et al. 2009, Rhudy et al. 2010).

> *I think when they first started; they were coming to the unit and administering it. And I remember having the vaccine a few times when they did that. But when it's been for me to go somewhere else, I get lazy.* (participant, Pierrynowski Gallant et al. 2009)

3.4.4.5. Lack of information (n=4)

Participants in four studies mentioned a lack of information, or contradictory information, as a possible barrier (Quach et al. 2013b, Quinn 2014, Raftopoulos 2008, Willis and Wortley 2007). Two studies (Quach et al. 2013b, Quinn 2014) found that confusion about vaccination for pandemic influenza contributed to uncertainty about seasonal influenza vaccination. One study found that HCWs in the private sector lacked information on the benefits of vaccination (Raftopoulos 2008).

3.4.4.6. Unfairness and distrust within workplaces (n=3)

In three studies participants discussed issues to do with fairness and trust within employer-employee relationships (Manuel et al. 2002, Quinn 2014, Yassi et al. 2010). These issues related particularly to (actual or potential) mandatory vaccination policies, and are discussed further under the 'mandates' theme. Two studies reported a perception that vaccination policies were narrowly focused on patient safety, and that HCWs' own wellbeing was not a priority for healthcare organisations.

> *Although participants universally agreed that protecting residents from influenza was important, they felt that the focus of immunization was to protect residents—at the potential expense, harm, and burden of responsibility of staff members.* (Manuel et al. 2002)

> *Some perceived that [vaccination] was offered to nurses in the context of productivity and patient protection, as opposed to staff health and wellbeing.* (Quinn 2014)

In two studies this was seen to undermine the credibility of vaccination policies, due to their narrow focus on HCW vaccination outcomes rather than on the broader goals of patient safety and employee wellbeing (Manuel et al. 2002, Yassi et al. 2010).

> *They felt that the current influenza campaign was conducted in isolation from other workplace health promotion activities, and they hoped for a more unified message about the importance of workers' health and safety on an ongoing basis. […] Workers felt that the influenza campaign was a standalone push to get workers to be vaccinated.* (Yassi et al. 2010)

Participants in two studies (Quinn 2014, Yassi et al. 2010) saw pressure to receive vaccination (whether in the form of mandatory policies or otherwise) as undermining the judgement and commitment of the professionals on whom healthcare organisations rely.

> *Autonomy for nurses empowers nurses as individuals and as a group. There was a perception that this hard-fought-for position for nurses was being eroded and undermined. Hence, findings revealed a sense of power imbalance between nurses and the organisation. Participants felt a sense of disbelief that they seemed to be making autonomous clinical decisions with and on behalf of older people — only for the organisation to take away this power.* (Quinn 2014)

> *I think there should be enough education out there that you're allowed to make a respectful independent decision based on your own views and experience with the understanding that our mandate is to protect the elderly.* (participant, Yassi et al. 2010)

3.4.5. Facilitators: Beliefs about the personal consequences of flu

3.4.5.1. Perceived high risk of contracting influenza (n=4)

Participants in four studies mentioned that they were at high risk for influenza, due to working with patients who could transmit infection, and that this could be a motivator for vaccination (Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Raftopoulos 2008, Seymour 2014).

Also, participants in four studies mentioned that having chronic illnesses which increase the risk of influenza was a reason for them to be vaccinated (Lehmann et al. 2014, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seymour 2014); asthma was the most commonly mentioned condition.

3.4.5.2. Self-protection (n=12)

Participants in twelve studies cited the protection of their own health (or that of HCWs more generally) as a reason to be vaccinated (Clarke 2007, Khodyakov et al. 2014, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Raftopoulos 2008, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007).

Six studies reported finding that in at least some cases, this was the main reason for vaccination or was more salient than the protection of patients (Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007).

> *First of all to protect myself and to protect my family, that I don't take germs home. But of course also to protect patients.* (participant, Lehmann et al. 2014)
>
> *It's getting influenza from them, not giving it to them.* (participant, Nowak et al. 2015)

One study suggested that HCWs tended to fall into two groups, depending on whether they emphasised the benefits to themselves or to patients (Pierrynowski Gallant et al. 2009). One participant in one study described vaccination as part of a broader focus on health promotion (Pierrynowski Gallant et al. 2009), but this perspective was not widely expressed in other studies. Participants in one study mention that as they became older, protection from influenza became more important (Pierrynowski Gallant et al. 2009).

3.4.5.3. Avoiding time off work (n=9)

Participants in nine studies reported that avoiding time off work was a reason to accept vaccination (Clarke 2007, Leask et al. 2010, Lehmann et al. 2014, Nowak et al. 2015, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014, Willis and Wortley 2007). This was a concern because of loss of pay (Nowak Nowak et al. 2015, Pierrynowski Gallant et al. 2009), an increased backlog of work (Prematunge et al. 2014), and because it might compromise patient care (Clarke 2007).

3.4.6. Facilitators: Beliefs about risks to patients / others

3.4.6.1. Protecting patients' health (n=14)

Participants in fourteen studies gave the protection of patients as a reason to accept vaccination (Clarke 2007, Khodyakov et al. 2014, Leask et al. 2010, Lehmann et al. 2014, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014, Raftopoulos 2008, Real et al. 2013, Rhudy et al. 2010, Seymour 2014, Willis and Wortley 2007, Yassi et al. 2010).

Participants in four studies saw vaccination as implied by the protection of patients to be a basic part of the professional ethos of working in healthcare (Clarke 2007, Khodyakov et al. 2014, Prematunge et al. 2014, Real et al. 2013).

> *[I]t's the Hippocratic Oath. The first thing you do is 'do no harm' and if you're carrying around flu germs from patient to patient, you're doing harm.* (participant, Clarke 2007)

> *I think if you're a good nurse, that's why you're there, is to help people, so you wouldn't want to complicate the situation by giving them influenza.* (participant, Pierrynowski Gallant et al. 2009)

Participants in five studies noted that vaccination was particularly important for HCWs who worked with vulnerable populations, such as older people or immunocompromised patients (Clarke 2007, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Real et al. 2013, Seymour 2014).

A participant in one study described patient protection as more important than protecting oneself.

> *And when I worked in a facility, clinical setting, hospital, as a staff nurse, I would get immunized, mostly for my patients, and then for myself.* (participant, Pierrynowski Gallant et al. 2009)

Programme implementers in one study noted that some HCWs who may not be motivated to accept vaccination for their own protection could be convinced that they needed to do so for the sake of patients (Clarke 2007). Similarly, in another study one implementer working in occupational health noted that the basic rationale for vaccination was patient safety, rather than the protection of HCWs themselves (Leask et al. 2010). Against this, however, one study found that "*protecting patients was mentioned only rarely as a primary reason for vaccination*" (Willis and Wortley 2007).

3.4.6.2. Protection of family members and others (n=9)

Participants in nine studies mentioned the protection of others, particularly their family members, as a reason to be vaccinated (Clarke 2007, Hwang and Lim 2014, Khodyakov et al. 2014, Lehmann et al. 2014, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seymour 2014, Willis and Wortley 2007). At-risk populations, such as young children, older relatives or people with chronic illnesses, were a particular concern (Lehmann et al. 2014, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seymour 2014). In one study, participants suggested that concern for family members could be a greater motivator than self-protection (Hwang and Lim 2014).

3.4.6.3. Protection of population health (n=3)

Participants in three studies mentioned that the vaccination of HCWs was important in terms of increasing herd immunity and protecting the health of the population at large (Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Real et al. 2013). However, one of these studies found that few participants thought in these terms, and one participant observed that HCWs did not generally consider the benefits of vaccination to population health.

> *[I]t's not really the big picture view of what you're seeing in terms of from an outcome perspective or from coverage perspective or the health of the population.* (participant, Pierrynowski Gallant et al. 2009)

3.4.7. Facilitators: Beliefs about flu vaccine

3.4.7.1. Effectiveness of vaccine (n=5)

Participants in five studies mentioned that their belief in the effectiveness of the vaccine was a facilitator of vaccination (Isaacson et al. 2009, Lehmann et al. 2014, Lim and Seale 2014, Pierrynowski Gallant et al. 2009, Seymour 2014). In two studies, participants described personal experience of the vaccine preventing disease (Isaacson et al. 2009, Pierrynowski Gallant et al. 2009).

3.4.8. Facilitators: Perceived contextual influences on decision-making

3.4.8.1. Influence of peers (n=9)

Participants in nine studies mentioned that the influence of peers and colleagues could encourage HCWs to be vaccinated (Hill et al. 2015, Hwang and Lim 2014, Lehmann et al. 2014, Lim and Seale 2014, Manuel et al. 2002, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quinn 2014). One participant in one study, argued that seeing other people being vaccinated could help to address fears about vaccination.

> *But if they can see that the 15 other people that had it, had no problem with it, then they, it starts to kind of break down the fears a little bit.* (participant, Pierrynowski Gallant et al. 2009)

Participants in two studies described how discussion between colleagues could act as a facilitator (Lehmann et al. 2014, Quinn 2014).

> *The way we all talk, we all dialogue at work, that then I would sell it on to someone else. We are definitely influenced by others, there are definite strong personalities that you listen to.* (participant, Quinn 2014)

3.4.8.2. Influence of management (n=6)

Participants in six studies mentioned that supervisors or management encouraged them to be vaccinated (Hwang and Lim 2014, Isaacson et al. 2009, Lehmann et al. 2014, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seale et al. 2012). Three studies mentioned the positive effects of senior staff 'setting an example' by being vaccinated themselves (Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seale et al. 2012). Participants in three studies described pressure from management over and above encouragement (Hwang and Lim 2014, Isaacson et al. 2009, Lehmann et al. 2014); the authors of one study wrote of the "*use of authority to informally mandate influenza immunization*" (Isaacson et al. 2009).

> *[T]he occupational physician basically insists on doing it. It is strongly recommended to do it. It is voluntary but you are explicitly made attentive that it would be necessary.* (participant, Lehmann et al. 2014)

3.4.8.3. Setting an example (n=3)

Participants in three studies mentioned the importance of HCWs 'setting an example' to their patients and the broader public by accepting vaccination (Clarke 2007, Lehmann et al. 2014, Willis and Wortley 2007).

> *We need to practice what we preach; we're preaching immunization, so we best do it ourselves.* (participant, Clarke 2007)

3.5. Factors relating to intervention programmes

The themes presented in this section relate to specific interventions. These data come both from studies of actual interventions (process evaluations) and broader studies which explored HCWs' perceptions of possible interventions. These data are additional to the data on general barriers and facilitators, presented above and summarised in Table 10. This section also includes data about the implementation of intervention programmes. The first sections correspond to the categories used in the synthesis of intervention studies, although education and awareness have been combined as there is little difference between these with respect to HCWs' views.

3.5.1.1. Increased access (n=12)

Participants in 10 studies mentioned interventions to increase access, such as workplace vaccination clinics or mobile carts (Clarke 2007, Hwang and Lim 2014, Isaacson et al. 2009, Lim and Seale 2014, Lindley et al. 2014, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Seale et al. 2012, Willis and Wortley 2007). However, limited data were reported on either HCWs' or implementers' perceptions of such interventions. One study found that HCWs had positive attitudes to mobile carts, but also that "*[a] few detractors to the idea of the mobile trolley felt that the unannounced presence of the trolley would not allow them the opportunity to psychologically prepare themselves for the injection*" (Hwang and Lim 2014). Another study of implementers reported that "*it was felt that going to the staff members in their own settings indirectly placed 'pressure' on them, which resulted in higher uptake rates*" (Seale et al. 2012); this suggests that interventions, such as mobile carts, may be effective through pathways other than increased accessibility.

In two studies, a substantial number of participants reported being vaccinated at a workplace or mobile clinic (Clarke 2007, Willis and Wortley 2007).

> *Among vaccinated participants, some believed strongly that vaccination was important and some did not have strong opinions. Many of the latter group seemed to have been vaccinated because vaccination had been made convenient (e.g., mobile cart).* (Willis and Wortley 2007)

Also, participants in four studies mentioned accessibility or convenience in general terms as a possible facilitator of vaccination (Clarke 2007, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Yassi et al. 2010). It was rarely described as a major motivator, and one study reported that it was of less importance than other rationales for vaccination (Clarke 2007). However, in another study, participants believed that convenience was a widespread reason, even if not explicitly discussed.

> *I think that there are probably tons of people in the health-care profession with my approach to it. If it's right there in front of you, maybe I'll have it; if it's not, I'm not going to go out of my way to go get it.* (participant, Pierrynowski Gallant et al. 2009)

3.5.1.2. Education and increased awareness (n=16)

Participants in sixteen studies mentioned educational or awareness-raising programmes, or talked in more general terms about their preferences for information (Clarke 2007, Hill et al. 2015, Hwang and Lim 2014, Khodyakov et al. 2014, Lim and Seale 2014, Lindley et al.

2014, Nowak et al. 2015, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Quinn 2014, Raftopoulos 2008, Rhudy et al. 2010, Seale et al. 2016, Seymour 2014, Willis and Wortley 2007, Yassi et al. 2010). A range of specific strategies was mentioned, including posters, emails, educational presentations and courses, and individually tailored communications.

Data from implementers showed that educational strategies were used in different ways within programmes. A participant in one study suggested using education mainly as an auxiliary to strategies such as declination forms, to "*decreas[e] the load*" of the latter (participant, Hill et al. 2015). In another study, there was "*universal agreement*" among participants (Lim and Seale 2014) that education should be the primary intervention strategy.

> *I think education is the key; I think we need to be looking at how the education is delivered and I think we need to be asking the healthcare workers themselves how they would like to receive the information.* (participant, Lim and Seale 2014)

Two studies found that the introduction of broader policies or legislation on vaccination had boosted the importance of education (Khodyakov et al. 2014, Lindley et al. 2014).

HCWs suggested that educational campaigns should include the opportunity to ask questions and raise concerns (Hwang and Lim 2014, Quinn 2014), and be delivered by doctors or experts who are seen as authoritative (Hwang and Lim 2014, Pierrynowski Gallant et al. 2009, Quinn 2014, Raftopoulos 2008). In terms of the preferred content of educational messages, participants felt that messages targeted to HCWs were better than generic messages targeted at the public (Clarke 2007, Nowak et al. 2015, Quinn 2014, Yassi et al. 2010); in three studies, participants preferred personalised information or data from HCWs' own work settings (Clarke 2007, Pierrynowski Gallant et al. 2009, Rhudy et al. 2010). They wanted information to be seen to come from reputable, unbiased sources (Clarke 2007). Participants felt that educational messages should provide more factual information, including quantitative information, and address HCWs' specific concerns around vaccine effectiveness and risks (Clarke 2007, Nowak et al. 2015, Pierrynowski Gallant et al. 2009, Rhudy et al. 2010, Seale et al. 2016, Seymour 2014, Yassi et al. 2010), and that they should be based on robust evidence (Clarke 2007, Quinn 2014, Yassi et al. 2010).

> *I think the one thing I would look for in this, as a critical thinker, is: what's the evidence that flu vaccine actually reduces transmission from healthcare workers to patients?* (participant, Clarke 2007)

However, possibly going against this, one other study found that simplicity was a positive characteristic of educational interventions (Rhudy et al. 2010).

One more specific strategy which was mentioned was the use of personal testimony (Clarke). One study found that "*messages that focused on self, patients and families resonated best, while those that induced guilt or mentioned missing work due to illness were not well received*" (Nowak et al. 2015).

In three studies, HCW participants expressed frustration with the content of existing education or awareness programmes, finding them oversimplified or 'dumbed down' (Seale et al. 2016) and insufficiently evidence-based (Quinn 2014, Yassi et al. 2010); this

was linked to the sense that messages were not tailored to the specific needs of HCW as against the general public (Quinn 2014, Yassi et al. 2010). One participant in another study also mentioned that information for HCWs was "*very basic*".

> *But when I think about what we're providing for our own staff... it's not enough, because, it's almost, just a little bit above what we would give a lay person*. (participant, Pierrynowski Gallant et al. 2009)

The failure of education campaigns to provide adequate information was seen to be counter-productive, and may link to the themes of trust and autonomy discussed above.

> *[Campaigns] should treat healthy people with a bit more respect and give them more information*. (participant, Seale et al. 2016)

Participants in three studies felt that there were too many posters, leaflets or emails (Quinn 2014, Seale et al. 2016, Seymour 2014), and that this excess of communication may make educational campaigns less effective.

Participants made several suggestions regarding how education should be delivered: in 'road shows' including presentations, incentives and vaccination clinics (Hwang and Lim 2014); as part of declination form programmes (Hill et al. 2015, Khodyakov et al. 2014, Seymour 2014); and as part of continuing professional education (Pierrynowski Gallant et al. 2009). One study found that views differed as to whether education should be compulsory (along the lines of existing mandatory training courses, such as fire safety), with some participants being supportive and another feeling that this would be coercive (Seale et al. 2016).

3.5.1.3. Incentives (n=7)

Participants in seven studies mentioned incentive programmes (Hwang and Lim 2014, Lim and Seale 2014, Lindley et al. 2014, Pianosi et al. 2013, Pierrynowski Gallant et al. 2009, Seale et al. 2012, Seymour 2014). In one study, implementers expressed a view that a small incentive (often one provided by the vaccine manufacturer) was effective (Seale et al. 2012). However, the same participants also noted that there was no budget available for other incentives, even though they felt that this would be more effective.

> *If we didn't actually have the lollipop I think we'd have less people being vaccinated, because whenever we run out there's a mass walkout*. (participant, Seale et al. 2012)

Participants in one further study felt that incentives at clinic level could help to increase vaccination uptake (Hwang and Lim 2014).

In two studies HCW participants expressed a view that those opposed to vaccination would not be swayed by incentives (Pierrynowski Gallant et al. 2009, Seymour 2014).

> *I have seen other organizations where they offer either a discount or whatever at Walgreens or something like that or gift card... In my case, to me, it doesn't matter because to me, it's a personal decision*. (participant, Seymour 2014)

3.5.1.4. Soft mandates (n=6)

Participants in six studies mentioned declination form programmes (Hill et al. 2015, Khodyakov et al. 2014, Quach et al. 2013b, Seale et al. 2012, Seymour 2014, Willis and Wortley 2007). Data from implementers indicated a range of potential issues with such programmes. In one study, implementers found a declination form programme to be easy to implement, believed it to be effective and also found that it provided additional opportunities to engage with HCWs and educate them (Hill et al. 2015). Facilitators of the success of this programme were identified as adequate education before the start of the programme, ensuring that HCWs knew what would be done with the information, and having active and engaged leadership (Hill et al. 2015).

However, in other studies some implementers thought declination forms had been ineffective in ensuring compliance (Quach et al. 2013b, Khodyakov et al. 2014, Seale et al. 2012). This was due to the programmes not including penalties for noncompliance (Khodyakov et al. 2014) or because of logistical challenges in implementation (Quach et al. 2013b, Seale et al. 2012). Also, two studies reported that there was resistance to the programme from HCWs, due to insufficient education before the programme commenced (Quach et al. 2013b, Seale et al. 2012). In one case, management abandoned the programme at most sites after one season due to this resistance and not having adequate extra resources to address it (Seale et al. 2012), and in the other study, it was found that many organisations did not proactively seek declinations because of the time involved in the process (Quach et al. 2013b).

Some participants in two studies reported that the desired impact in terms of engaging HCWs did not materialise (Khodyakov et al. 2014, Quach et al. 2013b).

> *[D]eclination doesn't help me get everyone protected … I was foolishly thinking that declination was going to make people think about how important [influenza vaccination] is, but it didn't.* (participant, Khodyakov et al. 2014)

> *But some people are just suspicious of putting their name. Some were like, 'Yeah, sure. Thank you. You know. No, I don't want it.' And I didn't ask them for their specific reasoning.* (participant, Quach et al. 2013b)

However, other participants in one study (Khodyakov et al. 2014) were more optimistic, feeling that the declination form requirement – which, in this study, was part of a legislative change which also mandated broader promotion efforts and publication of data on HCW vaccination rates – had helped to bring about broader improvements at the level of organisations. Participants felt that the programme helped to more accurately target unvaccinated HCWs, and that it had helped to shift norms more broadly: "*several participants suggested that the law facilitated a 'culture shift' toward treating influenza vaccination as a patient safety strategy and supported a 'culture of accountability' around HCP influenza vaccination*" (Khodyakov et al. 2014). Some noted that it had prompted greater investment in data management systems to track vaccination status data. One participant also noted that unions had been supportive of the policy.

The two studies which reported HCW perceptions found that views were mixed. In one study, participants felt they already had too many mandatory procedures.

> *We have so many tests and other things that are mandatory, so why add to that?* (participant, Willis and Wortley 2007)

Some participants were also concerned about disciplinary action if they declined the vaccine and then contracted influenza and had to take sick leave (Willis and Wortley 2007). In another study, participants were broadly positive about the declination form programme, due to its being confidential and not applying pressure (Seymour 2014). They also described it as very easy – one participant described it as too easy, while another suggested that declination may be under-reported – which may suggest that this programme was less stringent than some of those discussed in the other studies.

3.5.1.5. Hard mandates (n=11)

Eleven studies discussed some form of mandatory vaccination programme (Khodyakov et al. 2014, Leask et al. 2010, Lindley et al. 2014, Pierrynowski Gallant et al. 2009, Prematunge et al. 2014, Quach et al. 2013b, Rhudy et al. 2010, Seale et al. 2012, Seale et al. 2016, Seymour 2014, Yassi et al. 2010). However, unlike the data on declination form programmes, the majority of these explored such programmes only hypothetically, and did not investigate implemented mandatory programmes. The only study of an actual mandatory programme concerned a state law which introduced a requirement for unvaccinated HCWs to wear masks (Lindley et al. 2014).

Data from implementers and managers suggested that there were mixed perceptions of mandates, but at least some participants were in favour (Leask et al. 2010, Quach et al. 2013b). One study found that people at higher administrative levels tended to be more supportive than clinical managers (Leask et al. 2010). Supporters of mandates saw them as the only way to get beyond the limitations of voluntary programmes and achieve high uptake rates (Leask et al. 2010, Quach et al. 2013b, Seale et al. 2012).

> *Until it's mandatory, organizations flounder and we do the best we can with intimidation and prizes.* (participant, Quach et al. 2013b)

However, other participants in one study expressed ethical objections to mandatory vaccinations, or anticipated resistance from HCWs which would make mandatory policies hard to implement (Quach et al. 2013b).

> *People don't like to be told what to do and some who might actually take it [the vaccine] wouldn't take it just because we were trying to force them into it … I don't believe you can force somebody to do something just because they're a health care worker.* (participant, Quach et al. 2013b)

Participants in two studies had doubts about whether their organisations had the infrastructure, resources and organisational culture to introduce and effectively enforce such a policy (Quach et al. 2013b, Seale et al. 2012).

> *How can you make it compulsory? Are you saying people can't start their shift? I just can't imagine how, you know, I'd be standing at the front door, [saying], "You can't go to your shift until I've jabbed you".* (participant, Seale et al. 2012)

Facilitators of a successful mandate programme were seen to be political will or support from management (Leask et al. 2010, Quach et al. 2013b), and effective dialogue with the

HCW community and unions (Leask et al. 2010, Quach et al. 2013b) and with other stakeholders such as academic institutions (Quach et al. 2013b). Participants in two studies suggested that the decision needed to come from state- or national-level authorities, and could not be effectively implemented at the level of the organisation (Quach et al. 2013b, Seale et al. 2012). Participants in one study anticipated considerable resistance to a mandatory policy from unions (Quach et al. 2013b), although in two other studies they were less concerned about this (Leask et al. 2010, Lindley et al. 2014); one participant in one study suggested that a mandatory vaccinate-or-mask law at state level had helped to get "buy-in" from the unions for organisation-level policies (Lindley et al. 2014).

Implementers who were supportive of mandates tended to think that HCWs would comply despite having objections.

> *But you know, if they're told, 'well, you take it, or you don't come to work,' they tend to take it.* (participant, Seale et al. 2012)

In one study, participants suggested that the implementation of mandates could of itself bring about a shift in attitudes to vaccination.

> *If the influenza vaccination was mandated, I think the staff would see it not so much as their right to choose [but] as a responsibility part of it as being a health care worker, being willing to get the vaccine. […] They would believe that the vaccine is safe if it was mandatory.* (participant, Quach et al. 2013b)

One study explored a policy which involved a mandatory masking requirement for unvaccinated HCWs (Lindley et al. 2014). This study found that about some organisations encountered resistance to masking, and in some cases it was found to be difficult to monitor compliance.

> *We have employees, not spies. So we have no idea if they were actually in compliance or not. And I'm not about to go chasing people and I don't expect the director of nurses to go out and chas[e] people.* (participant, Lindley et al. 2014)

Some organisations found there were difficulties with HCWs communicating with patients while wearing a mask. Several participants also reported that the regulations were unclear as to exactly who fell within their scope (e.g., all employees or only those with patient contact). In general, though, most participants in this study did not report major challenges in implementing masking requirements.

Three studies reported that most HCWs were opposed to mandates (Rhudy et al. 2010, Seymour 2014, Yassi et al. 2010). However, many also said that they would accept the vaccine if it were mandatory (Rhudy et al. 2010, Seymour 2014); this tends to confirm the views of implementers, as described above. In one study, participants saw mandatory vaccination as the employer giving an "*ultimatum*" to employees, undermining the respect that they saw as basic to the relationship (Yassi et al. 2010).

> *I think the coercion backfires in that it gets people's backs up, and then they become more polarized.* (participant, Yassi et al. 2010)

HCWs' autonomy was seen to be compromised if they effectively have no choice but to accept vaccination.

> *And I think for a lot of people, especially folks who have families, or well, people, money—it comes down to getting a paycheck. Some people can't afford to take the risk of potentially getting the flu for the sake of the fact that they won't be respected for that particular illness because the employer has made a decision for you about how to avoid that illness, whereas they are not making that decision about other illnesses for us. But we're not allowed to decide how we manage that illness really. I mean, we can, but we take the risk of being withheld pay, and I don't think that's necessarily the most effective way to encourage.* (participant, Yassi et al. 2010)

3.5.1.6. Broader issues: barriers and facilitators of implementation (n=6)
The following sections describe issues and perceptions which apply to HCW vaccination campaigns more generally. These overlap with some of the themes discussed for particular intervention types above, but also cut across intervention types and are relevant to a range of vaccination campaigns. Three types of theme are relevant here: logistical challenges in implementing campaigns; the process of collecting and managing data on HCW vaccination status; and differences between groups of HCWs.

In six studies, programme implementers described actual or potential challenges in the implementation of vaccination campaigns (Hill et al. 2015, Leask et al. 2010, Lindley et al. 2014, Pianosi et al. 2013, Quach et al. 2013b, Seale et al. 2012). Participants noted that vaccination campaigns demanded considerable resources, due to their seasonal nature, which demands the mobilisation of substantial numbers of skilled workers in a short time period (Hill et al. 2015, Leask et al. 2010, Seale et al. 2012).

> *It takes time and effort. [Vaccinating] is an effort that lasts a few weeks and either you hire seasonal workers which, at the skill level you require, is hard to do or you pull those resources out of somewhere else.* (participant, Hill et al. 2015)

> *I'd support it – in principle. In actual operational terms it would be a logistical nightmare. We're talking about getting the entire staff of a hospital influenza-vaccinated within a 4-week period instead of over a whole year or over a whole lifetime, and we would have to do that each and every year.* (participant, Leask et al. 2010)

Participants in one study reported that providing vaccination clinics was limited by available staff resources, and in some cases meant fewer staff available to do other work (Seale et al. 2012).

> *[During] the six weeks of the flu campaign, all of our other work goes on hold.* (participant, Seale et al. 2012)

Campaigns also need to ensure that sufficient vaccine is available (Pianosi et al. 2013).

3.5.1.7. Broader issues: data collection and management (n=7)
Participants in seven studies described issues to do with the process of collecting and managing data on HCWs' vaccination status (Hill et al. 2015, Kalayil et al. 2015,

Khodyakov et al. 2014, Lindley et al. 2014, Pianosi et al. 2013, Quach et al. 2013b, Seale et al. 2012). Two concerned new requirements for data reporting (Kalayil et al. 2015, Lindley et al. 2014). Several of these studies went into considerable depth and reported extensive data; as this theme is of relatively less importance to this synthesis, only a brief summary is reported here.

Organisations used different modes to collect data, some using paper forms and some electronic systems, which were either simple spreadsheets or more complex systems (Kalayil et al. 2015, Lindley et al. 2014, Pianosi et al. 2013, Quach et al. 2013b, Seale et al. 2012). Some participants described paper-based systems as inefficient (Kalayil et al. 2015, Quach et al. 2013b), but their non-requirement of any technical skill to use was also mentioned as an advantage (Quach et al. 2013b). Participants in one study described improvements to data systems in general as a result of vaccination reporting requirements (Khodyakov et al. 2014).

Not all organisations effectively tracked HCWs, who received vaccination externally, or required written proof of vaccination status (Kalayil et al. 2015, Quach et al. 2013b).

Larger organisations were felt to have more difficulties in collecting data (Kalayil et al. 2015). One study mentioned that a high rate of staff turnover could lead to challenges in monitoring vaccination status (Hill et al. 2015). New starters, part-time staff and staff on leave also created difficulties (Kalayil et al. 2015, Quach et al. 2013b, Seale et al. 2012), as did independent physicians who worked across several organisations (Kalayil et al. 2015). As described in the following subsection, several studies mentioned the challenges involved in collecting data on contractors, students or other non-payroll staff, and this was mentioned in two studies as a particularly resource-intensive aspect of data collection (Kalayil et al. 2015, Quach et al. 2013b). Participants described confusion as to who exactly they should be collecting data on (Kalayil et al. 2015, Khodyakov et al. 2014, Quach et al. 2013b). Collaboration with other institutions – such as the academic institutions from which students came for placements or training – was noted as an important factor in data collection (Kalayil et al. 2015).

3.5.1.8. Broader issues: differences between HCWs (n=8)

Two themes relate to differences between different groups of HCWs (mainly between occupational groups, although there were a few data points relating to age and ethnicity). The first relates to how different HCWs perceive interventions, and the second concerns the question of the scope of the interventions – that is, who is defined as a HCW for the purposes of vaccination campaigns.

One study found that senior administrators were more likely to support mandatory vaccination policies than clinical managers (Leask et al. 2010). One study found that physicians were more likely than other HCWs, particularly nurses, to believe that the vaccine was effective (Nowak et al. 2015). One study found that implementers felt that HCWs in emergency departments or intensive care had more fear of side-effects because they cared for patients with Guillain-Barré syndrome (Quach et al. 2013b).

One study found that Black nurses in southern USA mentioned historical mistrust of vaccination programmes, deriving from the Tuskegee experiment (Willis and Wortley 2007). One study found that older nurses were more likely to accept vaccination than

younger ones, both because they perceived themselves to be at higher risk, and because they could remember the impact of severe communicable diseases, such as polio, before vaccination was introduced, whereas younger people did not have direct personal experience to support the importance of vaccination; they also perceived a broader cultural shift, whereby younger people were less trustful of authority (Pierrynowski Gallant et al. 2009).

> *I believe that people are more educated and we're trained or educated to question, right, more, and we don't do as people tell us, we think about it in a way more critically.* (participant, Pierrynowski Gallant et al. 2009)

The question of who counts as a HCW, for the purposes of vaccination campaigns, was answered differently across studies. Two studies found that most institutions included non-employees (students, volunteers and contract staff) in their HCW vaccination policies, although some did not (Lindley et al. 2014, Seale et al. 2012). Against this, however, participants in two other studies reported that many organisations could not accurately monitor the vaccination status of contract or non-payroll staff (including both clinical and non-clinical staff) because they did not have centralised data on their employment, or the resources to collect such data manually (Kalayil et al. 2015, Quach et al. 2013b).

> *Contractors run everything from an agency nurse … to the carpenter or the electrician … And how on earth am I supposed to know how many days they're here? How do I even know who they are? They don't work for me. I don't have a database of them.* (participant, Kalayil et al. 2015)

Participants in one study also reported having difficulty collecting data on students and volunteers. This study reported that "*[a]pproximately one-quarter of facilities remarked that they did not encounter data collection challenges for non-employees (LIPs [licensed independent practitioners] or adult students/trainees and volunteers)*" (Kalayil et al. 2015), implying that three-quarters did encounter challenges.

One study found that approximately half the institutions studied applied vaccination policy to all HCWs, and half only to those with direct patient contact (Lindley et al. 2014). Participants who applied policy to all HCWs argued for this in terms of simplicity and patient safety.

> *We took the stand that all employees of the [healthcare] system whether they be a clerical position … away from the [facility] or someone in direct patient care [are] all healthcare workers because we just found it too hard to differentiate.* (participant, Lindley et al. 2014)

> *The way I put it to the staff is if you breathe the same air that the patients breathe, you are considered a healthcare worker.* (participant, Lindley et al. 2014)

3.6. Comparison of the qualitative studies with the intervention studies

This section briefly compares the qualitative data with the information on implementation and context from the intervention studies (pp.20-27 above). While the qualitative and intervention studies were obviously distinct in their aims and methods, their contextual characteristics were broadly similar, for example in terms of country and setting (with a predominance of North American studies and hospital settings, in both cases). Individual

beliefs, which may act as facilitators or barriers to vaccination, were similar across the two sets of data. Several key barriers recurred in both cases: fear of side-effects; belief that the vaccine is ineffective, or that influenza is not serious; and the inconvenience of vaccination. The data about differences between groups of HCWs, particularly between doctors and other HCWs, also seem consistent.

However, we noted divergence in terms of the organisational or infrastructural factors. The intervention studies tended to suggest that most interventions were straightforward to implement and required relatively little in the way of resources, while the qualitative studies raised concerns about the level of commitment required, and about the risk of failure where interventions were under-resourced. The qualitative studies also raised concerns about both soft and hard mandate interventions, suggesting that there may be considerable resistance from HCWs, but this was rarely mentioned as an issue in the evaluations of these programmes.

A number of reasons may account for these differences. Information extracted from the intervention studies largely represented the study authors' interpretations of their findings, so it is to be expected that they have a more positive view than was found in studies reporting HCWs' own views. (In some cases, the study authors' views were based on survey data, but these focused mainly on the general perceptions of vaccination rather than on perceptions of the interventions themselves.) It is also possible that the interventions being evaluated were better supported or resourced than those implemented in everyday practice, which would have been the focus of the qualitative data. However, it should be noted that many of the intervention studies were observational, which means that they took place in a 'naturalistic' setting. Some of the qualitative findings on declination form programmes, for example, indicated that interventions may be incompletely or inadequately implemented. If so, the intervention effectiveness reported by researchers may not translate to programmes implemented in real-world settings.

3.7. Broader themes

This section briefly suggests some broader themes which emerged from the data coded above. These themes represent potential directions for interpretation of the data.

3.7.1. Relationships between employers and employees

Several studies suggested that the relationship between HCWs as employees, and the organisations employing them (including history and context), may affect how flu vaccination campaigns are perceived. HCWs perceived some types of intervention as disempowering and lacking in respect for their professional judgement. This applied not only to mandatory or coercive policies, but also information campaigns which are often seen to rest ultimately on an appeal to authority, and to fail to engage with what HCWs see as legitimate concerns about vaccination programmes. The argument that vaccination was demanded by patient safety may be persuasive for some HCWs, but others saw it as calling into question their commitment to patient care. Reluctance, on the part of organisations or campaign implementers, to engage with HCWs' concerns was then read as a high-handed disregard not just for HCWs as individuals, but for the professional norms and integrity which make the functioning of the organisation possible.

Perceptions about the credibility of vaccination campaigns were also important and credibility can sometimes suffer if campaigns are seen to narrowly focus on increasing vaccination coverage, without taking into account either other means of infection control, or HCWs' own health. Organisations were perceived as focusing on a vaccination uptake target as an end in itself, rather than working in a holistic way to promote patient safety and staff wellbeing. The appeal to these general principles as arguments for vaccination may then appear empty and *ad hoc*, and engender further scepticism. (The tendency for intervention research to focus on vaccination uptake outcomes, to the exclusion of patient health status, is arguably symptomatic of the problem here.)

As with the other qualitative findings, it is not possible to say how widespread these perceptions are; while they came only from a minority of studies, some studies did find critical views of campaigns to be widely shared. These findings indicate the importance of taking into account the organisational and social context of specific vaccination programmes, rather than focusing only on individuals' beliefs about vaccination in the abstract.

3.7.2. Pathways to benefit

Many HCWs, and some implementers, suggested that the evidence for patient benefit from HCW vaccination campaigns was not compelling. They also raised a number of specific criticisms about the putative pathways from increased vaccination coverage to improved patient outcomes, including mismatching between the vaccine and circulating strains of influenza, and the impossibility of vaccinating everyone who comes into contact with patients.

3.7.3. Non-standard models of health

Several studies suggested some HCWs hold non-standard models of health which lead them to question the value or safety of vaccination. This was manifest, for example, in the desire to avoid over-medication and to refuse medical interventions where there was no immediately obvious need, and the preference for 'natural' or complementary treatments over vaccination. The idea that one's immune system will be 'stronger' for exposure to pathogens runs on similar lines.

It is not possible to quantify how many HCWs hold such beliefs, although it appears to be a minority; studies reported such views from nurses as well as from non-clinical HCWs. It is possible that the more articulately expressed beliefs in the data resonate with implicit beliefs or 'folk theories' of health which were more widely held, although this is speculative. In any case, it is important to bear in mind that HCWs, including some with clinical training, may have theoretical beliefs about health which diverge from those that inform the scientific literature.

3.7.4. Differences between implementers and HCWs

The data suggested some differences in the perceptions of people implementing interventions and those of HCWs themselves. No studies systematically compared implementers and HCWs, and the two groups of studies were somewhat different in their theoretical orientations, so it is difficult to draw firm conclusions from the comparison, but the divergences are suggestive. For example, as already noted, implementers tended to identify hearsay ('gossip') or information found on the internet as sources of scepticism

about vaccine effectiveness and concerns about side-effects, while HCWs themselves mainly cited personal experience.

More speculatively, another divergence may concern views on the broader ethical implications of vaccine campaigns. While some implementers recognised an ethical tension between individual autonomy and the perceived benefits of mandatory policies, the perspective they took was a largely individualistic one, which emphasises abstract rights and duties, where the debate is about how to balance competing demands. By contrast, at least some HCWs took a more social perspective, which emphasised relationships – both their relation to their patients, and their employers' relation to them. In this perspective, the question is not whether the individual HCW has a right to refuse vaccination, but whether the organisation facilitates or hinders HCWs' commitment to the care of their patients.

This is not to say that a more social model of ethics necessarily leads to questioning the value of vaccination; indeed, in some cases, it clearly acted as a motivator. Nonetheless, the difference is interesting because it resonates with broader meta-ethical debates, such as Carol Gilligan's famous distinction between an ethics of justice, which emphasises abstract principles, and an ethics of care which emphasises interpersonal relationships (Gilligan 1982). We could also note that the implementer perspective is largely in line with the broader academic debate about the ethics of HCW vaccination (Ottenberg et al. 2011, van Delden et al. 2008), which similarly focuses on an individualistic ethics of justice, while the more social model implicit in HCWs' views has received less attention. This suggests that in some cases, HCWs' resistance to vaccination campaigns may result from a fundamentally different ethical perspective, and not just from a different estimation of risks or benefits.

3.7.5. Generalisability

The review of qualitative evidence found no studies conducted in the UK. This raises the question of the generalisability of the evidence to the UK context. The generalisability of studies from the USA, in particular, may be limited by the very different policy context of a decentralised, largely private healthcare system (and perhaps, more speculatively, by social or cultural differences, for example, regarding employer-employee relationships). This said, there are few clear differences between countries that are evident from the data. In particular, critical or sceptical perceptions of vaccination were reported in studies from several countries; such views were reported extensively in the one study conducted in Ireland (Quinn 2014), arguably the context most similar to the UK.

One possible difference concerns the implementer data relating to declination form programmes and hard mandates. We noted a tendency for participants in the US studies (Hill et al. 2015, Khodyakov et al. 2014, Lindley et al. 2014) to be more optimistic about implementing such interventions, or to report fewer negative experiences of them, than participants in other countries (Australia and Canada: Quach et al. 2013b, Seale et al. 2012). Two US studies concerned changes to legislation (Khodyakov et al. 2014, Lindley et al. 2014), which were not a focus of the studies from any other countries.

4. Overall discussion and research recommendations

This chapter briefly discusses the two reviews in relation to each other and highlights gaps in the evidence base. The first sections consider the specific intervention categories, followed by cross-cutting issues. The last section uses Michie et al. (2014)'s Behaviour Change Wheel approach as a means to understand the evidence base in a more synoptic way, in terms of the combination of approaches at different levels, and this is suggested as a potential framework to think about future interventions.

4.1. Education and increased awareness

The interventions evaluated in the literature have used a variety of approaches, often combining several educational or awareness strategies (and sometimes also increasing access). Mass marketing strategies have been widely evaluated, and vaccination champion programmes, which represent a more face-to-face approach, have also been evaluated in several studies. The information on implementation and context does not suggest any major challenges in implementing these schemes or barriers to their acceptability, although intensive programmes may have logistical and resource implications.

The evidence suggests that beliefs held by some HCWs may act as a barrier to vaccination, and could be targeted by educational or information campaigns. Some HCWs believed that they were at low risk of contracting influenza, and unlikely to transmit it to patients; that influenza was not a serious illness; that the vaccine was ineffective in preventing illness, and may have side-effects; that vaccination was unnecessary if other infection control procedures were followed; and that there was insufficient evidence of benefit to patients from HCW vaccination. Conversely, HCWs may be motivated to accept vaccination in order to protect themselves, their patients and their families from illness.

The qualitative evidence also indicates that many HCWs have clear preferences for the content of information and educational messages. In particular, they preferred messages which targeted their own needs and priorities as HCWs, rather than generic messages similar to those promoted to the general public. Many also felt that current educational strategies were oversimplified and patronising, and would prefer information to be more detailed and evidence-based, and to acknowledge counter-arguments. They appear to have had less strong views on the specific strategies used to deliver information, although a few suggested that an excess of marketing messages may be counter-productive. These data suggest that HCWs preferred a dialogical mode of communication which respects their professional judgement, and does not gloss over the limitations of the evidence base, to a marketing mode of communication which emphasises the one-way flow of information and the repetition of simple messages focused on behaviour change.

The intervention research largely does not seem to have addressed these concerns (although there was limited information on the detailed content of educational messages in the studies). The messages communicated in interventions commonly focused on stating facts, formulated generically and at a basic level, and rarely mentioned the source or empirical warrant for the information given.

The qualitative evidence appears to suggest that the use of peer educators and vaccination champions, who can engage with HCWs on a personal level, and educational formats which allow for dialogue, are more promising than one-way communication

strategies such as emails and posters. This is not necessarily borne out by the intervention studies. However, while more personalised approaches have been utilised in the literature, very few intervention studies explicitly reported an approach which focused on HCWs' specific needs or which allowed for dialogue.

4.2. Increased access

Although there were several studies that evaluated the effectiveness of interventions to increase accessibility, such as mobile carts or on-site vaccination clinics, there were relatively few controlled studies. Of the intervention studies including this component, around half focused on mobile carts and half on other forms of on-site provision of vaccination. Most of these interventions also included educational or awareness-raising strategies. The intervention studies did not indicate any major challenges to implementation, although in some cases these interventions may have substantial costs.

The qualitative evidence suggests that clinic opening hours or locations may be a barrier in some cases, and that some undecided HCWs may be encouraged to receive vaccination by mobile carts. The evidence does not indicate any major barriers to the acceptability of these interventions.

4.3. Incentives

Incentives can include both individual incentives (such as small gifts given to everyone receiving vaccination, or entry into a prize draw) or group-level incentives (where a whole unit or department receives some form of reward for meeting a percentage target). About two-thirds of the intervention studies concerned individual and one-third group-level incentives. There were few controlled studies of individual incentives, and none of group-level. Most studies treated incentives as an add-on component to a broader intervention package including awareness and/or access components, rather than as a stand-alone intervention. The intervention studies do not suggest any major barriers to implementation.

The qualitative evidence is limited. Some staff implementing vaccination programmes found incentives to be useful, but reported that resources to implement incentive schemes were limited. Some HCWs expressed scepticism about the effectiveness of incentives. The evidence does not indicate any major barriers to the acceptability of these interventions.

4.4. Soft mandates

Although, we identified several studies of 'soft' mandates, mostly declination form programmes in which HCWs who do not wish to accept vaccination must sign a form stating that they understand the consequences of this decision, none have used a controlled design. Information on implementation and context presents a mixed picture, with some studies suggesting that these interventions were often demanding in terms of resources and staff time – particularly data collection and monitoring – and others finding that they were relatively low-cost.

The qualitative evidence comes mostly from staff implementing programmes, rather than from HCWs themselves. The qualitative evidence suggests that declination form programmes were not straightforward to implement and required considerable education and engagement with staff before they began. They may also require substantial resources

to implement, particularly for the collection and management of data on HCWs' vaccination status. Some participants reported trying to implement such programmes and abandoning them because of logistical barriers. Participants expressed the hope that these programmes could bring about a broader cultural shift at the level of the organisation, but this did not always occur in reality. Declination form programmes appear to have varied widely in terms of how proactively they were enforced, and how much was demanded of those HCWs who declined. In some cases, programmes were launched with the expectation of strong and universal enforcement, but devolved into more voluntary schemes.

4.5. Hard mandates

There have been several studies of hard mandates, meaning strongly enforced mandatory policies obliging HCWs to receive vaccination. The interventions evaluated mainly involved making vaccination a condition for employment, with unvaccinated HCWs required to wear masks while undertaking patient care. Information on implementation and context suggests that there may be resistance to mandatory programmes from HCWs, although limited information was available. It also suggests some possible challenges to implementation, particularly around data management and the processing of exemption requests.

The qualitative evidence (which mainly reports hypothetical perceptions, rather than actual experiences) suggests that hard mandate programmes were widely opposed by HCWs for both ethical and practical reasons. They may face challenges in ensuring and monitoring compliance, and the adoption of a mandatory policy may not guarantee that all staff actually receive vaccination. HCWs were generally opposed to coercive mandatory policies, seeing them as increasing resistance among those sceptical of vaccination, and more generally as undermining constructive relationships between healthcare employers and employees. These data may indicate that mandatory policies may have longer-term adverse effects at an organisational level, which were not captured by the existing intervention research.

4.6. General issues regarding implementation

Both bodies of evidence suggest the importance of management being committed to the vaccination campaign. In a few cases, as discussed in the qualitative studies, policies were undermined by the indifference or outright opposition of senior management. The qualitative evidence also indicated that campaigns were likely to have more impact where they took place in organisations with a credible long-term commitment to both patient safety and staff wellbeing. Adequate communication with staff and engagement with stakeholders, such as unions and professional bodies, may aid in implementing interventions. In some cases, campaigns may involve collaboration between distinct departments or units, which may also pose challenges.

The infrastructure and resource requirements of any intervention should be considered before implementation. There are costs involved in the vaccination programme itself, in promotional strategies such as posters or competitions, and in collecting data on HCW vaccination status. Any extra administrative burden on HCWs, for example, in terms of filling out forms, should also be considered carefully. The intensive, seasonal nature of influenza vaccination campaigns may make the resource implications particularly pressing.

4.7. General issues regarding evaluation

With some exceptions, primarily the studies of hard mandates, most research has focused on multi-component programmes, which combine a range of different strategies. It seems likely that multi-component strategies will continue to be the focus of practice and evaluation research. In particular, approaches which combine strategies focused on behaviour change at the level of individual HCWs (such as incentives or education) with strategies at an institutional level (such as increasing accessibility) appear promising. Some intervention study authors (and previous systematic reviews; Lam et al. 2010) suggested that the difficulty of isolating the effectiveness of specific strategies within broader intervention programmes is a limitation of the evidence base. However, the qualitative evidence (and some of the contextual information from the intervention studies) suggests that the detail of the components, included in an intervention, is less important than the broad ethos informing it and the organisational and policy context within which it is delivered. In addition, we would argue that a more granular consideration of the effectiveness data would only make it harder to generalise from the specific contexts of the studies. Factorial or head-to-head designs, intended to isolate the effectiveness of intervention components, may have a place, but will probably be less useful than trials using a usual-care or no-intervention control group.

Many of these multi-component interventions, and also the mandatory interventions, can only be delivered at a fairly large scale (e.g., a hospital). Hence, randomised trials of such interventions need to be cluster-randomised trials with allocation at the level of the institution (or at least departments or units). Of the 13 RCTs in the intervention review, 10 were cluster-randomised; the three individually randomised studies focused on educational strategies targeted at individuals. Cluster-randomised trials generally need a larger sample size than individually randomised trials, which makes them more costly and complex. However, this is inevitable if such programmes are to be robustly evaluated.

4.8. Other gaps in the evidence

4.8.1. Groups of HCWs

There is some evidence that different occupational groups (e.g., doctors, nurses, and non-clinical staff) may perceive and respond to interventions differently. While we have not analysed subgroup outcome data for the intervention studies, there may be some potential for interventions to use different strategies for targeting these groups. Evaluation studies should collect subgroup data on occupational groups. Formative research (see below) could be of value both to determine whether differences between groups could influence intervention impact, and to inform the choices of subgroups (if any) for statistical analysis.

Intervention implementers should consider whether non-employees (e.g., students, contract staff, and volunteers), non-clinical staff in patient areas (e.g., porters and receptionists), and staff without direct patient contact (e.g., laboratory staff) fall within the scope of the programme. There may be administrative challenges to including, and indeed identifying, all relevant groups. The decision as to which to include should be based on a valid infection control rationale, and clearly communicated to all staff. The scope of the intervention should also be clearly stated in evaluation reports; many intervention studies were vague about who counted as a HCW and who was targeted by the intervention.

4.8.2. Formative research

Most interventions were not based on formative research to establish the preferences and views of the targeted HCWs (some intervention studies reported that some aspects of intervention strategies were based on survey data, or that participants' feedback on strategies was sought, but their involvement was generally limited). Taking HCWs' views into account in developing interventions could help to increase the effectiveness and acceptability of interventions, and reduce the likelihood of adverse effects (Craig et al. 2008). While this report provides an overview of the available evidence, HCWs' views and potential implementation issues are likely to vary between sites. Intervention implementers could consider conducting qualitative research with staff in targeted organisations before finalising intervention content. This would not need to be extensive or methodologically sophisticated to be of value.

In addition, few intervention studies collected data on participants' views of the intervention. The inclusion of views data along with effectiveness data in trials would be valuable in helping to understand how interventions work, and any barriers to their implementation. The review also located no qualitative studies at all from the UK: this is a major gap in the evidence base.

4.8.3. Theoretical foundations

While the value of theory has sometimes been overstated, the lack of theory in existing research is problematic. Intervention studies would benefit from focused thought at an early stage regarding: the theory or theories of change which set out the hypothesised mechanisms of effect of the intervention (e.g., through changing individual beliefs, shifting social norms, or changing default behaviours); the possibility of adverse effects; and the organisational history and context within which the intervention is to be implemented. Below we suggest that the Behaviour Change Wheel approach (Michie et al. 2014) might offer such a theoretical framework.

4.8.4. Outcome measures

There was a lack of validated outcome measures in the intervention research, with most only measuring vaccinations received within the organisational system and not attempting to track total vaccination coverage, and most of those which did, relying on self-reported vaccination status. Future intervention studies should, where possible, aim to collect validated data on vaccinations received outside the organisational system being studied.

4.8.5. Setting

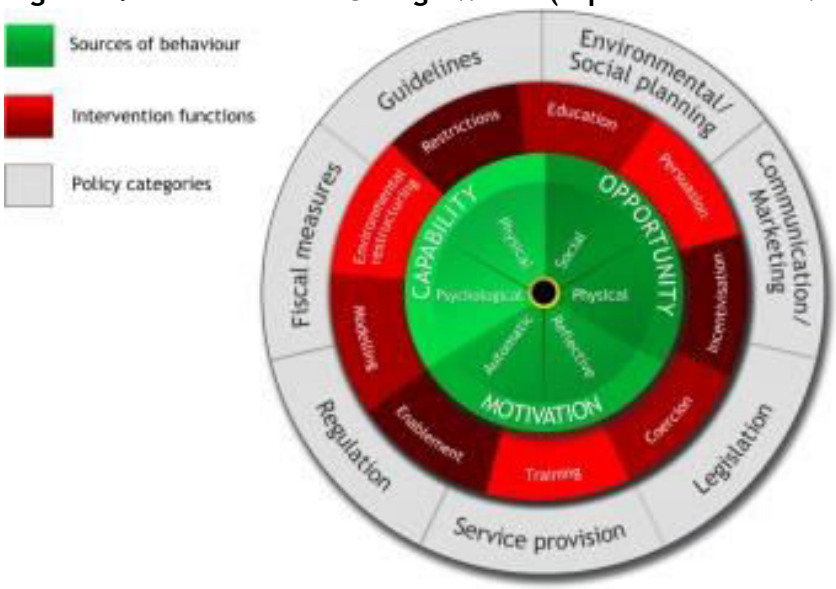
There is a need for more robust research in all healthcare settings. Most intervention studies have been carried out in hospitals, but few have adopted RCT designs. Although there has been less research on nursing homes or long-term care for older people, the available studies are more robust, including several RCTs. We identified no intervention research in primary care settings, nor in any other setting (e.g., mental health).

4.9. Developing future interventions: the Behaviour Change Wheel approach

In this section, we outline possibilities for thinking about the development of future interventions, or the selection of programmes to evaluate. As noted above, most published literature has taken a pragmatic, non-theory-based approach to the delivery, implementation and evaluation of interventions.

We have used Michie et al. (2014)'s Behaviour Change Wheel (BCW) as an example here. The BCW is a theoretical framework, for thinking about interventions, that takes a bottom-up approach to behaviour change. It has been widely used for interventions targeting HCW behaviour (Michie et al. 2014), so is well suited to the topic of promoting seasonal influenza vaccination. The analysis presented is a somewhat abbreviated version of the BCW process and does not include all the steps which a full BCW analysis would cover. Also, a full analysis would ideally involve a range of stakeholders. Nonetheless, this brief analysis provides some pointers about future research. Michie et al. (2014)'s graphical overview of the BCW is reproduced in Figure 3.

Figure 3. The Behaviour Change Wheel (reproduced from Michie et al. 2014)



The first step in applying the BCW is to identify and specify the target behaviour. The core of the analysis is then the COM-B model, in which Behaviour is seen in terms of a combination of Capability, Opportunity and Motivation. The next step is to identify the intervention functions which may impact on the relevant determinants from the COM-B model (roughly corresponding to the intervention components in our analysis). Finally, policy categories are identified to support the implementation of intervention functions.

4.9.1. Identifying and specifying the target behaviour

For our purposes, the target behaviour is increasing seasonal influenza vaccination among HCWs. A full BCW analysis would need to begin by (a) listing all the behaviours which could be relevant to the wider goals of policy (including broader infection control and workplace safety strategies), (b) understanding the place of each within a system of behaviours, and (c) analysing them in terms of potential impact and difficulty of change in order to identify the most promising targets. However, this is beyond the remit of our project.

4.9.2. The COM-B model

COM-B is a general model of behaviour change which includes capability, opportunity, and motivation as shown in Table 11. We include examples of how each might relate to the behaviour of interest (increasing influenza vaccination in HCWs).

Table 11. Indicative COM-B model for influenza vaccination for HCWs

COM-B domain		Potentially relevant factors with respect to influenza vaccination in HCWs
Capability	Physical	-
	Psychological	? Overcome fear of needles
Opportunity	Physical	Location and opening hours of vaccination clinics Availability of vaccine
	Social	Organisational policy on vaccination Senior staff seen to accept vaccination
Motivation	Automatic	? Habitual acceptance of vaccination
	Reflective	Beliefs about effectiveness of vaccine and side-effects Beliefs about efficacy of vaccination programmes in improving patient outcomes Ethical commitments to patient care

As Table 11 suggests, the Capability domains of the COM-B model are of limited importance to the question, since accepting vaccination does not pose any challenges for most HCWs in terms of their physical or psychological abilities. The Automatic Motivation domain is probably also of limited importance. Thus, the COM-B identifies the important target domains as: Physical Opportunity (primarily relating to the availability and accessibility of vaccination), Social Opportunity (relating to social networks and also to institutional or organisational factors) and Reflective Motivation (relating to the beliefs and values which may influence HCWs' choices regarding vaccination).

4.9.3. Intervention functions

Table 12 shows the intervention functions included in the BCW. It also links the BCW functions to the intervention categories used in our analysis, and provides some specific examples from the intervention literature.

Table 12. Intervention functions (partly adapted from Michie et al. 2014)

Intervention functions (BCW)	Definition (Michie et al. 2014)	Intervention categories (Lytras et al. 2016)	Examples
Education	Increasing knowledge or understanding	Education Increased awareness	Presentations or lectures Posters, emails
Persuasion	Using communication to induce positive or negative feelings or stimulate action	Education	Champions Social marketing
Incentivisation	Creating an expectation of reward	Incentives	Gifts Prize draws
Coercion	Creating an expectation of punishment or cost	Soft mandates Hard mandates	Declination form programmes
Training	Imparting skills	-	-
Restriction	Using rules to increase opportunity to engage in target behaviour	Hard mandates	Condition-of-employment policies
Environmental restructuring	Changing the physical or social context	Increased access	Mobile carts Workplace vaccination

			clinics
Modelling	Providing an example for people to aspire to or imitate	Increased awareness	Champions Vaccinating senior staff
Enablement	Increasing means or reducing barriers (beyond education, training or environmental restructuring)	-	-

As discussed in the main analysis, many of Lytras et al. (2016)'s categories cut across these intervention functions. For example, strategies such as mobile carts may act to persuade or educate individuals as much as to restructure the environment. (It should also be noted that Michie et al. (2014)'s understanding of 'coercion' focuses on interventions, such as pricing, which change the cost-benefit profile of decisions; in the review the 'soft' mandate interventions are arguably closer to this than the 'hard' mandates, which would count as 'restriction' in the BCW.)

The intervention functions, within the BCW, offer a somewhat more nuanced account of potential intervention strategies than Lytras et al. (2016)'s framework. Table 13 (reproduced from Michie et al. 2014) illustrates how these strategies can impact on the determinants identified by the COM-B model.

Table 13. Matrix of links between COM-B and intervention functions (reproduced from Michie et al. 2014)

	Education	Persuasion	Incentivisation	Coercion	Training	Restriction	Environmental restructuring	Modelling	Enablement
Physical capability					■				■
Psychological capability	■				■				■
Physical opportunity					■	■	■		■
Social opportunity						■	■	■	■
Automatic motivation		■	■	■	■		■	■	■
Reflective motivation	■	■	■	■					

Table 13 suggests that if Physical and Social Opportunity and Reflective Motivation are the most salient determinants of behaviour, then potentially all of the intervention functions may be of value in targeting vaccination uptake.

A full BCW analysis would also include an analysis of each intervention function using the APEASE criteria:

- affordability
- practicability
- effectiveness / cost-effectiveness

- acceptability
- side-effects / safety
- equity

While such an analysis is beyond our scope, we touch on these issues in the body of the report. In particular, there are concerns as to the acceptability of the 'coercion' and 'restriction' functions (as Michie et al. 2014 recognise), as well as issues with practicability and possibly side-effects.

4.9.4. Policy categories

The outer ring of the BCW includes the broader policies which can help to support the intervention functions. Table 14 again shows Michie et al. (2014)'s definitions of these along with some examples from the intervention research included in our synthesis.

Table 14. Policy categories (partly adapted from Michie et al. 2014)

Policy category (BCW)	**Definition (Michie et al. 2014)**	**Examples**
Communication / marketing	Using print, electronic, telephonic or broadcast media	Social marketing campaigns
Guidelines	Creating documents that recommend or mandate practice	Guidelines and support for implementation of programmes (Chambers)
Fiscal measures	Using the tax system to reduce or increase the financial cost	-
Regulation	Establishing rules or principles of behaviour or practice	Mandatory programmes Organisational policies which, e.g., require publication of vaccination data, or principles to ensure accessibility of vaccination
Legislation	Making or changing laws	Laws mandating promotion of vaccination, declination forms etc.
Environmental / social planning	Designing and/or controlling the physical or social environment	Dedicated on-site clinics Interventions aiming to change social norms (e.g., champions, group incentives)
Service provision	Delivering a service	Mobile carts

While we have not exhaustively reanalysed the intervention data according to these principles, we make some general observations. Most of the interventions relied on some combination of communication / marketing and service provision. Regulation and legislation have mostly been adopted in the form of hard mandate programmes; non-mandatory legislative measures were mentioned in the qualitative literature (Khodyakov et al. 2014) but not in the intervention literature. Fiscal measures (providing free vaccine) were occasionally used, but are of limited relevance to the UK context. Environmental and social planning have been used in some cases, particularly in interventions aiming to change social norms, but have rarely been explicitly theorised as such.

4.9.5. Implications

As noted, this is not a full BCW analysis, but our more limited approach gives an indication of how future intervention research might be conceptualised. At the most general level, it supports the idea (already implicit in much research and practice) that interventions should seek to use a range of different strategies to address different determinants of behaviour. The BCW suggests, and research evidence tends to confirm, that a wide range of factors influence HCW vaccination behaviour, from highly reflective reasoning about the value of vaccination programmes, to contingent matters of physical and social opportunity. The BCW indicates that a range of intervention functions may be appropriate to target this behaviour, subject to an analysis of the possible barriers to implementation represented by the APEASE framework.

The BCW's distinction between intervention functions and policy categories also helps to focus attention on the organisational or systemic dimension of interventions. We have already suggested that the precise mix of intervention strategies (the second ring of the BCW) may not be the most important question for people designing and implementing policies in this area. Rather, the overarching approaches represented by the outer ring deserve more attention. Much of the literature reflects an understanding of the intervention landscape as split between mandatory and voluntary approaches, where the former involve direct restriction of the behaviour of individual HCWs, and the latter focus mainly on education and persuasion. The BCW suggests that this leaves out interventions which primarily target organisational policies, but do not use coercive or restrictive means to change HCWs' behaviour. This could include, for example, using guidelines or regulatory approaches to influence organisational behaviour and culture, and incentivise local decision-makers to focus on vaccination uptake, while allowing them to choose the best mix of approaches for their particular situation. While the one recent RCT to have explicitly evaluated such an approach found it to be ineffective (Chambers et al. 2015), there is still scope for evaluation research on such organisation-level policy interventions.

The category of environmental and social planning, and the question of how interventions could promote vaccination by influencing (if not 'designing or controlling') the social environment, also deserves further attention. Some work has been done on interventions based on social networks, such as champions and social media campaigns, but this might be a promising focus of further research. (Such interventions could also have the benefit of informally enabling HCWs to feed back on the content of promotion campaigns.)

As noted, this is not a full BCW analysis, and a more complete application of the framework would include several more steps, particularly a wider discussion of the behaviour to be targeted, and a breakdown of potential barriers in terms of acceptability, practicability and equity. It might also involve extending the framework to consider more detailed aspects of intervention delivery, such as the content or level of educational messages, which the qualitative evidence suggests may influence the likely success of such interventions. It should also incorporate engagement with and understanding of HCWs' priorities and views: a full BCW analysis would involve input from a range of perspectives, both at the initial stages of defining the goals of the intervention, and at the subsequent stages of mapping out intervention components and policy categories. (As discussed above, such input has very rarely been a feature of evaluated interventions.) Such an application of the BCW could be a useful guide for thinking both about the design and

implementation of interventions, and about formative research to tailor them to particular contexts.

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Appendices

Appendix A. Search strategy for review of qualitative studies

Database: Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

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1 exp health personnel/ or exp allied health personnel/ or exp dentists/ or exp nurses/ or exp nursing staff/ or exp personnel, hospital/ or exp pharmacists/ or exp physicians/ (419844)

2 ((healthcare or health or medical) adj2 (personnel or worker$ or staff or practitioner$)).ti,ab. (69914)

3 (doctor$ or clinician$ or physician$ or nurse$ or dentist$ or pharmacist$ or midwife$ or practitioner$).ti,ab. (878516)

4 1 or 2 or 3 (1152039)

5 Influenza Vaccines/ (18610)

6 Immunization/ (46785)

7 (vaccin$ adj4 (flu or influenza or SF)).ti,ab. (18076)

8 (immuni$ adj4 (flu or influenza or SF)).ti,ab. (3431)

9 5 or 6 or 7 or 8 (70432)

10 Influenza, Human/ (41367)

11 (flu or influenza).ti,ab. (83856)

12 10 or 11 (89997)

13 4 and 9 and 12 (3450)

14 exp animals/ not humans.sh. (4245677)

15 13 not 14 (3442)

16 Attitude/ (41988)

17 Attitude of Health Personnel/ (100062)

18 Health Knowledge, Attitudes Practice/ (83835)

19 Choice Behavior/ (25562)

20 Decision Making/ (75572)

21 16 or 17 or 18 or 19 or 20 (303606)

22 (attitude$ or barrier$ or belief$ or believ$ or choice$1 or choose$1 or consider$ or decision$ or experienc$ or facilitat$ or factor$ or influence$ or opinion$ or option$ or preference$ or promot$ or view or views or viewpoint$).ti,ab. (6772567)

23 21 or 22 (6882220)

24 Qualitative Research/ (27145)

25 qualitative.ti,ab. (152193)

26 "Surveys and Questionnaires"/ (344617)

27 (survey$ or questionnaire$).ti,ab. (759219)

28 24 or 25 or 26 or 27 (1023758)

29 23 or 28 (7307199)

30 15 and 29 (2287)

Appendix B. Evidence tables: intervention studies

Abramson et al. (2010)

Setting	“Primary care community clinics”
Population	“All 344 permanent workers with direct patient contact—physicians, nurses, pharmacists, and administrative and ancillary staff—were included."
Intervention	"the intervention (in 13 of the 27 clinics) included a lecture session to the staff given in the clinic by a family physician …, e-mail distributed reminders and relevant literature, and recruitment of a key figure from the local staff (physician or nurse) who personally approached each staff member."
Information from discussion	"The intervention proved successful both among staff who had been immunized and those who had not been immunized the previous season. Among those not immunized the previous year, however, the intervention appeared not to be effective among staff who previously had an objection to immunization. It was more effective among those who gave other reasons for not receiving immunization, mainly belief that there was insufficient reason to immunize or lack of time. ... Immunization, which was correlated with lecture attendance (examined in 4 of the clinics), was not necessarily the effect of the lecture but possibly of the choice to attend the lecture; participation was significantly higher among workers with characteristics previously found to be associated with higher immunization rates. About two-thirds of the intervention staff attended the lecture, and possibly even fewer read the educational material sent by e-mail. It is probable that the specifics of the lecture and educational material played only a minor part in the success of the intervention. Our impression is that the program’s success resulted from the general effect of raising the immunization issue and recommendation repeatedly and from different directions: medical literature, a familiar family physician with expertise, and a local staff member. ... The success of our program, compared with the failure in the 1 previous controlled trial that included primary care staff, in which the intervention was performed by a visiting public health nurse, may partly have resulted from this multifaceted approach. Management not being involved in the program may have possibly decreased resistance and increased staff responsiveness. ... The intervention requires little investment of time and resources"
Limitations (author)	NR

Ajenjo et al. 2010

Setting	Non-profit healthcare organisation including 13 hospitals (2 academic acute, 4 community, 7 small suburban or rural)
Population	"All types of hospital employees defined as contracted personnel were included. The approximately 4,600 credentialed private physicians are offered free influenza vaccination but their vaccination rates were not tracked by BJC HealthCare because they are not hospital employees and so they were not included."

Intervention	Free vaccine; promotion (posters, communication forums, emails, campaign slogans, incentives incl. gifts / cash); delivery in multiple worksites, cafeterias, hallways etc.; promotion of leadership support; "system comparative data to promote friendly competition ... influenza vaccination rate included Best in Class scorecard"; declination statements. "HCWs had to either get the influenza vaccine or sign a declination statement, however, there were no penalties for employees that did not comply and not all unvaccinated HCWs filled out a declination form."
Information from discussion	None
Limitations (author)	Cannot distinguish effectiveness of intervention components (particularly declination form vs inclusion of vaccination data on scorecard). "[W]e were unable to obtain complete data before 2000. Some data were obtained from the structured interviews, which may not be completely accurate due to the subjective nature of this data, reliance on participants' memory, and the potential for recall bias. We were unable to obtain specifics about employee job titles in different facilities and influenza vaccination compliance among students was not tracked. Regarding physician influenza vaccination rates, this study only includes physicians who were employed by BJC HealthCare, primarily residents and fellows. Physicians in private practice or employed by Washington University in St. Louis were not officially tracked by BJC Occupational Health Services."

Awali et al. 2014

Setting	Tertiary care hospital in urban area
Population	Aimed at 'all healthcare personnel', no further information. "The majority of respondents were aged 36-65 years (75%), non-Hispanic white (66%), female (86%), working as a nurse (33%), and at the current job for >10 years (51%)."
Intervention	"The mandatory vaccination policy adopted in 2011-2012 specified that all HCP be vaccinated against influenza each year when the vaccine becomes available and no later than the annual deadline established by the hospital's Vaccination Planning Committee. Vaccination is a condition of employment for all HCP, including contracted, clinical, and nonclinical personnel. HCP who fail to obtain the vaccine receive a written warning with a suspension of at least 3 days, and are expected to be compliant by the end of the suspension period. HCP who fail to comply with the policy by the end of the suspension are immediately terminated. Exemptions for medical, religious, or other reasons are reviewed and validated by the hospital Occupational Health Services (OHS). HCP who are deemed exempt or are not vaccinated are required to wear a mask whenever within 6 feet of patients during influenza season or are reassigned from high-risk units, such as intensive care units or protective environment patient care areas, to low-risk units."
Information from discussion	"A pro-mandate attitude of HCP was significantly associated with receipt of influenza vaccination even after controlling for demographics and potential confounders. ... HCP who provided direct patient care were more willing to be vaccinated."
Limitations	"Web-based survey had a low response (32%) […] the survey was

(author)	based on voluntary, self-reported data, which might have led to social desirability and selection bias. […] the 2011-2012 seasonal influenza vaccination received much publicity, which might have contributed to the increased rate of vaccination in our HCP"

Babcock et al. 2010

Setting	Healthcare organisation including acute hospitals, 'extended care facilities', 'employed physician groups', etc.
Population	“all BJC employees, regardless of job function, including clinical and nonclinical staff, contracted clinical personnel, and volunteers. Hospital-employed physicians, including hospitalists, residents, and fellows, were included in the policy. Most attending physicians affiliated with BJC HealthCare are in private practice or are employed by Washington University School of Medicine (St. Louis, MO) and are not covered by the policy."
Intervention	“In 2008, as a patient safety initiative, influenza vaccination was made a condition of employment for all BJC employees ... The policy was communicated to employees through their managers, with standardized educational materials and fact sheets provided; an Intranet site; letters mailed to employees’ homes; articles in BJC Today, an in-house newspaper distributed at all facilities; and “Town Hall Meetings” scheduled throughout the vaccination campaign with infectious diseases physicians, infection prevention specialists, and occupational health nurses available for questions or concerns. The CEO of BJC published a letter in the BJC newspaper explaining the rationale for the policy. … Free vaccine, including thimerosal-free and intranasal preparations, was available at multiple locations at all facilities starting 15 October 2008. Vaccinations were tracked at each facility in real time. … All data were entered in real time or were downloaded regularly into the BJC occupational health database. Feedback was provided not less than weekly to managers at the facilities. Managers interacted with their staff to ascertain reasons for noncompliance and to provide coaching about influenza, the vaccine, and the consequences of noncompliance. Employees who were neither vaccinated nor exempted by 15 December 2008 were suspended without pay. Those who were vaccinated before 15 January 2009 could return to work. Employees still not vaccinated or exempt by 15 January 2009 were terminated for failure to meet their conditions of employment….. Medical or religious exemptions could be requested.”
Information from discussion	"Key factors that supported the success of the program included consistent communication emphasizing patient safety and quality of care, coordinated campaigns, leadership support, and medical director support to talk with any employee with concerns about the vaccine, on request. The program was established as a patient safety initiative; thus, no prospective attempts were made to link to absenteeism. ... Exemption requests often reflected misinformation about the vaccine and about influenza among employees and among their physicians. Several requests cited chemotherapy or an immunosuppressed state as reasons not to get the vaccine, even though these groups are at high risk for complications from influenza and are specifically recommended to be vaccinated. Several requests

	cited pregnancy, although the vaccine is recommended during pregnancy. ... Some health care workers whose initial request for exemption was denied returned to their personal physician for a more detailed note or requested that occupational health contact their physician to discuss their request. Some community physicians felt beleaguered by these multiple contacts. ... BJC HealthCare benefitted from strong leadership support for this initiative and a solid infrastructure for timely and consistent communication ... Not all physicians affiliated with BJC HealthCare are employees of the organization and, thus, were not covered by the policy.”
Limitations (author)	Effect on time off work not evaluated.

Camargo-Ángeles et al. 2013

Setting	Tertiary hospital
Population	“all health personnel”
Intervention	Leaflets, posters, letters, recommendation that unvaccinated HCWs wear mask
Information from discussion	All messages in the campaign were framed positively.
Limitations (author)	Cannot determine which component has more impact.

Chambers et al. 2015

Setting	A range of healthcare organisations including teaching hospitals, paediatric hospitals, community hospitals, regional health authorities, district health units, assisted living facilities, nursing homes and long-term care facilities
Population	"healthcare personnel", not further specified
Intervention	The main intervention is a guide for implementation of programmes (reproduced as a supplementary file to the paper) - which recommends various strategies incl. improved access, mandates etc. - but those aren't technically the intervention (since control sites continued doing whatever campaigns they had on already). "The Guide outlines five steps to planning, implementing and evaluating a seasonal influenza immunization program for healthcare personnel. Tools and checklists are provided as supplements to the Guide (the Tool Kit), as additional resources for program managers. … It was assumed that successful implementation of the Guide would require: an organizational context that was receptive to using the Guide to improve the organization’s voluntary influenza immunization program, and facilitation support from outside the organization on Guide implementation and on the day-to-day operation of the program. Two facilitated training workshops were held … The full-day interactive workshops provided in-depth assistance on how to implement the steps of the Guide and use the Tool Kit. The workshops were run by members of the research team. Two organizations did not send managers to these workshops, as they joined the trial too late. However, they received phone assistance about implementing the Guide from the research team. … individual

	site workshops were held at each of the 13 Intervention organizations. These workshops were held to conduct on-site inter-professional team training and facilitate problem-solving specific to each site, all involving senior leaders within the organization. Throughout the two intervention years … the research manager, in collaboration with experts in the Canadian Healthcare Influenza Immunization Network (CHIIN), maintained an ongoing relationship with the program managers in the Intervention group and responded to questions related to influenza and influenza immunization, the Guide, or other related topics. The Intervention group program managers were encouraged to use the network to share knowledge and resources, including use of a secure Internet forum. They were instructed not to share the Guide with other organizations. The organizations in the Control group implemented their campaigns as usual, without the Guide or any facilitation support. "
Information from discussion	"While the Guide, Tool Kit and facilitation costs were provided to the Intervention Group, these organizations reported incurring other costs from their previous practices for planning, implementation and evaluating their program, which could be expected when transitioning to a program with the whole organization fully engaged. … the trial organizations were found to not have comprehensive programs that did not focus on organizational change [at pre-test?]. … In this pragmatic trial, the turnover of program managers in both the Control and Intervention Groups created problems with the collection of both program implementation details and immunization rates. However, because the organization, rather than the individual manager, had committed to the trial, and, as importantly, the trial staff remained the same during the trial, organizations were able to obtain and report data required for the trial. … The learnings from preparatory work for this Trial demonstrated that: 1. within organization political challenges to influenza immunization of healthcare personal must be resolved including labelling activities to increase rates as a "program" and managing the program like other "programs" in the organization; 2. organizational commitment to the program from managers, leads and senior managers is required; 3. greater trust in the organization leaders who are implementing the program is required; 4. departmental silos must be removed and inter-professional/department co-operation encouraged; and, 5. there must be greater organization-wide understanding of the purpose of the immunization programs, the vaccine and its side effects. … The Intervention group in this trial reported that making the changes recommended in the Guide required substantial organizational changes. … Assistance to facilitate implementation of the Guide requires resources from somewhere in the system. It may be that facilitation is an important intervention component, but the design of this trial did not allow for the exploration of this as a separate effect."
Limitations (author)	"the turnover of program managers ... created problems with the collection of both program implementation details and immunization rates" - but unclear what these were exactly. Post-test rates may have been influenced by H1N1. "The 46 organizations were not recruited as estimated in the trial protocol sample size calculation. Too little information from previous studies was available to guide the level of difference between groups and times to know what

	would be clinically/administratively significant. Also, a simple randomized trial design was chosen to be used and can lead to imbalance in the characteristics of the groups being compared. ... Information characterizing the 46 organizations that did not participate in the Trial was not collected. It is possible that the 26 participating organizations differ from these organizations."

Chamoux et al. 2006

Setting	Teaching hospital
Population	Apparently all HCWs, but with focus on high-risk groups / specialisms
Intervention	vaccination clinics in workplace health centres; letters to individual HCWs; information for managers; lectures delivered by doctors; vaccination in workplace sites for high-risk groups
Information from discussion	The combination of three distinct factors (individual information, awareness raising and vaccination clinics) probably had an impact greater than the sum of the parts ("l'effet 'potentialisateur'"). High rate of adverse reactions observed.
Limitations (author)	Impact of individual letters and information for management can't be evaluated separately. Impact on health outcomes not evaluated.

Chittaro et al. 2009

Setting	Acute care university hospital
Population	"all HCWs (physicians, nurses, and ancillary workers)"
Intervention	Personalised letter; vaccination delivered in workplace sites (wards); staff "actively invited HCWs to be vaccinated". Vaccines free of charge at both pre and post
Information from discussion	Avian flu threat increased uptake of vaccination in short term. "In general, healthcare personnel who are highly motivated often attend the hospital's occupational health unit, while those who believe in vaccination but do not have the time generally take advantage of the availability of the vaccinators within the ward, as do the HCWs who are doubtful and need to be convinced before taking a decision. Based on their behavior during the 3-year study period, HCWs can be divided into four main groups: (1) those who never got vaccinated, the reasons for which should be explored in a future study; (2) those who were vaccinated in 2005–2006 in response to the advertized additional vaccination service provided in the wards; (3) those who were vaccinated in 2005 only, possibly in part due to the ''avian flu effect''; (4) those who were vaccinated each year, who firmly believe in the need to get vaccinated. Based on these results, we conclude that recruitment as a response to a global public health threat can be helpful in increasing vaccination rates, but it cannot guarantee a permanent effect. … [T]he benefit [of the intervention] was smaller during the second year after its implementation, and an alternative hypothesis to explain the lower coverage in 2006 could be the lack of sustainability of the impact of the campaign."
Limitations (author)	"The global rate of influenza vaccination among the HCWs in our study could have been underestimated because employees who were vaccinated outside of the hospital and could not be reached during

	the survey were considered as being not vaccinated." Results may reflect a general upward trend in Italian population over the study period.

de Juanes et al. 2007

Setting	Hospital, no further info
Population	All HCWs (nursing assistants, nurses, physicians, ancillary staff)
Intervention	Vaccine offered in workplace (information posters and letters at both pre and post)
Information from discussion	Highest impacts on physicians. "These increases can be mainly attributed to the adoption of vaccination in the workplace. ... Persons vaccinated in a previous campaign were between four and nine times more likely to be vaccinated in future seasons."
Limitations (author)	Effect may reflect impact of SARS or avian influenza.

Dey et al. 2001

Setting	Primary care + nursing homes
Population	Doctors, nurses, admin, ancillary
Intervention	"those worksites allocated to the intervention group were visited by a public health nurse, who raised awareness of the campaign, emphasized the efficacy and safety of vaccination, outlined the possible side effects and contraindications, discussed the impact of influenza on absenteeism, and attempted to allay anxiety and to correct misconceptions. The public health nurse also disseminated promotional materials and informed staff where they could obtain vaccination free of charge. All GPs were informed by the Health Authority that they would be reimbursed for vaccinating any HCW ... We attempted to maximize ascertainment of vaccinated HCW by contacting GPs, practice nurses and practice managers on two occasions to remind them that reimbursement could be claimed for HCW vaccinated by their practice and advising them on how this could be secured. When practices informed us that they had vaccinated HCW but no claim forms had been received, these practices were given a further reminder."
Information from discussion	None
Limitations (author)	NR

Doratotaj et al. 2008

Setting	Tertiary care hospital in urban area
Population	"physicians and nurses with predominantly direct patient contact"
Intervention	"subjects were assigned to receive either (1) no additional intervention beyond the usual multi-factored approach (e.g., educational posters, newsletters, t-shirts, buttons, department meetings, and open access for long hours at multiple influenza shot stations), which had been successfully used in previous years; (2) an

	influenza vaccine educational letter with the hospital logo from the head of infectious diseases; (3) a palm tree-decorated raffle ticket offer to win a $3000 Caribbean vacation for 2, with documentation of receiving influenza vaccine; or (4) both the letter and the raffle ticket offer."
Information from discussion	"The difficulty of the raffle drawing entry process may have prevented a number of individuals from participating. ... A stronger positive effect may be seen if this study were repeated using an easier raffle entry process and with more widespread advertisement of the raffle beyond a single letter home, perhaps even featuring the prior year's prize-winning employee." Vaccine shortage during study period may have lowered uptake rates.
Limitations (author)	NR

Drees et al. 2015

Setting	"a 2-hospital, 1,100-bed, private, not-for-profit, community-based academic healthcare system"
Population	"all health system employees, regardless of level of clinical contact. In addition, the masking policy also applied to nonvaccinated physicians not employed by the health system."
Intervention	"[T]he new policy required all employees to complete 1 of 3 forms prior to November 30: a consent form (which included attestation of vaccination elsewhere), an exemption form (ie, either medical contraindications or religious exemption), or a declination form, which included reasons for declining. … Beginning 2 weeks after the start of the campaign, every manager and vice president in the system began receiving weekly lists of their employees, notated as vaccinated, not vaccinated, or no response. Managers were required to follow up with employees who had not responded. In addition, managers were aware of which employees had not been vaccinated and, thus, were required to wear masks once the flu season began … the task force decided to adopt a "blitz" campaign during the first 2 weeks of the season. Beginning in early October, vaccination stations were set up across all shifts at entrances to hospitals and other outpatient/ancillary facilities. Staff were not prohibited from entering via other entrances, nor were they required to stop at a vaccination station. At each entrance, volunteer "clerks" (who ranged from administrative assistants to leadership personnel) scanned the HCP's identification badge and the appropriate form (taking ~30 seconds), and then directed him/her to the next available vaccinator (volunteer nurses and pharmacists). After vaccination (or attesting vaccination elsewhere), HCP were given hanging badges, stating "I'm vaccinated because I care," to wear with their regular identification badges. Wearing the tag was not mandatory, but anyone not wearing an "I'm vaccinated" tag was required to mask while in patient care areas, regardless of their actual vaccination status. After the blitz ended, Employee Health staff served as roving vaccinators to capture weekend staff and others, but the need for this measure was greatly diminished compared to prior years, as ~70% of all employees were vaccinated during the initial "blitz." … The policy used the existing disciplinary process for employees who either

	did not complete 1 of the 3 forms by November 30 (ie, the mandatory declination), or who were not vaccinated and repeatedly failed to mask. While the discipline alone did not result in termination, it was considered in performance evaluations and could result in an employee being considered “below standard.” Employees in this status were ineligible for annual raises or any financial incentive. ... Health system leadership approved use of the employee influenza vaccination rate as 1 of 3 metrics comprising a pre-existing employee bonus program, known as the Transformation Rewards Program (TRP). … a minimum 75% employee influenza vaccination rate (excluding those with medical/religious exemptions) was designated as the TRP patient safety metric, with additional payout available if rates reached 80% or 85%. After determination of the total TRP bonus amount, that amount was then paid to all full-time employees in good standing (and prorated for part-time employees). Individuals were not required to be vaccinated themselves to receive the TRP bonus, as long as they were not under any disciplinary measures."
Information from discussion	“Our intervention to increase HCP influenza vaccination demonstrates theory and findings from the fields of communications, psychology, and behavioral economics, as well as adoption and diffusion of innovations and organizational changes. … Decisional balance is the process of weighing the gains and losses related to a decision. Ambivalent personnel may not decide until this balance clearly favors one or the other. Decisional balance was demonstrated anecdotally in our program when Employee Health reported a surge of employee vaccinations among those who had previously declined, once the start date for masking was announced (the negative consequences of remaining unvaccinated outweighed the benefits of declining vaccination). … Mandatory declination policies are frequently employed but with mixed results. Our experience demonstrated that such requirements are ineffective without accompanying accountability. We believe that adding accountability by requiring manager intervention and informing vice presidents was a major component of our success. … We did not require written documentation of outside vaccination, medical contraindication, or religious objection, instead allowing HCP to simply attest to their status, consistent with current CDC protocol.”
Limitations (author)	NR

Frenzel et al. 2016

Setting	"comprehensive cancer center" within teaching hospital
Population	All employees included in analysis, with focus on 4 high-risk groups in particular: "HCWs in high-risk areas included all employees working in the departments of stem cell transplantation and cellular therapy, leukemia, lymphoma and myeloma, infectious diseases, and pulmonary medicine and in the division of pediatrics, the division of anesthesiology and critical care, and emergency center areas. Nursing staff included all inpatient nurses and affiliated nursing staff. The clinical operations group, of which the high-risk areas and the nursing staff are subgroups, included all employees reporting to the physician-in-chief, providing direct patient care, providing hospital

	ancillary services, or providing administrative support. These employees are located in the main hospital complex and have a high likelihood of patient contact or have consistent interaction with HCWs who provide direct patient care. The patient care facilities group consisted of housekeeping employees with direct patient contact; these employees are responsible for cleaning inpatient rooms and surroundings or outpatient clinic facilities."
Intervention	"In 2006, our baseline year, the employee influenza vaccination program consisted of large, on-site influenza vaccination clinics that were distributed throughout >20 geographically dispersed patient care areas and research and administration buildings and were supplemented by 1 week of roaming vaccination services via mobile carts to patient care areas. … In 2007, EH initiated strategies to increase influenza vaccination rates … All influenza vaccination clinics were relocated to the main hospital complex. Roaming service hours were increased from 30 to >100 hours, enhancing easy access to vaccinations in busy patient care areas. We also increased the number of on-site clinics and the scheduled clinic hours to >100 hours to improve access to vaccination opportunities during all work shifts. We expanded our education and communication campaign by prominently advertising the expanded clinic schedule and centralized, hospital-based locations and distributing various educational materials on the safety and efficacy of influenza vaccination. We communicated with HCWs via all-employee e-mails, our institutional Web site, employee bulletin boards, and presentations at institutional meetings. Additionally, EH partnered with the infection control team to provide on-site vaccinations following their respiratory virus season in-services to inpatient areas as part of their preventive strategies to reduce nosocomial transmission. A mechanism for efficient on-site data entry of influenza vaccinations into an electronic medical record was developed, facilitating queries of vaccination rates and the ability to provide weekly updates of vaccination rates to supervisors and senior management. Furthermore, in 2009, we piloted the mandatory participation influenza prevention program, which targeted HCWs in high-risk areas and in the nursing staff as subsequently defined. Program compliance was defined as one of the following: receiving an influenza vaccination from EH, providing documentation of vaccination by an outside provider, or signing a waiver-declination form. The waiver declination form allowed for medical and personal belief exemptions and informed HCWs of the risk to our immunocompromised patients and to themselves posed by their declining vaccination. Weekly compliance updates were sent to managers and supervisors, and a final noncompliance list was sent to our executive leaders. In 2010, the program expanded to include all clinical operations employees; Patient care facilities employees with direct patient contact were added in 2011. In 2011, a compliance sticker was placed on institutional identification badges as visual confirmation of influenza vaccination. In 2011, a new state law in Texas required health care facilities to implement a vaccine-preventable diseases policy. This legislative directive enabled us to develop and implement an institutional policy in 2012 for a mandatory vaccination program requiring all HCWs, including employees, contractors, trainees, and volunteers, either to receive

	influenza vaccination or to wear a surgical mask when caring for patients during the respiratory virus season. Compliance with mask use for unvaccinated HCWs was the responsibility of supervisors in each clinical area and was documented in a vaccine preventable diseases policy compliance-monitoring database. Failure to comply with this policy could result in disciplinary action, including termination."
Information from discussion	"Sequential expansion of the program over several years was a key element to the success of our comprehensive, multifaceted influenza vaccination program. … Senior leadership supported our initiative by aligning institutional goals with the 2007 Joint Commission requirement to increase HCW influenza vaccination rates. … The use of mandatory declination forms has been associated with better HCW vaccine acceptance; however, the precise effect is unclear because of the simultaneous implementation of other strategies to increase vaccination rates, as in our program. On the other hand, the 2011 Texas state law requiring health care facilities to implement a vaccine-preventable diseases policy by 2012 for HCWs with routine and direct exposure to patients provided the legislative directive and impetus for our institution to implement a fully comprehensive mandatory influenza vaccination program. This mandatory program required employees who requested a vaccination exemption for medical contraindications or for reasons of conscience to wear a surgical mask when caring for patients; the 2012 program also required compliance tracking and employment actions for noncompliant individuals. The placement of a compliance sticker on institutional identification badges for all HCWs, including employees, contractors, trainees, and volunteers, as visual confirmation of influenza vaccination provided a readily accessible mechanism for supervisors to identify HCWs who had received vaccination. Unvaccinated HCWs did not have a sticker and were required to wear a surgical mask. The compliance stickers also promoted positive reinforcement from coworkers and patients who perceived vaccination as an important patient safety measure. … state laws requiring HCW vaccination as part of a comprehensive infection control program can provide an impetus and legal justification for employers to implement mandatory vaccination programs, as in our institution. Furthermore, effective educational and communication strategies that promote influenza vaccination as a core patient and HCW safety measure and that address beliefs and concerns about vaccination are critical for positively affecting HCWs' attitudes toward influenza vaccination and other vaccines."
Limitations (author)	Findings come from a single centre and may not be generalisable. (Other limitations relate to influenza outcomes and are not in scope of this review.)

Goodliffe et al. 2015

Setting	Academic acute care hospital
Population	"Staff and students"; "non-staff physicians ... payroll employees ... volunteers"
Intervention	Two separate comparisons are made in the study. (1) Oct-Nov Hospital-wide campaign with advertising and mobile carts in year 1

	(2011-12) and the same with the addition of champions and increased reporting in year 2 (2012-13), offering injections only. "[Year 1:] Intramuscular trivalent, inactivated vaccine was available, free of charge, at various times and locations throughout the hospital for staff and students. The vaccination campaign had support from senior leadership including modeling vaccine receipt, providing resources, and policy implementation, and was advertised using a variety of internal media with a corporate target of 53% for the season. … both stationary clinics and mobile carts [were] available Monday through Friday from 0700–1430 along with 4 evening clinics. Four weekend clinics and mobile vaccination carts offered vaccine during November. [Year 2:] Vaccine was available in the same areas and times as in the 2011–2012 campaign. Four changes were made compared with the previous year: 1) the corporate target was increased to 61%, 2) influenza vaccination champions were introduced who advocated for vaccination through education, advocacy, levering relationships, and negotiating professional boundaries, 3) managers followed up with more staff to complete vaccination/declination forms [note v unclear what this involved], and 4) unit-level coverage was reported to unit managers." (2) Dec-Feb nurses proactively approached staff with mobile carts and offered unvaccinated staff a choice of injection or intradermal vaccination. This is compared with the uptake figures in each year, but also itself varies: "[Year 1:] nurses provided vaccine with a mobile influenza vaccination cart during daytime, evening, and weekend hours. Staff were … vaccinated according to their preference of IM [intramuscular injection] or ID [intradermal] vaccine. [Year 2:] study nurses offered 3 choices of influenza vaccine through the mobile influenza vaccination cart: self-administered ID, nurse-administered ID, or nurse-administered IM. A trained study nurse demonstrated and verbally instructed the healthcare worker using a dummy injection device. Successful self-administration was defined as safely administering the full dose of ID vaccine on the first attempt."
Information from discussion	Only relating to injection vs intradermal, not in scope of this review
Limitations (author)	Multiple intervention components. Cannot determine likely effect of offering intradermal vaccine earlier in the promotion campaign.

Guanche Garcell et al. 2015

Setting	Secondary care hospital
Population	"physicians, nurses, and technologists"
Intervention	At both pre- and post-test: on-site clinics, mobile cart, free vaccination, educational materials and incentives. At post-test only: "Group educational sessions were conducted before the initiation of the campaign. Also, corporate email system was used for distributing information about the progress of the campaign. * On a weekly basis, the progress of the campaign was posted through reporting emails to managers and heads of departments. The information included immunization coverage in each department and names of pending staff (only for reminding purpose). * In a mandatory declination form, the HCWs who were not willing to be vaccinated were asked about

	the reason for their declination including medical reasons (eg, adverse events to components of the vaccine or other medical reasons) and nonmedical reasons (eg, religious, personal decision) ... No penalties or sanctions were applied to those who refused the vaccination."
Information from discussion	"During our intervention, we received the full commitment of the leaders and heads of departments; that was an important advantage to achieve the results. Strongly related with this were monitoring of compliance and giving feedback to leaders, implemented on weekly basis during our campaigns. The main purpose of such adopting such strategy was to remind those HCWs pending to receive the shot and to do additional educational actions, more at personal level. It is important to emphasize that although our results would be considered acceptable, because was achieve the goal of 90%, many of the refusals reported did not have a proper justification, mainly those who referred to nonmedical causes. "
Limitations (author)	NR

Harbarth et al. 1998

Setting	Selected high-risk departments (geriatrics, obstetrics, and paediatrics) in teaching hospital
Population	HCWs, not further specified
Intervention	Educational conferences; vaccine offered in workplace sites (wards, clinics and conferences); newsletter; electronic reminders; personal letters; posters; free vaccination (at both pre and post)
Information from discussion	"Unfortunately, the group of HCWs with the closest and most intimate contact with patients, the nursing personnel, was, and remained, the most reluctant to accept immunization."
Limitations (author)	Unclear generalisability. Time off work not assessed. Nationwide media campaign may have had impact on results.

Hayward et al. 2006

Setting	Care homes for older people (private)
Population	"staff", not further specified
Intervention	"Lead nurses in the intervention homes acted as advocates for vaccination. Staff in intervention homes were eligible for vaccination. A local occupational health service provided three vaccination sessions (at least one during a night shift) within the homes in October. Staff in control homes were informed of the study by letter and advised of the Department of Health recommendation that adults with chronic illness should be vaccinated by their general practitioner."
Information from discussion	None
Limitations (author)	NR

Heinrich-Morrison et al. 2015

Setting	"tertiary referral health service"
Population	HCWs, not further specified. Categories were "medical, nursing, allied health, laboratory, other staff with clinical contact, staff without clinical contact"
Intervention	"The program consisted of the following components: a) Vaccine availability. Immunisation nurses were available throughout the vaccination program on wards and during routine multidisciplinary meetings to offer the influenza vaccination to HCWs. … Staff resources available for vaccination outside of the mass vaccination days were … 2.9 EFT for 8 weeks. b) Communication. Information regarding staff influenza vaccination sessions was provided in weekly electronic communiqués with the support of senior executive and short presentations with a strong public health message were delivered at various hospital-wide meetings. A small campaign sticker was developed …. Posters and screensavers for network computers were locally developed and displayed across all three campuses. c) Marketing. In preparation for the 2014 HCW influenza vaccination program, the Public Affairs Unit at Alfred Health was engaged to formulate a social marketing campaign to improve staff influenza vaccination uptake. Key elements of this campaign included: Development of targeted messages to address perceived barriers to influenza vaccination; Improved marketing of mass influenza vaccination days, including enhanced communication strategies and provision of incentives for vaccinated staff. Marketing was based around general framing and specific targeted messages. … Specific messages were evidence-based, and focused on the increased risk of HCWs acquiring influenza, the small risks of serious complications from influenza vaccination and the risk of severe complications from natural infection…. d) Database and reporting…. a new database was developed to record all staff employed during the campaign, including each staff member's direct line manager. … On a weekly basis, names of those staff yet to declare their intention for influenza vaccination were extracted and submitted to managers so they could prompt staff to confidentially report to the Staff Immunisation and Exposure Management Unit. Regular reports of vaccination uptake displayed by ward, medical unit and employment category were disseminated electronically to all Alfred Health staff by hospital executive. e) Incentives. Free coffee was provided to staff who attended the first 3 hours of the mass vaccination days. Door prizes were also offered and the opportunity for any department achieving over 80% compliance with vaccination to go into a draw to win a coffee machine for their department."
Information from discussion	"Our immunisation program was implemented with only a small increase in resourcing, used to increase vaccine availability as well as developing a social marketing campaign and database support for timely reporting throughout the program. … Our findings also suggested that a significant minority of staff opted for vaccination elsewhere, an important issue to consider where a large proportion of the workforce is employed on a part-time basis. … Our program focused on the "marketing mix" of price (provided free, and addressing perceived barriers), promotion (strategic use of incentives, regular communication and feedback), placement (mass immunisation days supplemented by ward-based services) and product (emphasizing the benefits of vaccination). A feature of our

	infection prevention activities is the strong support of senior hospital executive and senior medical staff. … The staff influenza vaccination campaign forms part of a broader effort to improve patient safety at our health service by preventing infections in staff and patients. … Our program coincided with a statewide target of 75% vaccine uptake by HCWs being … introduced as a key performance indicator for Victorian hospitals. … Our program spanned … multiple hospital campuses, and did not involve direct liaison of hospital executive with employees"
Limitations (author)	NR

Honda et al. 2013

Setting	Tertiary academic medical centre
Population	"all employed HCWs, including staff physicians, residents, nurses, hospital administrative personnel, and other medical personnel (eg, pharmacists, paramedical staff) directly employed by Teine Keijinkai Medical Center. HCWs who were not employed by the study institution (eg, rotating medical students, medical volunteers) were not included"
Intervention	"Declination form use. Declination form was distributed to all HCWs, and they were required to submit the form before the influenza vaccination period. Vaccine fee coverage. Cost of vaccination was totally subsidized by the hospital (since the 2011–2012 season). Written announcement during vaccination period Written reminder of influenza vaccination requirement was distributed to all HCWs on day 8 of the influenza vaccination period. Prospective audit and telephone feedback. We tracked the HCWs who had not been vaccinated or had not submitted the declination form at days 5, 8, and 11 of the vaccination period. Real-time telephone feedback was provided for those who had not received vaccination on the last day of vaccination period. Medical interview by hospital executive with additional vaccination opportunities. Unvaccinated HCWs who had not submitted the declination form were interviewed by the hospital vice president. They were required to either accept vaccination at the interview or submit the declination form. Interviews were held over 3 days, and vaccination was provided at the time of the interview if they accepted. Mandatory submission of vaccination document from other institutions. HCWs who received vaccination outside the study institution were required to submit a receipt or certificate of vaccination."
Information from discussion	"It remains unclear why the vaccination rate among physicians before the interventional year was lower at the study institution. … It may be that physicians are not able to secure enough time for vaccination because of busy schedules. In this study, physicians comprised the majority of HCWs who interviewed with the hospital vice president, and they noted scheduling conflicts as the reason for not getting vaccinated. Increased vaccination rates overall were seen with our multifaceted intervention, especially among physicians. The study was also established as a quality improvement project at our institution because the decline of the HCW vaccination rate after the pandemic year's increase was concerning. … Although it is unclear

	why these interventions were so effective in our institution, we believe these interventions were culturally more acceptable and contributed to the high vaccination rate. … Since each intervention for this study was considered to be effective on the basis of prior published experiences, the implementation of a combination of interventions was felt to be important in achieving success. Implementing these strategies, however, required strong leadership at the institutional level, with increased recognition of the importance of vaccination of HCWs by the institution and financial support. Moreover, the content of each intervention also required a labor-intensive and time-consuming effort by the departments of infection prevention and occupational health. Besides planning the interventional strategies, a routine daily meeting was held during the vaccination period to review the real-time vaccination rate, make calls for real-time feedback, and establish the medical interview to improve adherence to the vaccination policy. These commitments were essential to improve the vaccination rate of HCWs without a mandatory program. … since the multifaceted intervention was not intended as a mandatory policy, we accepted all reasons for declination, regardless of the content."
Limitations (author)	Results may not be applicable to other settings. Pre and post data not strictly comparable because exclusions were applied in previous years. Not all HCWs included [more a limitation of the policy than the study].

Hood and Smith 2009

Setting	Non-profit organisation including "medical center with 297 beds, a physician network ... a home health company, a health plan, a health foundation, and a health care system."
Population	Staff, not further specified
Intervention	“A patient-centered, evidence-based approach to educating employees within the organization. * Vaccination at unit staff meetings, regardless of time and location. * Vaccination of night shift employees at alternative times (i.e., in the evening when they arrive, rather than in the early morning as they leave). * Vaccination at educational nursing activities such as “Skills Week.” * Declination for those who, after education, still decided to opt out of vaccination. This was considered a “last resort” approach, but the team was cognizant that this was an important part of The Joint Commission’s IC.4.15 standard. * Support from upper management for the vaccination campaign. This support had been present in the past, but needed to be more apparent to staff. * Replace the current computer-based training module on influenza with a new module on pandemic influenza as an annual training requirement for all staff. * Extra focus on high-risk units (i.e., hematology and oncology, neonatal intensive care, pediatric intensive care, and emergency department).”
Information from discussion	“The team chose not to include incentives because this was not part of the organization’s culture of caring. … Active support from upper management was an important part of the vaccination campaign. A presentation to System Leadership identified successes of previous programs, opportunities and challenges for improving vaccination

	rates for the organization, and content and design of the weekly e-mails. Overwhelming support was received"
Limitations (author)	NR

Iten et al. 2015a

Setting	Teaching hospital
Population	HCWs, not further specified
Intervention	"since 2012 … HCW were obliged to be vaccinated or to wear a mask in ward corridors and patient rooms during SI epidemics … HCWs vaccinated against SI wear a badge with the text "I am vaccinated to protect you" and those who were not vaccinated wear a badge with the text "I wear a mask to protect you"."
Information from discussion	None
Limitations (author)	NR

Kimura et al. 2007

Setting	Long-term care facilities for older people
Population	"all employees with direct resident contact (nurses, nursing assistants, rehabilitation therapists, and housekeeping staff)."
Intervention	(a) educational campaign including videos, flyers, posters; (b) 'Vaccine Day' including free vaccines delivered at workplace sites + posters, reminders. Study used 2x2 design comparing control, a, b, a+b in combination
Information from discussion	"LTCFs in the educational campaign group, Vaccine Day group, and combined intervention group reported that the interventions were easy to implement. On average, LTCFs reported spending less than 30 minutes on displaying posters and distributing flyers, less than 1 hour for planning in-service training, and less than 1 hour for organizing Vaccine Days. … the estimated cost to conduct both the educational campaign and Vaccine Day interventions in a facility with 100 employees was $1150. … We feel that offering the vaccine in such a well-publicized, institutionally supported manner was critical to the success of this intervention. … Although our educational campaign addressed [HCWs'] misconceptions, it did not significantly affect employee vaccination when implemented independently of Vaccine Day. Therefore, although education should be part of any intervention to increase LTCF staff vaccination, improving access to the vaccine is crucial."
Limitations (author)	Low response rates for survey data. Respondents and non-respondents could not be compared because responses were anonymous. Only one setting and hence potential sampling bias. Compliance and completeness of implementation were not assessed.

Ksienski 2014

Setting	All acute and residential care facilities in province

Population	"all health authority employees, medical trainees (medical students and residents), staff physicians, administrative and non-patient care staff (i.e., housekeeping or medical records), contractors and vendors (all such individuals collectively referred to as “health care workers”) who attend a patient care area."
Intervention	"The Policy requires all HCWs to be vaccinated annually against influenza or to wear a surgical mask while in patient care areas for the entire flu season (December 1 to March 30 inclusive). Influenza vaccination (specifically, the trivalent inactivated vaccine) is provided at no charge through onsite clinics and can also be obtained from an individual’s general practitioner or local pharmacy. HCWs are obligated to report their vaccination status annually to Infection Control. Once vaccinated, a HCW must place a green dot on his or her identification tag. HCWs who witness any colleagues violating the Policy are required to report the incident to their supervisor. As initially designed, non-compliance would result in remedial action; continued violation of the Policy could ultimately result in termination of employment, contract cancellation or revocation of faculty privileges."
Information from discussion	Stakeholders questioned the policy on grounds of (1) vaccine efficacy (2) lack of robust evidence showing HCW vaccination improves patient outcomes (3) masking efficacy. “Ultimately, the Health Sciences Association filed formal grievances with the Health Employers Association of BC (represents the health authorities) in November 2012. It contended that a collective bargaining agreement could not be unilaterally modified, that the Policy violated section 7 of the Canadian Charter of Human Rights and Freedoms (right to liberty and security of persons) and was coercive, stigmatizing and shaming. … the arbitrator ultimately sided with the Health Employers Association of BC. First, he reaffirmed that nosocomial influenza is a serious disease that causes devastating morbidity and mortality among the elderly and the chronically ill. On review of the evidence, Mr. Diebolt felt that influenza vaccination is approximately 60% effective in conferring immunity to the recipient and does reduce transmission from infected HCWs to patients. Second, other unilaterally imposed vaccination policies (e.g., vaccination or unpaid leave of HCWs) have already been upheld in Canadian courts with respect to influenza outbreaks. Regarding the masking policy, the arbitrator argued it was not coercive but, rather, was an important patient safety initiative and a way of accommodating HCWs with medical, religious or philosophical objections to influenza vaccination. … The Policy was established as a patient quality and safety initiative similar to hand hygiene…. In 2001, Canadian Union of Public Employees Local 416 presented an application to the Ontario Superior Court of Justice declaring compulsory vaccination to be contrary to the Canadian Charter of Rights and Freedoms. Ultimately, in 2002, before the issue was formally addressed in court, the Ontario Ambulance Act was altered to allow paramedics to be vaccinated or undertake an educational module on influenza. On the basis of this change, the Canadian Union of Public Employees withdrew its constitutional challenges to the legislation. The Policy has three great strengths. First, it brought a great deal of public attention to the issue of nosocomial influenza. Second, … the Policy included all health care professionals who have patient contact. This

	makes greater biologic sense, as a central goal of any vaccination policy is to surpass a threshold vaccination level (termed “herd immunity”) in a population. Last, the Policy was ultimately successful in increasing influenza vaccination coverage among HCWs after years of prior failures. A major limitation of the Policy was the sudden suspension of the disciplinary component immediately preceding the flu season. On November 30, 2012, the Deputy Minister of Health announced that the punitive aspect of the Policy was in abeyance in order to facilitate educational efforts and ongoing stakeholder consultations. HCW vaccination rates in BC might have been higher had a disciplinary protocol been in effect. Another weakness of the Policy (as initially written) was the failure to include visitors: friends and family of a hospitalized patient are in close contact and are potential sources of disease transmission. In the spirit of collaborative policy-making, the Ministry of Health has implemented key changes to the Policy for the 2013/14 flu season to address stakeholder concerns. Likely in response to complaints about the confidentiality of medical information, HCWs are no longer required to wear identifiers indicating receipt of the flu shot. Less significant, HCWs are “expected” to report incidents of non-compliance among co-workers, whereas previously they were “required” to do so. Last, visitors to acute and residential care facilities will be obligated to wear masks if not vaccinated. It is vitally important that data on clinically significant outcomes be prospectively recorded and analyzed. While the stated goal of the Policy is to increase HCW vaccination rates, the ultimate aim is to reduce the incidence of nosocomial influenza and influenza-specific mortality. Furthermore, if a reduction in mortality caused by influenza can be associated with increased HCW vaccination rates, it would provide more support for the Policy. In summary, institution of the Influenza Protection Policy was associated with a higher proportion of BC HCWs being vaccinated. Health care unions and some members of the scientific community questioned vaccine efficacy and considered the Policy coercive. However, a recent arbitration ruling provides support for continued implementation of the Policy. Continued stakeholder engagement is required to ensure that the decision-making process is collaborative and the Policy is not viewed as punitive."
Limitations (author)	NR

Kuntz et al. 2008

Setting	Academic tertiary medical centre
Population	All employees (incl. without patient contact)
Intervention	“During the last week of October 2005, UIHC implemented a pandemic influenza preparedness drill in anticipation of the 2006 requirement to test the response phase of its emergency management plan. Instead of being a table-top exercise, this drill included a component for immunizing many HCWs quickly (i.e. mass vaccination). When the drill was initiated, hospital administrators were presented with the following scenario and directive: “A strain of influenza has caused serious illness and several deaths in other states; therefore, the Iowa Department of Public Health directs that

	healthcare workers providing direct patient care be immunized immediately." … The drill included several methods for dispensing vaccine. Nurse "champions" coordinated a peer vaccination and dispensing program for the staff on their units. Nurse champions also educated their staff about influenza vaccination, promoting vaccination as the most important preventive measure. The University Employee Health Clinic provided the nurse champions with packets containing vaccine, necessary supplies, and consent forms. These supplies were replenished by staff in the Program of Hospital Epidemiology as needed. Additionally, nurse champions were given a pager number they could use to place an immediate request for more vaccine or supplies. The Department of Pharmacy helped coordinate the vaccine supply in the distributing pharmacies and also at the unit level. Mobile vaccination teams—nurses equipped with wheeled carts carrying vaccination supplies and laptop computers—complemented the peer vaccination and dispensing program's activities by responding to special requests to vaccinate staff at different venues (e.g., at medical staff meetings or during grand rounds). During the drill, HCWs also could be vaccinated by staff of the University Employee Health Clinic. … Throughout the drill, hospital epidemiology and employee health staff distributed educational and promotional materials describing the benefits of influenza vaccination. New educational materials included: (1) "Flu Facts" screensavers displayed on computers throughout clinical areas; (2) posters placed at the main entrance of the hospital and in staff dining areas, nursing units, and clinics; (3) e-mail broadcasts sent to hospital staff; and (4) educational talks given at leadership meetings. … vaccination rates … were subsequently reported during daily meetings with the HEICS leadership and distributed over a shared Web site to midlevel leaders (e.g., nurse managers). The HEICS leadership used the vaccination rates as immediate feedback to direct resources to specific areas (e.g., mobile vaccination team routes), in an effort to increase vaccination levels on specific units and to assess overall vaccine supply."
Information from discussion	"[T]he pandemic influenza drill addressed 2 important needs in a single exercise: the drill allowed UIHC both to test different vaccination delivery methods and to conduct a bioemergency drill in a realistic scenario while simultaneously fulfilling a requirement established by the Joint Commission on Accreditation of Healthcare Organizations. Innovations in vaccination delivery methods were essential to the success of this drill. … For example, the new peer vaccination program allowed UIHC to deliver vaccination quickly without disrupting patient care. Because we vaccinated HCWs where they worked, they did not have to walk to the University Employee Health Clinic during their lunch hour or break. In addition, nurse champions, who vaccinated their peers, had closer working relationships with their coworkers than the most visible proponents of previous influenza vaccination campaigns (eg, infection control professionals). Mobile vaccination teams administered only a small percentage of vaccinations, perhaps because other delivery approaches were so successful. Although the drill was associated with improved vaccination rates, the extensive resources needed to conduct the drill (eg, daily meetings with numerous senior hospital administrators) precluded us from running another drill in 2006.

	However, the drill required the cooperation of personnel from many different departments, thereby demonstrating to hospital administrators the effort needed to develop a more effective vaccination program. In 2006, the year after the drill, UIHC devoted significantly more resources to the influenza vaccination campaign than it did in the years prior to the drill. For example, in 2006, staff members from many groups helped plan and execute the vaccination campaign. These planning groups included hospital administration, pharmacy, nursing, and information systems. Most importantly, we continued the peer vaccination program in 2006, which likely sustained the higher vaccination rates first achieved in 2005. Although the higher vaccination rates were sustained in 2006, the time that was needed to vaccinate a substantial proportion of HCWs increased significantly without the drill. During the 2005 drill, UIHC vaccinated 41% of staff members with direct patient contact in 2 days, whereas the 2006 campaign required more than a week to achieve a similar vaccination rate. However, this difference is probably not clinically significant (except in the event of an early influenza season). UIHC will need to conduct subsequent influenza vaccination campaigns before we can determine whether the additional resources will sustain the higher vaccination rates. … we identified logistical problems (eg, deficiencies in the hospital's personnel database and in its ability to track vaccine supply) that we otherwise would not have recognized. For example, we had difficulty collecting and interpreting data throughout the drill. To track vaccination delivery and generate daily vaccination reports, we had to identify which HCWs did and did not provide direct patient care and identify which HCWs had and had not been vaccinated. Our information management systems did not allow us to quickly identify HCWs who provide direct patient care at UIHC. … We may have underestimated the actual vaccination rates for direct healthcare providers because we inadvertently included some research staff in the denominator count data. Additionally, we could not track the influenza vaccination status of HCWs who received vaccination at a location other than UIHC, which may have caused us to further underestimate actual vaccination rates. We determined the vaccination status for most HCWs by manually entering information from vaccination consent forms into a database. … the data collection process was labor-intensive and required an extensive time commitment from drill organizers."
Limitations (author)	Coverage data may include some staff without patient contact.

LaVela et al. 2015

Setting	Specialist Veterans Affairs centre for spinal cord injuries/disorders
Population	HCWs including nurses, physicians, PTs, OTs, counsellors, psychologists etc.
Intervention	"We implemented a DFP that included a declination form to be completed in person and at the time the vaccination was offered. The form asked HCWs to identify a reason for declining vaccination and required a signature acknowledging personal risks and risks to patients because of the HCW declining vaccination." Introduced with

	information sessions and messages. Implemented by local teams, some of whom linked it to ongoing initiatives e.g. mobile clinics.
Information from discussion	"Overall, the DFP was well-accepted (compatible), flexible, easy to use, and supported by leadership. … [T]he implementation of a HCW DFP for influenza vaccination is of minimal cost (less than a full work week on average across the entire vaccination season of approximately 6 months), but does require some staffing dedication and resources. … [W]e learned that the DFP provided an opportunity to address concerns about the influenza vaccine and provided focused one-on-one attention and education at the time of vaccination; this also instilled a sense of accountability among HCWs. … [M]any HCWs embraced the declination form policy after DFP implementation. Using the DFP to promote influenza vaccination was described as constructive because it was active rather than passive, like many of the existing strategies. One explanation for the success of the DFP is that it required far more involved interactions between vaccinating staff and potential HCW vaccine recipients rather than accepting a simple no … As this might suggest, for more widespread implementation of the DFP … additional time and resources might be needed for implementation efforts … The implementation teams from both sites reported that the DFP is a viable approach to improving influenza vaccination rates in VA HCWs on a larger scale, provided their institutions supported the program. In this pilot study, leadership at multiple levels of the organization facilitated the program in a number of ways, including by being visibly and actively supportive of the program during all stages of the process and by providing resources and staff time to support DFP efforts. … Leveraging and compl[e]menting existing programs were discussed as an important component of easing a DFP into place. This offers a number of important advantages such as capitalizing on existing resources and reducing the likelihood of duplication. In addition, as suggested, using a mix of passive and active strategies to promote vaccination might reduce potential time and resource needs required for the active component. … Pilot data suggest that the program is feasible and acceptable; further testing in a larger study is needed to understand and identify program components (in addition to supportive leadership) that contribute to success and to assess effectiveness of the DFPat a larger number of sites (and with a larger sample size of HCWs)…. Close working relationships between and among the key stakeholders (leaders, implementation teams, research) was helpful to move an evidence-based strategy into practice ... This initiative was successful, in part, because those involved in implementation held a common goal … Leadership support during the early stages was particularly helpful in the conceptualization and preimplementation work required for program start-up. Facilitation workgroups at each site were necessary to tailor local plans for moving the DFP implementation forward. Local leadership championing and support was an essential factor to full HCW participation in the DFP."
Limitations (author)	Small sample size. Vaccination status self-reported. Ongoing promotion campaigns may have influenced results. Cost savings not assessed.

Lee and Fong 2007

Setting	Tertiary hospital
Population	All employees
Intervention	Free vaccines. Mobile vaccination teams and workplace clinics.
Information from discussion	"The reasons [for intervention impact] could be the physical proximity and the convenience of timing brought about by on-site arrangements. Participation and interaction during the vaccination period by groups of employees within the same locality could also act as encouragement and motivation for some employees who might otherwise remain hesitant about receiving influenza vaccination. The vaccinations at same-service areas by familiar nurses from within the service area could also have contributed to the higher influenza vaccination rates."
Limitations (author)	Difficult to quantify impact of distinct components.

Lehmann et al. 2016

Setting	"a center of expertise for the diagnosis and treatment of patients with complex chronic organ failure, in particular obstructive pulmonary diseases (i.e., COPD and asthma) and chronic heart failure"
Population	All employees incl. physicians, nursing staff, psychotherapists, social workers, ergo-therapists, physiotherapists, laboratory staff, biomechanical engineers, dietitians, and researchers. "Most employees have patient contact."
Intervention	"The annual procedure for influenza vaccination of HCWs in the center is as follows: The chest physician sends an e-mail to all employees that free vaccination is available at one day mid-October and if they want to get vaccinated they have to respond to the e-mail. Depending on the number of employees who respond, the center buys vaccines and the employees are vaccinated as walk-ins by a nurse at the day specified in the e-mail. In the beginning of October 2014, CIRO+ employees were invited to attend a presentation, outlining the available evidence regarding the effectiveness of influenza vaccination in protecting patients, during one of their regular educational seminars. In mid-October, all 122 employees at CIRO+ were randomly assigned to one of two conditions in a one-factorial between-subjects design (email invitation: opt-in vs. opt-out). Randomization was done by the first author, who listed employees alphabetically by their last name and split the sample in half. Employees were blind to group assignment, as were the nurses administering the vaccination. Those in the opt-out condition received an e-mail from the responsible chest physician explaining that they had been scheduled for the annual influenza vaccination, with the day, time, and location provided. Vaccinations free of charge were given on two different days of the week. Hyperlinks in the e-mail allowed participants to change or cancel the appointment day and/or time. For those in the opt-in condition, the e-mail explained that there were two days on which free influenza vaccinations were available and they had to schedule an appointment by responding to the chest physician via e-mail if they wanted to get

	vaccinated, which resembled the annual procedure at this center. In the week of the vaccinations, all opt-out participants that had changed or did not cancel their appointment were sent a reminder. Opt-in participants were not sent a reminder."
Information from discussion	"Since a large group of HCWs could be expected to have a negative attitude toward influenza vaccination, it was not surprising that condition did not show a total effect on getting vaccinated. However … we found that the effect of the opt-out intervention was mediated by the appointment status of participants. Participants in the opt-out condition were more likely to have a vaccination appointment than participants in the opt-in condition, which increased the probability of getting vaccinated … HCWs who retained their appointment for vaccination were most likely the ones who already held a neutral or a positive attitude toward influenza vaccination. … while it becomes more common for US health care settings to employ such mandates, most European health care settings are more concerned with the violation of civil liberties and the individual right to refuse medical treatment. Implementation of mandatory vaccination programs are highly unlikely in most European countries, which is probably why nudging approaches get more attention in recent years.”
Limitations (author)	Small sample size. No data on participant demographics. Findings may not be generalisable to other types of setting.

Leibu and Maslow 2015

Setting	A system including "three acute care hospitals, a children's hospital, an inpatient rehabilitation hospital, home care, transportation services, and several off-site clinical office practices including diagnostic facilities"
Population	"all staff who work in or visit clinical facilities frequently ... includ[ing] physicians, nurses, and ancillary personnel employed by AHS, as well as contracted employees, students, and volunteers" were in scope of the mandate. Staff not working at / visiting clinical facilities were "encouraged but not required to be vaccinated", although unclear whether this changed over the study period.
Intervention	There were "systemwide voluntary campaigns" in place at pre-test, but no further info given. Staff working at / visiting clinical facilities were required to be vaccinated (other than with medical or religious exemptions, both requiring documentation; staff whose exemption was accepted were required to wear a mask in any clinical facility experiencing influenza activity at a 'moderate' level or higher). "Failure to wear the mask properly ... would result in a warning with the first offense and termination with repeated offenses. Personnel who were not vaccinated by the vaccine deadline date, and who were not approved for a vaccination exemption, were removed from the work schedule and given 2 weeks to decide if they wanted to be vaccinated. If they chose not to be vaccinated, they were subject to disciplinary action." Vaccination clinics conducted during all shifts; flu champions; mobile carts (unclear how much of this was also present at pre-test).
Information from discussion	"Some of the challenges faced during program implementation were the difficulty in clarifying medical requests for vaccine exemption. Often times the medical reasons presented were written by an

	employee's health care provider who had little or no knowledge of vaccine physiology, reactions, and/or true contraindications to vaccination. ... All medical requests required extensive investigation into history including discussions with both employees and their healthcare providers as deemed appropriate, literature searches and allergist/specialist referral as needed ... Sadly, many employees only addressed concern for potential illness from vaccine reaction in themselves and without concern for patients and coworkers, which were the main goal for the vaccine campaign."
Limitations (author)	NR

Leitmeyer et al. 2006

Setting	Hospitals
Population	HCWs. Survey respondents are all either physicians or nurses
Intervention	"The main activity of the campaign was a mass mailing to the hospitals' medical services of all German hospitals (n~2000), which included information and training materials, such as a powerpoint presentation for in-house education, posters, handouts, text suggestions for employee mailings and a list of suggested activities to increase influenza vaccination among HCW. In addition, information about the campaign was provided in articles published in the national public health bulletin and the journal of the German Medical Association." Analysis compares those hospitals which used the materials with those which didn't.
Information from discussion	"[A] certain level of "desirable" knowledge and attitude seems to be crucial to achieve any increase in vaccination rates. This is supported by three findings: first, vaccination coverage increased significantly between 2001 and 2003 only among physicians, but not among nurses. Physicians were also significantly more likely to believe to be at increased risk for influenza and to believe in the effectiveness of the vaccine. Second, the analysis of converters revealed that perception to be at increased risk and trust in the vaccine were significantly associated with having converted from vaccine non-recipient to vaccine recipient. Interestingly, however, the effect of knowledge and attitude on conversion was substantially more pronounced among nurses, suggesting that also nurses need to be convinced of their risk and the value of the vaccine before they decide to become vaccinated. Third, only HCW who both believed in their risk and knew of the high effectiveness of the vaccine had a significant increase in vaccination rate. This suggests that this is the group where new vaccinees can be most easily recruited from."
Limitations (author)	Possible selection bias at level of both individuals and institutions

Lemaitre et al. 2009

Setting	Nursing homes
Population	Staff, not further specified
Intervention	Promotional campaign incl. posters, leaflets, face-to-face meetings (which included provision of vaccination)

Information from discussion	None
Limitations (author)	None relevant (only relating to mortality outcomes)

Llupià et al. 2010

Setting	University hospital
Population	HCWs including physicians, nurses, support staff, others
Intervention	Weekly emails, prize draws, website to promote campaign generally and show management support, mobile vaccination unit, telephone helpline
Information from discussion	"We attribute the increased demand to faster, more effective transmission of messages during the vaccination campaign. Involving HCWs in the transmission of educational messages seems to have produced good results. With regard to the profile of vaccinated HCWs, the increase in vaccination was greatest in physicians and administrative staff. In our hospital, these 2 groups have their own e-mail accounts, whereas other categories (support staff) do not and must receive information from their supervisors who have personal e-mail accounts. Although the staff of each ward had free access to the Internet and thus to the ‘‘I've already been vaccinated’’ Web page, the differences in coverage suggest that the distribution of information was not uniform, and that the transmission of messages through the Internet was more effective in professional categories with direct access. This suggests that the increased accessibility of mobile units and the prizes was not the sole factor in the increased coverage, and that access to the Internet should be improved for all HCWs or alternative strategies should be devised for HCWs who do not have their own e-mail account. Most of the pictures on the Web page were of small groups and were taken by the staff of the mobile units, suggesting that this had a ‘‘snowball’’ effect on vaccination. The staff of the mobile carts reported that in wards in which someone knew of the Web page, recruitment was easier and HCWs encouraged each other to be vaccinated so they could appear in the posted picture. Photos also were used to spread educational messages: for example, a photo of a pregnant vaccinated HCW at the end of the second trimester to emphasize the safety of the influenza vaccine in this risk group. The increase in the number of vaccinated HCWs and the concentration of vaccination in the earlier weeks of the campaign suggests more rapid spread of the messages. This may be due to the simultaneous dissemination of messages to different groups of HCWs by through the use of information technologies and the word-of-mouth effect. These actions resulted in a significant increase in the overall coverage of HCWs vaccinated by both the mobile unit and the OHC, demonstrating that knowing the route of the mobile units in advance did not reduce vaccination by the OHC. Because coverage did not increase much after the first month of the campaign, it seems reasonable to focus efforts on a more active but shorter campaign, despite the later second prize drawing."
Limitations (author)	Data not collected on age and shift of participants; changes in motivation not measured; cannot quantify impact of intervention components

Looijmans-van den Akker et al. 2010

Setting	Nursing homes
Population	HCWs including physicians, nurses, nurse assistants
Intervention	"Our multi-faceted intervention program consisted of three main components; an outreach visit by the primary researcher during which the homes received a script of the program, all required materials and background information (component A), a plenary 1 h information meeting (organized twice in each home) by a specialised nurse of the local municipal health centre (component B) and appointment of preferably a physician as local program coordinator (component C)."
Information from discussion	None
Limitations (author)	Three institutions dropped out. Both intervention and control groups had higher vaccination coverage at baseline than national average, which may indicate selection bias

Lopes et al. 2008

Setting	Tertiary teaching hospital
Population	"all HCWs"
Intervention	“The strategy implemented during the 2006 season featured both an educational campaign and a vaccination campaign. The educational campaign addressed influenza and emphasized the importance and safety of vaccination through lectures, informal handouts, fact sheets distributed with employees’ paychecks, and posters. The vaccination campaign offered the vaccine at places of easy access during expanded hours…. In the main building of the hospital, the vaccination was made available by mobile teams … At the change of shift, the mobile teams were located in the hall of each of the 2 main HCW entrances. The rest of the day, the mobile teams walked all the floors of the building visiting inpatient wards, the emergency department, laboratories, and the radiology department. In the other buildings of the complex, the vaccine was offered to the HCWs in places of easy access, but mobile vaccination was not implemented.”
Information from discussion	None
Limitations (author)	NR

Marwaha et al. 2016

Setting	"a multisite academic community hospital"
Population	"employees, professional staff, students and volunteers"
Intervention	Five main components, informed by social marketing model. 1) Incentives (chocolate bar, coffee gift card) and prize draws. 2) “Disruptive” advertising with distinctive campaign branding and display of current vaccination rate at each site. 3) Increased number of mobile carts (from five to eight); trained peer vaccinators (n=36);

	vaccines delivered in outpatient pharmacies at weekends and off-hours. 4) Improved data integrity for tracking vaccination uptake. 5) Distributed vaccine status cards to be submitted to employee health services for employees to declare offsite vaccination or medical exemption (employees could self-declare vaccine status initially, but had to submit proof later).
Information from discussion	Additional funding required compared to previous year. Flu cases went up despite increases in vaccination uptake. "[T]here were reported incidents of tension and confrontation from unvaccinated staff near the campaign's final two weeks." Data management was labour-intensive, and difficult to get accurate denominator for % rate because employee, volunteer and physician data was in separate databases. Employees were allowed to self-report having been vaccinated elsewhere and while they were theoretically required to document this, not all of them did. "Finally, our volunteer population was difficult to reach through standard campaign communication channels. THP has over 1,300 volunteers who work anywhere from a few hours to regular weekly shifts. We suspect a large proportion of them received their vaccination outside of the hospital but were not captured in our numbers." Ineffectiveness of 2014 vaccine was widely reported – this may have dissuaded people. Sustainability of intervention is unclear. Flu vaccination programmes should be used in conjunction with other infection control efforts such as hand washing.
Limitations (author)	NR

Nace et al. 2011

Setting	Nursing homes ("long-term care" for older adults)
Population	HCWs not further described
Intervention	All sites formed immunization teams of ≥4 staff members and created email list to distribute information on vaccination. Intervention sites received 1x 0.5-day training programme including "didactic education, a review of baseline immunization rates, training in barrier identification, and goal setting. Education focused on the impact and prevention of influenza and pneumococcal disease in the LTC setting … A content expert in LTC quality improvement … facilitated barrier identification … teams identified program interventions, specified process and outcome measurements, and set completion time frames."
Information from discussion	Authors stress important role of high staff turnover as a barrier to attaining high rates of vaccination. "Practicality was achieved by disseminating an inexpensive and widely available evidence-based immunization toolkit; using an e-mail communication network; and, for the collaborative [intervention] group, using a single half-day training session." Baseline rates were very low and post-intervention rates did not reach Healthy People 2010 targets. "Influenza immunizations provide a special challenge based on the perceived short immunization period. Although this program was conducted over 1 year, most providers view the influenza immunization season as running from only October to December. Short immunization seasons leave little time for traditional quality improvement cycles.

	By the time initial measurements are available, most immunization opportunities are gone." "[P]articipating facilities did not use standing order programs. Standing orders allow administration of [vaccine] to residents and HCW without individual physician orders. Participants … were resistant to [standing orders]." "Staff turnover, competing organizational demands, and uncertain team collaboration represent plausible barriers to improving immunization rates".
Limitations (author)	Possibly confounded by enactment in 2002 of legislation on immunization for employees of long-term care institutions. Limited power. Randomisation not stratified. Research team did not implement intervention and "do not have information on how well the immunization teams collaborated, how interventions were designed or executed, or compliance with the chosen interventions."

Nicholson et al. 2009

Setting	Tertiary care hospital
Population	All employees, contract staff, volunteers, students, incl. those not delivering direct patient care
Intervention	Nurse 'flu coordinators' in each department coordinating administration of vaccinations. Coordinators received education about vaccine, supplies and consent forms and were responsible for contacting co-workers in their department. Also information delivered by email and newsletter to all employees. Some coordinators delivered mobile vaccination carts and/or workplace clinics.
Information from discussion	None relevant
Limitations (author)	NR

Ohrt and McKinney 1992

Setting	University hospital
Population	"internal medicine, obstetrics-gynecology, and general surgery residents and junior medical students"
Intervention	All groups received vaccine free of charge. "Employee and student health nurses … took the vaccine to various clinics and conferences". All groups received general educational memorandum. Two intervention groups; (1) personalised letter from chief of infectious diseases + map to employee or student health services; (2) "a personalized telephone call from a general internal medicine staff member encouraging them to become vaccinated". At a subsequent stage (after first follow-up), all groups received outreach intervention where vaccine was offered at various workplace sites and student lectures.
Information from discussion	Low vaccination rates at baseline and high likelihood of working despite flu-like symptoms indicate need for intervention. Influenza vaccination of patients increased in line with that of HCWs. Some differences in barriers between staff and students. "Persons more advanced in their training were more likely to refuse immunization, possibly due to a change in educational policy, but more likely, they

	are willing to refuse recommendations." Costs were US$300 for whole programme excluding vaccine costs. "We recommend that support from local respected infectious disease and infection control staff be obtained … An educational memorandum should be sent to all physicians each fall when the influenza vaccine becomes available. Ideally, the vaccine should be offered in person to all individuals at work sites."
Limitations (author)	Possible contamination between intervention and control groups. Possible selection bias in questionnaire data as it was only given to people requesting vaccine (for some groups). Results may not generalise to other groups of HCWs or contexts, particularly where vaccine is not available without charge.

Pan et al. 2015

Setting	Hospital
Population	Healthcare workers, not further specified
Intervention	Mobile vaccination cart
Information from discussion	None
Limitations (author)	NR

Podczervinski et al. 2015

Setting	"a large comprehensive cancer care center"
Population	All employees
Intervention	"During all campaigns, the vaccine was provided free of charge to all employees. … Two weeks before the campaign start, the vaccine availability was advertised via multiple modalities at the center, including mass e-mail messages, newsletter articles, and intranet postings. All employees were required to either be vaccinated or complete a 1-page signed declination form acknowledging that they understood the risks of declining the vaccine in a setting with such high-risk patients. Employees were allowed to return the declination form via e-mail, fax, or in person. Influenza vaccination was provided at drop-in vaccine clinic locations throughout the center's clinical and administrative areas; mobile vaccine carts provided additional opportunities for vaccination throughout the campaign…. In addition to the baseline measures described above, an incentive component was added to the 2011 vaccination campaign. This incentive was organized so that if 95% of all employees received the vaccine the entire staff would be rewarded with a $25 gift card. The incentive was advertised across the center, and weekly, department-level breakdowns of vaccination rates were posted on the center's intranet and e-mailed to all managers and supervisors. The Infection Prevention Department joined the Occupational Health Department and visited areas within the clinic with vaccine carts to encourage program participation and promote vaccination. … employees were now required to return the declination form in person to the Occupational Health Department registered nurses, who had offices located 1 block away from the clinic. Employees declining for

	medical reasons were required to provide a note from a caregiver outside the center specifying the rationale for influenza vaccine contraindication. Employees who did not comply with the policy were reprimanded by their manager in a face-to-face meeting and given deadlines for compliance. … During the 2012 campaign … the incentive policy was replaced with a penalty-driven strategy for vaccine declination. Employees who opted to decline vaccination were required to complete a 30-minute online education module with posttest, undergo a 1-on-1 counseling session where an 11- point attestation statement was reviewed by Occupational Health Department or Infection Prevention staff, and sign the attestation in the presence of these staff members (ie, active declination). The declination process took > 1 hour and required staff to schedule offsite counseling sessions within limited time blocks. Any staff member who did not meet campaign deadlines by either receiving or declining the vaccination were required to meet with his or manager and a disciplinary letter signed by Infection Prevention Department and center directors was placed in the employee's personnel file. Employees who did not comply following these efforts were warned that they would receive additional penalties, including suspension from clinical care, leave without pay, and possible dismissal unless they became compliant with the policy by receiving or declining the vaccine."
Information from discussion	"[Intervention effectiveness] appeared to be linked to the challenges of declining rather than educational components. ... Mandatory vaccine policies were considered but not pursued. Masking decliners was not implemented because this was in conflict with our center's employee sick policy, which does not allow masks to be worn by staff to prevent employees from coming to work sick. Studies have also shown that masks negatively influence patient and caregiver interactions, and such policies were also thought to potentially increase anxiety in patients at highest risk for respiratory virus complications. … By promoting an increased focus on education and counseling this [penalty-based or 'stick'] policy also addressed many of the major arguments for incentive policies while avoiding associated incentive costs. Additionally, the effort and time needed to decline required multiple steps, planning, and organization for these employees. … Importantly, our study found that the major improvements in vaccination rates with the penalty-driven strategy occurred in employees who do not have direct patient care responsibilities. … Interestingly, although the implementation of influenza education within the organization likely raised awareness in staff with limited patient exposures and knowledge about the benefits of vaccination, no staff underwent vaccination after completing the educational component of the policy. This suggests that the main effect was either the time burden of declining (the penalty), or the requirement for active face-to-face declination with Infection Prevention Department and Occupational Health Department staff. … [R]equired compliance dates were set for study years 2011 and 2012. Shortened influenza vaccine campaigns can have substantial benefit for occupational health and infection prevention departments, easing program time commitment and encouraging early vaccine uptake. Additionally, setting short deadlines improved tracking of employees, allowing our Infection

	Prevention Department and Occupational Health Department staff to address HCPs who had not yet received or declined vaccination late in the season and avoid employee noncompliance. Interestingly, we found that regardless of vaccination program strategy, 50% of employees received vaccine in the first 14 days of each vaccine campaign."
Limitations (author)	Effect of interventions in successive years may have been cumulative (i.e. not independent). Cannot identify effectiveness of specific intervention components. Monetary incentive for 'carrot' intervention may have been too small to motivate change. Findings may have been affected by seasonal fluctuations in influenza severity. Findings may not be generalisable to other settings with lower baseline coverage rates.

Porras-Povedano et al. 2015

Setting	Hospital, described as "centro sanitario público de atención especializada" (public health specialised care centre)
Population	All employees including physicians, other clinicians, nurses, technicians, management and administrative staff
Intervention	Limited information. At all time points: signage, internet and email information ("Durante las 3 campañas se han llevado a cabo estrategias de difusión de la vacunación, mediante cartelería informativa, anuncio en la web del Hospital y correo electrónico a cargos intermedios con is fecha de inicio de la campaña, horario y lugar de vacunación."). In 2013/14 season, offered some form of workplace/mobile vaccination ("A partir de la campaña 2013/14 se incluye estrategia active, acudiendo a las diferentes plantas y servicios del hospital a ofertar la vacunación a profesionales que se encuentran en su puesto de trabajo, si bien únicamente en turno de mañana." Also in discussion chapter: "los profesionales recibían visita de la enfermera y médico de medicina preventiva en su puesto de trabajo")
Information from discussion	Importance of information systems in analysing vaccine coverage. Middle managers may be important in driving vaccination among staff - highest rates in this study were seen in internal medicine department, whose head was active in the vaccination campaign.
Limitations (author)	NR

Quan et al. 2012

Setting	"a tertiary care, multispecialty academic medical center"
Population	"clinical and nonclinical workers, including residents, fellows, students, volunteers, and contract workers employed at the UC Irvine Medical Center as well as faculty physicians and staff employed by the UC Irvine School of Medicine who were physically located at the medical campus or affiliated clinical areas. Vendors were also required to comply with this policy"
Intervention	Mobile van providing vaccination in off-site workplaces; declination forms; decentralized distribution of vaccines by nurse managers; mobile carts in clinics; mandatory requirement to be vaccinated or

	wear mask during flu season [unclear what penalties were imposed]; noncompliance tracking fed back to staff and managers; linking of vaccine noncompliance to departmental budget allocations
Information from discussion	"We expect additional gains during the 2011–2012 season with the institution of unpaid furlough for those HCP with nonparticipation in vaccination as of December 1, 2011. … [M]erely approving such a [mandatory] policy without enforcing it is unlikely to be successful. In this instance, the involvement of hospital leadership and human resources personnel was necessary to achieve near-complete vaccination. The institution of a real-time noncompliance tracking tool was pivotal in ensuring participation, because staff members were held directly accountable to their supervisors rather than to Occupational Health. Furthermore, e-mail reminders of the mandatory nature of vaccination from the chief medical officer and chief executive officers instilled the gravity of the mandatory vaccination policy in HCP. Similar to other academic institutions, we encountered issues of accountability for physicians, because many are employed by and accountable to the School of Medicine rather than the hospital system. … a significant increase … was attained by the active involvement of the dean to reinforce the importance of good standing, which often carries financial repercussions for School of Medicine departments whose members fail to meet thresholds of compliance with institutional policy. Because all departments met good standing requirements, we can only assume that this had a substantial impact. … [I]t is necessary to overcome many HCP misconceptions about the influenza vaccine. For example, in this study, concern for vaccine safety remained a major reason among those who declined vaccination in favor of masking for the duration of the influenza season. … [T]he proportion of declinations for preferential reasons markedly increased in response to the mandatory declination requirement and dramatically decreased in response to mandatory vaccination. One explanation for this may be that mandatory declination differentially captures HCP who feel strongly about declining the vaccine but does not capture those who, although not opposed to the vaccine, have not made vaccination a priority. In contrast, the masking requirement associated with lack of influenza vaccination under the mandatory policy may provide sufficient disincentive to encourage the large number of stragglers to prioritize vaccination. … We found that convenience was an essential factor in HCP vaccination, even for those who had already decided to receive the vaccine. The unwillingness of one-quarter of HCP to wait for more than 10 minutes indicated that high vaccination rates require highly convenient access and minimal effort for HCP. However, we showed that even with maximum convenience, including after-hours events, centralized and decentralized vaccine distribution, and mobile cart and mobile van vaccinations, only 60% of HCP were vaccinated."
Limitations (author)	NR

Rakita et al. 2010

Setting	"a tertiary care, multispecialty medical center"

Population	"All employees of the medical center ... [and] other people working at the medical center, such as students, vendors, volunteers, contractors, and outside physicians"
Intervention	"The campaign began that summer and included an informational Web site with links to outside sources of information … an online learning module; meetings with staff and leadership to answer questions; grand rounds speakers; trained advocates, or "champions," of influenza vaccination; and one-on-one meetings with concerned staff. …. All employees of the medical center are required to receive the influenza vaccine. In addition, other people working at the medical center, such as students, vendors, volunteers, contractors, and outside physicians, are required to be vaccinated. No form of declination statement is used. … HCWs can apply for an accommodation for medical or religious reasons."
Information from discussion	"we have demonstrated our ability to sustain this practice by maintaining vaccination rates of more than 98% over several years. Note that, if one includes HCWs who wore masks because of an accommodation or because they were a member of WSNA, compliance with this policy did approach 100%. One of the key requirements for the success of such a program is to have strong support from the leadership of the healthcare institution. Many objections to implementation of the program were raised, and without a strong endorsement from the CEO, president, and governing board, it is unlikely that the program would have been successful. Extensive communication is also required, and the use of multiple staff focus groups in planning the influenza vaccination campaign the first year helped to ensure that needed information was available to staff in a variety of different ways. Another key requirement for such a program is an infrastructure that enables delivery of a large quantity of vaccine and the ability to track employees to ensure compliance. … the major need [was] that of additional work hours for vaccinating and tracking employees. During our planning, the question arose as to whether the requirement should be limited just to HCWs with direct patient contact. Our decision to extend it to all HCWs greatly simplified tracking, and it eliminated the often difficult question of what constitutes direct patient contact. This decision also provided a sense of fairness among HCWs. … only 7 (0.15%) of 4,703 HCWs left during the first year of the requirement, including those who were terminated and those who cited the influenza vaccination requirement as the reason for their leaving…. Over the course of the last 4 influenza seasons, only 2 additional HCWs have left Virginia Mason Medical Center as a result of this requirement. Employee satisfaction, as judged by an annual external survey, has actually improved in recent years, and many HCWs say that they are proud to belong to a healthcare organization that puts patient safety first. … At Virginia Mason Medical Center, influenza vaccination has become just one of several fitness-for-duty requirements. Many of these have been in place nationally for years and have not raised much controversy. For example, skin testing for latent tuberculosis … During the planning process for our program, the ethics committee was involved, and we enlisted the help of outside ethicists as well. Overall, it was felt that the importance of protecting our patients was paramount. However, a mandatory program needs to be flexible enough so that valid reasons for

	avoiding vaccine use can be accommodated. We include both medical and religious reasons as part of this process. For example, our HCWs have had their accommodation requests approved if they had a prior history of Guillain-Barré syndrome, even though the connection between that and influenza vaccine is controversial. We require nonvaccinated HCWs, whether because of an accommodation or the union dispute, to wear a mask during influenza season. … The major cost associated with this effort involves the acquisition and administration of vaccine. The large amount of time necessary for planning and coordination decreased significantly after the first 2 years of our study. After that, HCWs were familiar with the requirement, and new employees are presented with the requirement at the time of hiring. Thus, influenza vaccination has become routine and is integrated into our culture of safety. … When considering implementation of this type of program, it is important to consider the resistance that may be encountered by unions and the resulting litigation. The costs related to this litigation may be considerable. Although all unions are clearly not the same, it is interesting to note that unions in New York and Iowa also filed suit to block implementation of mandatory influenza vaccination requirements at healthcare institutions in those 2 states. We would hope that such actions are not an inevitable response to these programs. Early communication with union members may be beneficial.”
Limitations (author)	Data on influenza outcomes not collected. Findings may not be generalizable to other settings.

Ribner et al. 2008

Setting	"a healthcare system that consists of 2 adult, tertiary care, urban hospitals with a total of 1,084 licensed beds; a 100-bed geriatric specialty inpatient facility; a 250-bed skilled nursing care facility; a large, multisite, faculty practice plan that has approximately 2 million outpatient visits per year; and a large administrative office building"
Population	All non-physician employees (physicians not included in study because no routine data were collected on them, but were encouraged to get vaccination)
Intervention	"Although no employee was required to receive influenza vaccination, employees were officially required to sign a form that served as either a vaccination consent form, a form to document medical contraindication(s) for vaccination, or a vaccination declination form (Figure). In addition to a short statement that summarized the advantages of employee vaccination, the declination section of the form allowed employees to mark the reason(s) for declination of influenza vaccination. A blank space was available for employees to write in any reason(s) not preprinted on the form.... Although supervisors could strongly encourage the employees in their area to participate in the program, no formal disciplinary action was specified for failure to participate." "As often happens in such circumstances, the new use of the declination statement was not the only change made in our program during the 2006-2007 influenza season. Top management took a much more public stance in support

	of the program, supervisors were given weekly feedback on the participation of employees in their sections, a very popular T-shirt was given to employees who received vaccinations, and mobile vaccination carts were used more extensively." Also various strategies at both pre and post (posters, mobile carts, free vaccine)
Information from discussion	Nurses had lowest rates of declination. "The reasons for declination of influenza vaccination also varied by occupation—nurses were least likely to select the reason “afraid of needles” or “fear of getting influenza from the vaccine” and were more likely to write in objections to being coerced or pressured into vaccination than were all other groups." Intervention included other components as well as declination form and unclear which contributed to effectiveness. Programme helped to identify staff groups who might need targeted education or other intervention to increase acceptance. High rates of fear of getting flu from vaccine even after education programme. PR team were involved in the intervention but should have addressed concerns about side effects and benefits for patients and employees' families. Several pregnant staff members reported being advised to decline vaccination by obstetricians. Declination form may have contributed to perception that programme as a whole was coercive (although "our overall conclusion was that the form made a positive contribution to the vaccination program").
Limitations (author)	NR

Rodríguez-Fernández et al. 2016

Setting	"three-level [i.e. tertiary?] paediatric hospital"
Population	"all paediatric hospital HCP including: physicians, registered nurses, radiologists, laboratory personnel, and also administrative staff and managers"
Intervention	“The vaccine educational programme was led by three attending physicians as part of the Hospitalist group … The programme was not mandatory and included an interactive session that provided information about the virus and infection, the risk of nosocomial transmission, and the effectiveness of influenza vaccination. … The programme did not offer influenza vaccination; however, it facilitated access to the vaccine by providing the specific time and location for influenza immunization”
Information from discussion	None relevant
Limitations (author)	Possible selection bias in survey respondents. Uncontrolled design.

Rothan-Tondeur et al. 2011

Setting	"geriatric health care settings (GHCSs), long term care and rehabilitation care settings"
Population	"all the HCWs in regular contact with elderly patients ... i.e., physicians (geriatricians and residents), nurses (nurses and head nurses), nursing auxiliaries, and other workers (physical therapists, occupational therapists, etc.). Nursing or nursing auxiliary students

	were excluded"
Intervention	Program 1 … was educational. It included a slide-show (52 slides + 4 short movies), a leaflet, and an investigator guide. In each HCS, after informing the head of department and the occupational medicine department, the local investigator (with the help of the guide) organized information sessions for the HCWs. The slide show, entitled "Myths and Reality about Flu Vaccination", was shown during the information sessions. The 52 slides were intended to expose myths to realities: for example, the myth that "the vaccine can cause flu" was Three of the four short movies were interviews with physicians and the fourth, which was humoristic, showed an elderly patient asking his HCW to get vaccinated. ... Program 2 was incentive. Its objective was to involve HCWs in the creation of "safety zones" which the flu virus could not "get through". The program included two kits: Kit 1 was intended to improve vaccination coverage and Kit 2 to reward HCSs showing increased vaccination coverage. Kit 1 included a slide show, posters, two booklets/leaflets, and rubber bracelets. In each HCS, the local investigator contacted a few of the HCWs previously identified as opinion leaders in the HCS to support him/her in promoting flu vaccination. The HCWs who agreed to promote vaccination showed the "Myths and Reality about Flu Vaccination" slide-show, slightly modified so as to answer colleagues' future questions. Posters indicating that the department was combating flu were displayed on the HCS doors. One leaflet was distributed by the HCWs to families visiting their elderly relatives, and the other was kept for the HCWs themselves, providing answers to their main concerns about flu and vaccination. A rubber bracelet bearing the message "All together against flu" was given to all vaccinated HCWs. When the flu VCR in the HCS reached >50%, the HCS received Kit 2. Kit 2 mainly comprised posters indicating that the department had reached its objective. These posters were displayed on the HCS doors and seen by the HCWs, the elderly persons and their families."
Information from discussion	Low baseline vaccination rates (23%), higher among physicians than nurses or nursing auxiliaries. Intervention (program 2) "took into account the profile of non-vaccinated HCWs identified in the diagnosis phase of the VESTA study: i.e., female (84%), aged between 20 and 40 years (51%), mainly working as nursing auxiliaries (46%), afraid of adverse events (52%), unaware of the vaccination status of their immediate superior (74%), not planning to be vaccinated in the future (70%), not considering the vaccine to be personally advantageous (49%), and believing that there are other means to prevent flu (e.g., homeopathy) (data non shown). Its objective was to give personal satisfaction to the vaccinated HCWs before giving them collective satisfaction: the rubber bracelets indicated that the HCW belonged to a group, the group of vaccinated HCWs combating flu; and the Kit 2 posters showed that the HCS had succeeded in this combat. The success of Program 2 showed that personal satisfaction was the key to HCW flu vaccination." Intervention developed with assistance of marketing experts. Difficult to identify effect of intervention as against secular trend to higher vaccination rate. Higher rate may also have been influenced by pandemic flu at post time point.
Limitations (author)	No long-term follow-up. HCW vaccination rates in France show a general upward trend, which may account for some of the observed

	increase. Control sites may have experienced increase in coverage as a result of being included in the study (Hawthorne effect). Pandemic flu may have influenced behaviour. Possible selection bias as a result of differential consent to participate at level of individual HCWs. Control sites may have differed from sites which immediately agreed to participate. Program 2 was delivered shortly after Program 1 and so may have owed some of its effect to the latter.

Sadlier et al. 2015

Setting	Hospital
Population	Health care workers including doctors, nurses and members of multidisciplinary teams
Intervention	Targeted education interventions outlining survey findings along with benefits of influenza vaccine were undertaken at departmental meetings. E-mail reminders and posters promoting influenza vaccine were circulated.
Information from discussion	None
Limitations (author)	NR

Samms et al. 2004

Setting	Hospital, no further information
Population	"employees in clinical departments"
Intervention	"nursing Retention and Recognition Council (R&R) members were asked to act as champions for the employee influenza vaccination campaign. R&R membership consists of clinical registered nurses (RNs) from each nursing department (about 40 members). A training session was held with R&R to provide materials members could use to educate others. Members also agreed to vaccinate fellow employees in clinical departments. This allowed employee health nurses to focus attention on departmental visits in other areas. In addition to receiving the vaccine in nursing departments and employee health, employees could receive the vaccine in the emergency department during off-hours. R&R nurses were also responsible for documenting vaccination and submitting documentation to employee health for recordkeeping. Managers supported staff nurse administration of vaccine to limit time away from patient care. Posters and badges were developed by the marketing department to advertise the vaccination campaign. Administrative staff received departmental vaccination rates during the campaign. Individuals and departments who were successful in reaching the corporate goal were eligible to receive an award.”
Information from discussion	"Having a team of clinical RN champions to implement the program at the department level encouraged other employees to receive the vaccine. Some employees preferred vaccination by a peer. Disseminating vaccine to clinical nursing departments made the vaccination process more convenient for employees and supported continuity of patient care."
Limitations	NR

(author)	

Sartor et al. 2004

Setting	"a 620-bed acute care hospital comprising 307 medical beds, 26 intensive care beds, 173 surgical beds, 114 gynecology and obstetric beds, and an emergency department operating 24 hours per day. An infection control team composed of one physician and two nurses is located in the hospital. There is also an employee health unit composed of one physician and one nurse."
Population	All employees
Intervention	"the mobile cart influenza vaccination program was implemented by the infection control committee and the employee health service in 2000. For the mobile cart influenza vaccination program, the information campaign started with articles in the monthly infection control newspaper delivered to each physician and unit of the hospital. … Announcements of the mobile cart vaccination program were also published in a letter personally addressed to each physician and each head nurse in mid-October and finally in posters located throughout the hospital … additional educational sessions were performed … where a low vaccination rate had been noticed ... A mobile cart carried the vaccination register, survey data forms, influenza multidose vaccine vials, alcohol disinfectant hand solution, a needle and syringe disposal container, and cotton, as well as adrenaline in case of anaphylactic shock. … each unit was visited on specified dates at least 3 times on all tours of duty, including 2 nights. Fifteen vaccination teams were composed of one nurse and one physician. Unvaccinated staff was educated by the vaccination team about the benefits and adverse reactions of the vaccine, as well as about the epidemiology of nosocomial influenza in the setting during the past and the impact of immunization of healthcare providers for the protection of patients."
Information from discussion	Low baseline levels of vaccination (7%). Intervention more effective among physicians (students) than other employees, esp. nurses. Reasons for declination: "an undefined opposition of the employees to influenza vaccination on principle, the fear of side effects including concern about getting influenza from the vaccine, and the belief that they were at low risk of acquiring influenza". Vaccination of chief or associate professor or unit increases rates through 'leader effect'. "Increasing the contacts of the employees and the educational sessions to nurses and nurse aides may improve the vaccine acceptance rate. The mobile cart influenza program was also time-consuming. Therefore, the active participation of the wards in the vaccination of their own employees may improve the feasibility of the mobile cart influenza vaccination program." Only 60% of employees were reached due to sick leave and vacations.
Limitations (author)	Not all employees accessed [although this is a limitation of the intervention rather than the study]. Employees vaccinated outside the hospital were counted as non-vaccinated.

Seale et al. 2011

Setting	"tertiary-referral teaching hospitals"
Population	"every staff member on the ward ... We excluded any staff member who was currently on leave (during the study period) or who were temporary or agency staff members."
Intervention	Unclear. There was a mandatory policy regarding other infectious diseases but not flu - "Annual influenza A vaccine is recommended but not mandatory. ... annual influenza vaccine which is offered to all staff free of charge."
Information from discussion	Survey findings (% agree). I am happy with how the policy was implemented 75.6%. Part of my responsibility to my patients is to be updated with the vaccines under the NSW Health staff vaccination policy 89.9%. I am able to access staff immunisation services if needed 85.7%. I understand what immunisations I am required to have 88.5%.I am satisfied with the staff immunisation services provided by the hospital 77.9%. Post-test survey conducted at peak of H1N1 pandemic. Increases in influenza vaccination appear to be "'off the back'" of mandatory policy regarding other vaccinations. Linked qualitative study (see Leask in qualitative review) shows following barriers to mandatory policy: "(1) providing and communicating a solid evidence base supporting the policy directive; (2) addressing the concerns of staff about the vaccine; (3) ensuring awareness amongst staff about the need to protect patients; and (4) addressing the logistical challenges of enforcing an annual vaccination. This would require considerable resourcing, organisational support, staff education and institutional leadership commitment."
Limitations (author)	Generalizability of findings may be limited. Low response rates and non-responders were not followed up. H1N1 pandemic may have influenced results. Different individuals at pre- and post-test.

Shah and Caprio 2008

Setting	Neonatal intensive care unit
Population	"HCWs (including senior neonatologists, fellows, and resident physicians, nurses, respiratory therapists, X-ray technicians, and clerical staff)"
Intervention	"Prior to the onset of the influenza season, the nursing staff was educated about the need to vaccinate parents and about the benefits of TIV vaccination for household contacts and HCWs. Education consisted of a 10-slide Microsoft PowerPoint presentation reviewing the epidemiology of influenza in New York State, the mode of transmission, and the mortality and morbidity rates among former premature infants with influenza. One reported study of an influenza outbreak in an NICU was also discussed.18 The educational program, which lasted 15 minutes, was presented to nursing staff 5 times per week (3 times on the “day” shift per week and 2 times on the “night” shift per week) for 4 weeks prior to the November 1 start date." Also education aimed at increasing uptake among parents
Information from discussion	Greatest % increase among nurses. Physicians more likely to decline vaccine due to concerns about side effects. Most common reason among nurses was fear of needle (unlike in previous studies). Possible concerns about viral shedding immediately after vaccination leading to patient infection - could be eliminated by vaccinating staff before they leave for break, but this may be impractical. This intervention

	would suit staff of newborn nursery and other night staff.
Limitations (author)	NR

Shannon 1993

Setting	Community hospital
Population	Staff, not further specified
Intervention	Educational and poster campaign; coordinator met with department supervisor to discuss issues with vaccination; vaccination offered at education events; incentive coupon for free dessert at cafeteria
Information from discussion	75% of incentive coupons were redeemed, indicating programme was generally popular. Cost approx $1.26 / vaccine dose (vaccine was provided free - would have been ~$3.10 if purchased)
Limitations (author)	NR

Slaunwhite et al. 2009

Setting	"District Health Authority" - a range of settings, NR exactly
Population	Staff, not further specified
Intervention	"The selection of unit champions utilized an opinion leadership process. Champions were identified by contacting the heads of various departments and requesting that they select an individual willing to serve as a champion. … We communicated that the proposed champion be someone that co-workers trusted, who were committed to follow through on the study and willing to promote and encourage co-workers to accept influenza immunization. The proposed champions were also to be someone who accepted the influenza immunization yearly themselves. Managers were required to support the champion process by allowing the unit champion to attend an all-day training session prior to influenza season. Through the Occupational Health Department at CDHA we were able to train the pre-selected individuals. The training consisted of a one-day educational session on the influenza virus, the importance of HCW influenza immunization, common misbeliefs about influenza immunization and, where appropriate, training in the administration of influenza vaccine. Presentations from various health professionals regarding the importance of vaccine compliance were also included in the full-day training session. In addition, each champion was provided with supporting literature."
Information from discussion	Unclear whether training the champions was actually necessary for effectiveness - maybe just identifying them would suffice. Low attendance at training sessions and those who did not attend appear to have still promoted the campaign. Differences in effectiveness between clinical and support staff [unclear what exactly these were]. Future research should use strategies based on psychological theory & social marketing and focus on how champions can persuade non-compliers (this was not specifically part of this intervention).
Limitations (author)	Limited power due to low attendance rate. Champions identified by unit managers and this may introduce bias.

Smedley et al. 2002

Setting	University hospital
Population	Doctors, nurses, nursing assistants
Intervention	Leaflet; memo to wards and departments; notices on intranet and noticeboards; information about vaccination in manager's briefing to staff; information in newsletter; presentations. Vaccination clinics in occupational health including out-of-hours sessions and in workplace sites.
Information from discussion	Barriers to uptake: concern about side-effects of vaccine; difficulty of getting time off work; limited access to vaccination. Pre-post findings may be influenced by increased severity of flu in intervention year, as well as by intervention. NHS-wide campaigns could usefully supplement local initiatives. Low baseline levels of vaccination among doctors (although may be underestimated if they were immunized elsewhere) and very little effect of intervention observed among doctors. This may be because harder to address barriers - access to vaccine less of a problem than for nurses, and lack of time more of a problem, but not something local OH can address. Doctors may be disinclined to pay attention to health-related educational messages from non-doctors. Campaign involving medical peers might be more promising, but would be more costly than this intervention.
Limitations (author)	High rates of influenza in study period may have influenced results. Some staff may have received vaccination from other sources.

Smith and Van Cleave 2012

Setting	"a large regional healthcare system", no further details
Population	"all employed persons both with and without direct patient contact, contracted providers, students, and volunteers (“employees”)"
Intervention	Mandatory policy. "The policy required annual influenza vaccination or an approved exemption ... Exemptions were allowed for specific medical and religious reasons. ... Broad communications …continued periodically throughout the fall influenza vaccination season, emphasizing the requirement as a patient safety intervention. … Managers were responsible for monitoring the vaccination/exemption status of employees in their department. Employees who were deficient in either vaccination documentation or exemption approval were notified in early December. Employees who did not have documentation of influenza vaccination or approved exemption were not scheduled to work after January 1, 2012."
Information from discussion	Religious exemption programme "required the HCW to submit a statement describing how influenza vaccination would violate one’s deep-seated belief system". Legal advice taken on design of interview and criteria for religious exemptions. No apparent increase in major adverse events, possible small increase in minor adverse events. "Service disruption to patients did not occur." Nurses' union "was involved early in planning and was an effective and supportive partner. We strongly recommend that union representation participate throughout the process." Study authors responded to feedback on process, and corporate communications department managed individual inquiries. Senior leadership support critical to

	success. Challenging to evaluate exemption requests over holidays to meet 31 Dec deadline. Policy does not include 1,072 non-employed physicians & other 'practitioners' [i.e. clinicians?] who work in the org.
Limitations (author)	NR

Stuart et al. 2014

Setting	Department of nephrology within a tertiary referral service
Population	HCWs not further specified (intervention description says "during patient care", so presumably only those involved in direct patient care, but not clearly stated)
Intervention	At pre and post, a programme including “mobile rounds, extended hours and promotion via newsletters and announcements.” For intervention period, “unvaccinated HCWs [were] asked to wear a surgical mask during patient care throughout the influenza season”. Unclear what penalties were in place or how strong the mandate was - elsewhere in the study the intervention is described as "enforced" masking and discussion covers mandates generally.
Information from discussion	Masking is both incentive to get vaccination and a means to decrease transmission. Unit leadership was strong in the intervention department, which may have contributed to the success of the intervention.
Limitations (author)	Small sample size. Results may not be generalisable.

Tannenbaum et al. 1993

Setting	Nursing home
Population	"all regular staff" incl nurses, nursing assistants, orderlies, other professionals, kitchen staff, maintenance staff, laundry staff, security guards, cleaning staff
Intervention	“The intervention program consisted of information sessions for all staff given by physicians on five different occasions over a one-week period. Following these sessions, memos providing similar information were distributed to the staff and posters were placed on each floor in the nursing home. Vaccination clinics were held on three different occasions over the subsequent two weeks; vaccine was also available on request.” Intervention site had previously had “no special promotional activities” but vaccine was available free; control site is described as ‘similar’ to this but no details reported.
Information from discussion	“Despite the program, the overall vaccination rate in the intervention group was only 26%, below the recommended rate of 80%. This did not appear to be due to lack of accessibility of the vaccine or lack of support from the institution. However, it does appear that many staff were still concerned about the efficacy of the vaccine and side effects. Further research is needed on the effectiveness of different approaches in overcoming these barriers.”
Limitations (author)	NR

Tapiainen et al. 2005

Setting	University children's hospital
Population	HCWs not further specified
Intervention	"(1) An informational letter based on misconceptions noted in the survey, (2) educational conversations with head nurses, (3) more "walk-in" immunization clinics, and (4) a direct offer of influenza immunization on the wards."
Information from discussion	Intervention based on survey data showing doubts about efficacy of vaccine (esp. for nurses) and lack of time (for physicians) as barriers to uptake. Misconceptions about vaccination were prevalent. Some adverse effects of vaccination reported.
Limitations (author)	NR

Thomas et al. 1993

Setting	Nursing home ("life-care community")
Population	All staff incl. nurses and aides, "dietary workers", environmental service, maintenance staff, administration and special services
Intervention	"An educational intervention began 1 month before scheduled vaccination …. Department heads reviewed Centers for Disease Control recommendations with their staff. Individual encouragement and answering of questions was offered. The educational intervention culminated in a 1-day Staff Vaccination Fair. The Vaccination Fair was planned for a payday with refreshments served. On that day, all physicians, administrative, and nursing supervisory personnel simultaneously received the free influenza vaccine. A key element of the program involved first immunizing all attending physicians and supervisory personnel in the presence of assembled staff. … Group participation served to set precedence by example and to encourage compliance. Night supervisors worked with their staff who were unable to attend the Fair."
Information from discussion	None relevant
Limitations (author)	NR

Venci et al. 2015

Setting	530-bed teaching hospital
Population	HCWs not further specified
Intervention	The social media sites Facebook and Twitter were used to disseminate information to employees about influenza, vaccination, and times when HCWs could be immunized. The social media sites appeared on large monitors throughout the hospital and through direct posts to individual "followers." These sites were also linked to the hospital intranet site, the Centers for Disease Control and Prevention web site, and The American Society of Health-System Pharmacists Stop the Flu web site. Central facets of the existing influenza campaign included intranet announcements and a kick-off event to vaccinate mass numbers of HCWs. The social media and web

	sites also provided information through Ask a Pharmacist links.
Information from discussion	None
Limitations (author)	Impact of social media component specifically unclear

Zimmerman et al. 2009

Setting	“acute care facilities”
Population	Non-physician employees. Intervention specifically focuses on employees not involved in direct patient care but who could transmit influenza. Stratified in 3 groups, all included: "HCP with “direct patient contact” were those whose jobs involved hands-on or face-to-face contact with patients (e.g., nurses, nursing aides, phlebotomists, therapists, transporters, and patient registration clerks). “With the exception of staff physicians or hospitalists, physicians were excluded from the database, because it was assumed that many would likely have been vaccinated in their private medical offices and not in the hospital. HCP with “indirect patient contact” were those whose jobs entailed being in and around patient care areas but who did not necessarily work with patients (e.g., environmental services employees, maintenance workers, and health unit coordinators). Business and/or administrative employees were those whose jobs involved no patient contact or time in patient care areas (e.g., secretarial staff, laboratory technicians, medical records clerks, and upper management)."
Intervention	All groups received free vaccine, posters, peer vaccination in clinical units and communication with department heads. "Two additional interventions—incentives and use of mobile vaccination carts—were implemented using a factorial (or quadrant) design... such that 4 facilities had incentives only, 2 facilities had mobile vaccination carts only, 3 facilities had both incentives and carts, and 2 control sites had neither. Initially, there were 4 incentive sites at which vaccinees selected an envelope containing a thank you note, 10% of which contained a notice of winning a $10 grocery store gift card. Some sites established their own incentive program independent of the investigators. Specifically, at 2 sites, a lottery was held among vaccinees, with winners each receiving a paid day off, and 1 site offered a party to the unit with the highest influenza vaccination rate. These facilities were assigned to the appropriate incentive quadrants for analysis. Mobile carts were staffed by contracted emergency medical technicians to provide convenient access to influenza vaccine. The carts visited each patient care unit and each non-patient care, nonbusiness unit at least once during all shifts, including weekends."
Information from discussion	Convenience a particularly important factor. Different interventions effective for different categories of staff - particularly direct patient care vs staff with little/no contact with patients. Intervention benefited from being based on survey data.
Limitations (author)	Vaccinations outside the system were not tracked.

Appendix C. Evidence tables: qualitative studies

Clarke 2007

Study aims	To explore the determinants of vaccine behaviour among healthcare workers, and their preferences regarding vaccine communication
Sampling and recruitment	"To ensure an appropriate sample, various groups of healthcare workers were invited to participate … The focus was on eliciting as diverse an array of perspectives on influenza vaccination as possible. … For each research location, relevant supervisors and/or administrators were contacted and asked if their facility was interested in participating. These individuals were also asked if they personally wished to be interviewed. Once an interview was conducted at a location, snowball sampling was then used, by which individuals would recommend other colleagues to contact, either within or external to their own organization." (p39)
Setting and context	Various: university clinic, schools, long-term care, etc.
Sample size	n=17 for in-person/phone interviews (which provide most of the qualitative data), plus n=25 complete and n=79 complete online survey respondents
Population characteristics	61% employed in healthcare for >5 years Main role: 65% direct patient care, 22% administration, 5% research, 5% support / assistant Affiliation: health department n=5, private practice n=5, Department of Human Services n=3, university health clinic n=38, nursing home n=2, schools n=3, ambulance service n=5 NB that these numbers appear to refer to (parts of) the whole sample; characteristics NR separately for 'in-depth' interview sample
Data collection	Semi-structured interview guide based on programme theories. Participants were also asked to respond to a 1-page brochure about vaccination and HCWs. Interviews carried out in person or by phone; took ~20 mins. Online survey available for participants who preferred this; same questions as interview guide. Changes in interview guide / survey made during the project, based on emergent themes and participant suggestions.
Data analysis	Coding framework based initially on theoretical model. Interviews tape-recorded and transcribed, individually coded, and responses then grouped across transcripts.
Limitations (author)	Brochure prompt may have primed participants to think of particular issues. Data from small area and may not generalise to other settings. Some data from online survey were incomplete. Possible social desirability bias in interview responses.
Limitations (reviewer)	Limited information on sampling or participant characteristics. Cognitive focus of theoretical model is arguably a narrow perspective.

Hill et al. 2015

Study aims	To explore factors influencing implementation of a declination form programme to increase influenza vaccination in HCWs
Sampling and recruitment	Sample aimed to include three to four key members of team implementing intervention. No further information on sampling or

	recruitment.
Setting and context	Veterans Affairs specialist spinal cord injury centres
Sample size	7
Population characteristics	Female n=4, male n=3. Mean age 46. Nurses n=3, physicians n=2, infection control staff (non-clinical) n=2.
Data collection	Semi-structured interviews, focusing on overall perceptions of intervention, difficulties with the programme, support and resources. No further information.
Data analysis	Analysis carried out by two researchers expert in qualitative methods. Mixed inductive-deductive approach. Initial framework used constructs derived from Diffusion of Innovation theory; subsequent coding used iterative grounded-theory approach to identify sub-codes and final structure. One researcher conducted coding of all transcripts with final codeset. NVivo used.
Limitations (author)	Small sample and only two sites so limited generalizability. Stakeholder group included people who were already enthusiastic about intervention.
Limitations (reviewer)	Very limited information on methods generally. Likely sampling bias. Study has fairly narrow focus and is of limited applicability.

Hwang and Lim 2014

Study aims	To understand the barriers and motivators towards influenza immunisation among primary care HCWs
Sampling and recruitment	"HCWs were included from various occupational categories of staff — doctors (D), nursing staff (N), pharmacy staff (P), patient service assistants (PSA) and health attendants (HA). Ten participants were selected to be invited for each focus group—two from each category. The recruitment of participants was conducted using an on-line randomiser programme." No further information; role of randomisation unclear, and sampling frame and recruitment not described. Participation rate among those invited 80% (16/20)
Setting and context	Primary care polyclinics; no further information
Sample size	16
Population characteristics	Female n=13, male n=3; doctors n=3, nurses n=4, pharmacy staff n=3, patient service assistants n=3, healthcare attendants n=3; Chinese ethnicity n=12, Malay n=3, Indian n=1; mean age 39
Data collection	Facilitated focus group, conducted in English
Data analysis	Focus groups tape-recorded and transcribed; transcriptions checked against written notes; key themes identified
Limitations (author)	NR
Limitations (reviewer)	Limited information on sampling, recruitment and data collection

Isaacson et al. 2009

Study aims	To investigate the relationship between organisational culture and HCW's influenza immunisation behaviours
Sampling and	Practices (n=3) selected for diversity in ethnicity of population served

recruitment	(Hispanic, African American, white) and setting (urban vs suburban). Within sites, sampled lead physician, office manager, and head nurse or medical assistant, and a range of other HCWs. Limited information on sampling and recruitment of individuals.
Setting and context	Three primary care practices, two in urban minority communities and one in suburban white community
Sample size	n=32 (total NR, but suggested by breakdown on p204)
Population characteristics	For whole population, rather than study sample (but the latter is most of the former, n=32 out of n=37 or n=39): clinicians n=15, nurses n=3, medical assistants n=6, office managers n=3, support staff n=10, administrators n=1, technician n=1. Hispanic n=9, white n=18, African American n=9, other n=3.
Data collection	Semi-structured one-to-one interviews using interview guide informed by theory (reproduced Table 2) for lead physicians, office managers and head nurses. Informal unstructured interviews with other staff members. Interviews conducted at practice sites. Observations of staff and patient interactions.
Data analysis	Interviews recorded and transcribed. Data analysis conducted in Atlas.ti using grounded theory approach. Initial coding scheme developed by four members of research team and then refined by fifth researcher, with verification by other researchers. Relationships between codes then investigated to explore influence of organizational culture on HCWs' views.
Limitations (author)	Small sample size. Sample not representative at practice level.
Limitations (reviewer)	Some unclarity around data collection. Presentation of data is driven by the "organizational culture" dimension of the analysis, but this is arguably not well motivated in the report.

Kalayil et al. 2015

Study aims	To evaluate a data collection initiative for standardising information on vaccination status of hospital personnel
Sampling and recruitment	At institution level: sampling frame created from list of hospitals reporting vaccination rates, stratified according to region and size of institution. Selected using random sampling within strata, with oversampling of larger institutions as previous evidence suggested possibly greater barriers in this group. At individual level: email (and follow-up phone calls) to facilities asking for participation from staff responsible for entering data into system. Some participants asked other people with relevant knowledge to participate. Participation rate at institution level 32% (n=46 of 145; n=36 declined or did not respond, n=65 were not followed up because quota / thematic saturation had been reached).
Setting and context	Acute care hospitals
Sample size	59 individuals (46 institutions)
Population characteristics	Median years at institution 12. Main role: infection prevention 41%, occupational health 29%. No further information.
Data collection	Semi-structured interviews by telephone, ~30 minutes. Interview guide (22 questions) focused on methods of data collection and successes and barriers. Initial pilot test on 3 participants.
Data analysis	Codebook developed from initial interviews and subsequently

	modified. Analysis carried out by 3 researchers with all transcripts coded independently by two and differences resolved by discussion. Thematic analysis. Analysis by categories of HCW where applicable.
Limitations (author)	Data did not cover whole influenza season. May not be generalizable to institutions other than acute care hospitals. Findings could not be linked to data on vaccination coverage.
Limitations (reviewer)	No major limitations. Study has fairly narrow aims.

Khodyakov et al. 2014

Study aims	To explore the implementation of the 2007 California regulations on influenza vaccination of hospital-based HCWs
Sampling and recruitment	For case studies: at institution level: Maximum variation sampling stratified by low/high vaccination rate, masking policy, location, rural/urban status, and size. N=9 out of 17 institutions participated. At individual level: initially sampled person responsible for reporting vaccination data, then snowballing to identify other people familiar with the requirements. For key stakeholder interviews: organisations identified by consultation with health authorities and snowballing. Organisations included public health authorities, unions, professional bodies etc. Sampling and recruitment of individuals NR.
Setting and context	Hospitals, not further described
Sample size	N=26 individuals in total (slightly unclear; n=9 institutions for case studies and apparently n=13 individuals, n=13 individuals for stakeholder interviews)
Population characteristics	For case studies: employee health n=6, infection prevention n=6, education coordinator n=1. No further information. No information on key stakeholder sample.
Data collection	Interviews using conversational interviewing techniques, using open-ended questions, conducted by 2 researchers. Topics included perceptions of the law, barriers and facilitators to compliance, etc. Also document analysis of hospital policies. Stakeholder interview topics included the law's implementation, impact and effectiveness. No further information.
Data analysis	Thematic analysis using MAXQDA. Two researchers coded all data independently and reviewed coding to ensure consistency, resolving disagreements by discussion. Coders incorporated themes from literature and document analysis as well as emergent themes from interviews. Data analysis used triangulation between the two bodies of interview data and the document analysis. Cross-case analyses for the hospital case studies to identify similarities and differences.
Limitations (author)	NR
Limitations (reviewer)	Some unclarity in sampling and data collection. Study focuses on the evaluation of a specific policy; data are fairly limited in extent and arguably of limited generalisability to other policy contexts.

Leask et al. 2010

Study aims	To explore the views of administrators and clinical leaders about

	(hypothetically) adding influenza to the mandatory vaccination policy for HCWs in New South Wales
Sampling and recruitment	Maximum variation sampling (Helms et al. 2011) or stratified purposeful sampling (Leask et al. 2010) to identify maximum variation in experiences related to policy implementation. Targeted four groups involved with the policy: NSW Department of Health; NSW Health Implementation Group (a policy implementation group consisting of representatives from each region); professional associations; public hospitals and universities. No detailed information on sampling process, and no information on recruitment.
Setting and context	Hospitals (data all relate to hospitals, although unclear if the scope of the policy studied is broader)
Sample size	58
Population characteristics	Institution: Department of Health n=8; Health Implementation Group n=5; hospitals n=37 (administrative leaders n=24, clinician managers n=13); universities, unions and professional associations n=8. No other information.
Data collection	Semi-structured interviews, all by same researcher, most conducted face-to-face (n=3 by telephone). Questions based on framework of implementation of evidence-based practice. Interview form piloted and revised.
Data analysis	Thematic analysis using NVivo. Findings compared across hospital types and professional groups to identify influences on participants' views. Interpretation conducted by authors with different opinions about mandatory vaccination.
Limitations (author)	Data refer to whole regions and not specific hospitals. Not representative sample.
Limitations (reviewer)	No major limitations

Lehmann et al. 2014

Study aims	To investigate HCWs' reasons for influenza vaccination or non-vaccination and views and experiences of vaccination, with a focus on social-cognitive determinants of behaviour
Sampling and recruitment	At site level, hospitals sampled for having comparable vaccination programmes and a substantial number of unvaccinated HCWs. At individual level: "Participation was open to all HCP. Particular effort was done to obtain a comparable proportion of physicians and nursing staff among employees from the three hospitals. Participants were provided with information concerning the purpose of the interview, anonymity and confidentiality conditions, and the voluntariness of participation before each interview. … Interviewees were HCP from different wards and with different professions. Recruitment was performed by the first author and continued until saturation occurred." (p2)
Setting and context	Hospitals; no further information
Sample size	123
Population characteristics	Female 68%, male 32%; mean age 37; physicians 26%, nurses 46%, students 6%, other 22%
Data collection	Semi-structured interviews (topics listed in report). Interviews lasted ~10 minutes. No further information. Interviews appear to have been

	conducted in participants' native languages, and translated after analysis, but this is not clearly reported.
Data analysis	Analysis conducted using NVivo. Coding "based on a combination of a deductive and a general inductive approach", with Reasoned Action Approach providing a framework. Conducted by a single researcher with discussion with other authors.
Limitations (author)	Analysis cannot establish causality or relative importance of different determinants. Coding performed by one researcher alone. Few participants belonged to high-risk group (age, pregnancy or medical condition). Sites sampled for convenience rather than representativeness and so findings may not be generalisable.
Limitations (reviewer)	Minor unclarity around sampling and data collection

Lim and Seale 2014

Study aims	To explore the views of key stakeholders regarding influenza vaccination for HCWs
Sampling and recruitment	Sampling targeted stakeholders involved with policy-making or implementation of strategies in hospitals, including "infection control officers, key infectious disease opinion leaders, and health department leaders" (p607). Health department websites were searched for potential participants and then contacted by email. Also snowballing by recommendations from participants. Aimed to recruit at least one participant from each state/territory. Participation rate 54% (n=21 of 39).
Setting and context	Hospitals, not further specified
Sample size	21
Population characteristics	"Participants included immunization managers/directors, senior medical advisors/officers from the health department, communicable disease directors, and public health nurses responsible for coordinating hospital campaigns" (p607); no further information
Data collection	Semi-structured interview using open-ended questions. Interviews conducted by a single researcher either in person (n=1) or by telephone (n=20). Member checking conducted during interviews to confirm early phase of analysis. Interview guide focused on attitudes to and knowledge of HCW vaccination, challenges with vaccine provision, and strategies to improve coverage.
Data analysis	Interviews recorded and transcribed. List of themes developed by two researchers from one-quarter of transcripts. Framework then applied to another subset of transcripts and further modified, then all transcripts coded. Software not used.
Limitations (author)	Small sample. Snowballing recruitment may have limited range of opinions. Data not collected on participants' specific roles. Data not collected on participants' receipt of industry funding.
Limitations (reviewer)	None

Lindley et al. 2014

Study aims	To evaluate the implementation of a state-wide masking requirement

	policy for HCWs
Sampling and recruitment	At institution level, aimed to sample different types of facility and institutions that did / did not report vaccination data in previous season. Among reporting facilities, sampling stratified by facility type, size and reported vaccination coverage rate, and randomly sampled within these strata. Non-reporting facilities sampled randomly without stratification. At individual level, aimed to sample person primarily responsible for implementation of policy. Participation rate 90% (n=18 of 20).
Setting and context	Acute care hospitals, nursing homes, community health centers, nursing service agencies, and home nursing care providers
Sample size	18
Population characteristics	"Respondents had worked at their facilities for an average of 15 years" (p5964). No further information.
Data collection	Interviews conducted by telephone by three interviewers from health research organisation, ~40 minutes. No further information.
Data analysis	Codes developed by two researchers, applied independently then reviewed and consensus reached by discussion.
Limitations (author)	Findings may not apply to non-reporting facilities. Data could not be linked to reporting status or vaccination coverage rate. Information on practices was self-reported and not independently verified. Data not broadly generalisable.
Limitations (reviewer)	The paper is an evaluation of a specific policy and broader implications are not drawn out.

Manuel et al. 2002

Study aims	To investigate the health behaviour associated with influenza vaccination among HCWs
Sampling and recruitment	"Nonmanagerial HCWs from all occupations in the long-term–care facilities were invited to participate in one of two focus groups". No further information.
Setting and context	Long-term care facilities
Sample size	16
Population characteristics	Healthcare aides n=9, members of nursing staff n=3, dietary or maintenance staff n=2, other n=2; n=11 of 16 vaccinated
Data collection	Facilitated focus group, 1 hour. "The format included two introductory questions to initiate discussion: “What is the first word that comes into your mind when I say ‘flu shot’ and ‘flu outbreak’?” and “Why do staff get or not get the flu shot?” (p610)
Data analysis	Focus groups recorded and transcribed, then coded independently by two researchers using 'editing analysis style' (roughly grounded theory)
Limitations (author)	Findings may not be generalisable because small sample and one site had recently had an influenza outbreak.
Limitations (reviewer)	Focus groups are a minor part of the study (main focus is questionnaire findings) and data are limited.

Nowak et al. 2015

Study aims	To explore the public's and HCWs' knowledge, attitudes and beliefs relating to influenza vaccination

Sampling and recruitment	NR
Setting and context	Various settings, not reported in detail
Sample size	Approx n=215 total (unclear exactly which studies report relevant data)
Population characteristics	A range of professions including physicians, nurses, allied health professionals and physician assistants. No further information
Data collection	Interviews and focus groups; no further information
Data analysis	NR for original studies; for this analysis, "the authors independently focused on identifying the themes related to influenza and influenza vaccination knowledge, attitudes and beliefs" (p2743); no further information
Limitations (author)	Findings not quantifiable or generalizable. No pre-determined theoretical framework. Differences in context of different studies over time (e.g., recommendations, vaccine shortages, new products, pandemics). Some groups not represented.
Limitations (reviewer)	This report summarises the findings of several studies. The full study reports are unpublished and we have been unable to access them for this review. Hence we have coded this report as a primary study. However, there is limited information reported on either the methods or findings of the research. It is also unclear (a) which views are HCWs' and which those of the public, and (b) of the former, which refers to HCWs' own vaccination and which to their views on vaccination of their patients. Table 2 appears to include some studies with HCW populations, but does not distinguish between them and the public views, so these data have not been included in the review (only Table 3). Note also that one of the studies (FG10) appears to be reported in a separate study which is also included in the review (Willis and Wortley 2007), so there is some overlap.

Pianosi et al. 2013

Study aims	To understand the vaccination policies of institutions involved in training healthcare students, and the attitudes of key stakeholders towards a more co-ordinated system for vaccination of students
Sampling and recruitment	At institution level, sampled all schools which had student placements at a specific hospital (unclear if all schools were sampled; no further information on sampling strategy). Participation rate 100% at institution level. Individuals identified through public directories for schools and contacted by email or telephone; no further information on sampling at individual level.
Setting and context	University departments which sent students on placement to a tertiary care paediatric and maternity hospital.
Sample size	21
Population characteristics	NR
Data collection	Semi-structured interview; questions focused on institutions' policies on vaccination of students and collection and management of data. Interviews ~45 minutes, at preferred location of participant.
Data analysis	Interviews recorded and notes taken. Coding conducted based on common themes (and implicitly on the interview schedule), manually or using NVivo.

Limitations (author)	Sample only included programme co-ordinators, not students themselves. Cost-effectiveness of proposed programme not evaluated. Data not linked to vaccination coverage rates.
Limitations (reviewer)	Most of the findings relate to the quantitative survey component; relatively limited findings are reported from the interview data, and only in summary form. Data mainly relate to a hypothetical intervention and broader attitudes are not explored.

Pierrynowski Gallant et al. 2009

Study aims	To understand how nurses decide whether or not to be vaccinated against influenza
Sampling and recruitment	Snowballing from first participant, guided by 'maximum variation' (not further defined). "The majority of the participants were selected based on the above means; others were chosen based on my own professional associations." (p36) Inclusion criteria: registered nurses; >=1 year experience in Nova Scotia healthcare system; could read and write English; willing to participate. Elsewhere the sampling process is described as driven by theoretical saturation (p41).
Setting and context	Range of settings including long-term care, mental health, acute care, public health
Sample size	11
Population characteristics	All nurses; female n=9, male n=2; median age 47 y; 'Caucasian' n=10, Black n=1; years of experience range 3.5-35
Data collection	Unstructured individual interview, 30-60 minutes. Questions developed from emergent hypotheses as study proceeded. Some participants (n=4) contacted for follow-up interviews.
Data analysis	Three-level coding (open, selective, theoretical) based on grounded theory principles. Analysis was ongoing during data collection and included testing of emergent hypotheses. Coding conducted in Atlas.ti.
Limitations (author)	Small sample size. Possibility of social desirability bias in individual interviews.
Limitations (reviewer)	None

Prematunge et al. 2014

Study aims	To investigate HCWs' motivators and barriers to pandemic and seasonal influenza vaccination
Sampling and recruitment	All HCWs at 1 selected hospital invited to participate. Participation rate 31%. No further information
Setting and context	A large tertiary care hospital
Sample size	3,275
Population characteristics	Mean age 43; female 81%; 'Caucasian' 89%. Nurses 35%, physicians 5%, allied HCWs 11%, administrative/clerical 22%, technicians 7%, research/laboratory 8%, facilities/logistics 7% other non-clinical 4%. Vaccinated for seasonal influenza 2008-09 74%, 2009-10 54%.
Data collection	Survey included closed questions on demographics and vaccine history and an open question on reasons for vaccination to decisions. Participants returned survey to occupational health department. No

	further information
Data analysis	Initial coding framework developed based on previous literature and piloted on random subsample by two coders, in consultation with topic and method experts. Barriers and motivators coded separately from qualitative data, followed by quantitative vote-counting analysis of most frequent themes. Conducted in Excel and SPSS by a single coder.
Limitations (author)	Limited generalisability and sample over-represents certain groups (white, female). Sample over-represents vaccinated HCWs which may indicate recruitment bias. Responses may not reflect participants' true motives. Coding may have been influenced by external factors. Initial coding schema depended on existing quantitative research and may not have reflected more 'subtle' factors.
Limitations (reviewer)	Only survey responses so the data are shallow, and reporting is presumably highly selective. Limited information on analysis. Unclear which data points refer specifically to pandemic influenza and hence are outside the scope of this review.

Quach et al. 2013b

Study aims	To explore programme managers' perceptions of strategies to improve influenza vaccination uptake among HCWs (main paper) and of processes to collect vaccination data (linked paper).
Sampling and recruitment	Previous online survey study used a range of methods to recruit healthcare organisations, including contact with health authorities, infection control networks, emails and bulletin boards, and cold calling. Of those who indicated willingness to participate in future research (n=478), n=30 were sampled for variety in type of organisation, size, and province (excluding provinces without HCW vaccination programmes or incomplete responses to relevant survey questions). Participation rate 70% (n=21 of 30) at institution level. No information on sampling of individuals. Participants received $5 voucher incentive.
Setting and context	Various including acute and long-term care
Sample size	n=23 individuals (n=21 organisations)
Population characteristics	Median 5 years of experience with HCW vaccination programmes; all participants were lead organizer in their organization. For analysis reported in main paper: occupational health and safety nurses n=6, occupational health and safety managers n=4, infection control nurses n=3, workplace health and safety adviser n=1, director n=1. Institutions: continuing care n=6, acute care hospitals n=7, public health organisations (including both acute and continuing care) n=8
Data collection	Semi-structured interviews including questions about vaccination programmes, data collection and reporting. Interviews ~1 hour, conducted with single participant or two participants where two recruited from the same organisation, conducted in English (n=18) or French (n=3); English interview guide translated and reviewed for accuracy for French interviews. All English interviews conducted by one researcher, all French by another.
Data analysis	Interviews recorded and transcribed (and French transcripts translated into English). Content analysis conducted by two researchers working together on one-quarter of transcripts. Three researchers then reviewed the codes and revised the codeset. NVivo used for analysis.

	Themes also examined by organisation type. Respondents were given the opportunity to review a summary of the results for accuracy.
Limitations (author)	Did not include representation from all provinces/territories. Findings not broadly generalizable.
Limitations (reviewer)	Some unclarity around sampling.

Quinn 2014

Study aims	To understand nurses' views of influenza vaccination
Sampling and recruitment	"Registered nurses working at the research site were selected based on the fact that they had direct experience of the seasonal staff influenza vaccination campaign" (p942, but unclear if this means generically or as individuals). No further information on sampling or recruitment; described as 'purposive' in abstract
Setting and context	Large long-term care facility for older people
Sample size	11
Population characteristics	All registered nurses; all female; years of experience 7-22; grade ranging from staff nurse to manager
Data collection	Semi-structured interviews; no further information
Data analysis	Interviews transcribed and "thematically analysed with the Braun and Clarke Framework" (p943); no further information
Limitations (author)	Small sample size. May not be generalizable to other groups of HCWs.
Limitations (reviewer)	Generally limited information on methods.

Raftopoulos 2008

Study aims	To explore nurses' knowledge, attitudes and beliefs regarding influenza vaccination
Sampling and recruitment	Inclusion criteria; able to participate; Greek-speaking; registered nurses working in healthcare setting. Participation rate 71% (30/42), although unclear what the denominator refers to. Described as 'convenience sample' (p36). "To ensure that the sample was representative, nurses who worked in various healthcare settings such as hospitals, emergency departments, outpatient clinics, surgical and medical hospital departments in private and public healthcare facilities were approached" (p36).
Setting and context	Two private hospitals, one public general hospital and one public health (disease surveillance) unit.
Sample size	30
Population characteristics	Mean age 31; mean 7 years of experience; 77% female; 3% vaccinated
Data collection	Focus groups, conducted at participants' workplaces. Focus groups included HCWs from same setting to encourage participation. Participants were encouraged to interact with each other.
Data analysis	Focus groups recorded and transcribed. Analysis was fed back to participants for additional comments. Content analysis carried out by two researchers independently and differences resolved by discussion. Themes focused on knowledge and beliefs regarding vaccination, and

	barriers to vaccination.
Limitations (author)	Small convenience sample. Possible errors in recall and social desirability bias. Possible barriers to generalisability.
Limitations (reviewer)	None

Real et al. 2013

Study aims	To segment HCWs into groups relating to risk perception, safety beliefs and vaccination uptake
Sampling and recruitment	For broader study, recruited via emails to managers and posting on hospital intranet. For qualitative sample, unclear how sampled: participants volunteered and were paid $50 for participation, but NR how many were approached or whether there was any specific sampling strategy.
Setting and context	Academic medical centre
Sample size	29
Population characteristics	Registered nurse n=15, MD n=7, allied health n=6, unit manager n=1. No further information
Data collection	Interviews. Protocol based on initial pilot interviews with HCWs (n=3) before main study. No further information.
Data analysis	Themes developed from iterative analysis using constant comparison method.
Limitations (author)	Limitations reported only relate to quantitative component
Limitations (reviewer)	Paper is mainly quantitative and there is little detail on the methods or findings of the qualitative component. The overall aim of the paper is quite narrowly focused and not directed towards understanding broader determinants of vaccination behaviour.

Rhudy et al. 2010

Study aims	To understand factors influencing nurses' decisions about influenza vaccination
Sampling and recruitment	Described as 'convenience sample' (p113). Sample drawn from a previous survey (sampling methods for that study NR). All participants in the previous survey who said they were uncertain about or did not intend to receive vaccination were contacted by email. N=27 initially indicated willingness and n=14 finally participated.
Setting and context	A large multi-specialty medical group practice. Various departments incl. critical care, neurology, thoracic unit, emergency department, outpatient surgery, gynaecology etc.
Sample size	14
Population characteristics	All nurses. Inpatient setting n=8, outpatient n=6. Mean age 44, mean years nursing experience 13. 'Caucasian' n=12, African American n=1; female n=11, male n=2.
Data collection	Semi-structured interviews, 15-60 minutes. Interview guide piloted with first n=4 participants, conducted face-to-face. Subsequent interviews conducted by phone. All interviews conducted by a single researcher.
Data analysis	Interviews transcribed and analysed using iterative content analysis.

	Coding carried out independently by different researchers and validated by a third coder not involved in the study.
Limitations (author)	Small convenience sample. Limited generalisability. Low participation rate.
Limitations (reviewer)	None

Seale et al. 2012

Study aims	To understand current policy and practice on influenza vaccination for HCWs in Australian public hospitals
Sampling and recruitment	Sampling focused on all metropolitan public hospitals in selected states (N=92 eligible). Individual responsible for co-ordinating vaccination campaigns identified for each site and contacted by post (some had responsibility for multiple sites). Institutions called up to five times before being considered non-respondent. Participation rate n=29 of 34 (85%), representing n=82 of n=92 institutions.
Setting and context	Public hospitals (general, tertiary and specialist)
Sample size	n=29 individuals representing n=82 institutions
Population characteristics	NR
Data collection	Semi-structured interviews, <=45 minutes, conducted by two researchers. Interview guide focused on current vaccination policies, measures used to promote vaccination, data collection, potential barriers to vaccination, and support for a hypothetical mandatory policy.
Data analysis	Interviews recorded and transcribed. Two researchers developed list of codes after analysing one-quarter of transcripts and agreed framework applied to a further subset and modified further. All transcripts then coded to agreed framework. Analysis was discussed with colleagues. Coding conducted manually.
Limitations (author)	Member checking not undertaken. Small sample. Participants' specific role not included in analysis.
Limitations (reviewer)	No major limitations. Staff other than programme co-ordinators not sampled.

Seale et al. 2016

Study aims	To explore HCWs' attitudes towards an online decision aid providing information about influenza vaccination
Sampling and recruitment	Participants recruited by posters, emails and snowballing. Recruitment continued "until we reached the point of saturation" (not further defined). Some ward directors were specifically contacted (implicitly, those responsible for departments where fewer staff had been recruited). Participants received an Au$50 voucher as compensation.
Setting and context	Large public hospitals
Sample size	41
Population characteristics	Female 68%, age <35 46%, median years working healthcare 12. Resident / registrar n=10, staff specialist n=3, NUM n=1, registered nurse n=13, other n=14.

Data collection	Semi-structured interviews focusing on both general attitudes and perceptions and existing strategies for vaccine promotion, and the specific decision aid implemented in the study. Interviews undertaken by two researchers.
Data analysis	First n=24 interviews transcribed; subsequent interviews reviewed for emergence of additional themes but not transcribed. Member checking conducted to validate emergent coding scheme. Thematic analysis initially conducted on one-quarter of the transcripts and then reviewed.
Limitations (author)	Participants were self-selected and so possible recruitment bias. Findings not compared with broader population.
Limitations (reviewer)	Study has specific focus on information, rather than broader determinants of behaviour

Seymour 2014

Study aims	To explore public health professionals' reasons for declining influenza vaccination
Sampling and recruitment	Participants recruited through online survey sent to (all?) employees of selected organisation. Inclusion criteria: employed by selected orgnaisation and unvaccinated at time of study.
Setting and context	Public health department
Sample size	10
Population characteristics	Female 60%; ages 30-62; roles incl. educators, outreach workers, nurse, dietitian, administrative assistant
Data collection	Semi-structured interview, with questions focusing on reasons for declining vaccine and any factors which could motivate them to receive vaccination, based on Health Belief Model.
Data analysis	Interviews recorded and transcribed. Analysis using directed content analysis, with framework based on Health Belief Model (focusing particularly on rationale and motivations). Transcripts coded by one researcher and a subset reviewed by a second. Case tables then constructed to summarise coded data.
Limitations (author)	Data possibly shaped by researcher's own bias in favour of vaccination. Small sample and may not be representative.
Limitations (reviewer)	Limited information on sampling and recruitment; little data on context or setting

Willis and Wortley 2007

Study aims	To explore the attitudes and beliefs of vaccinated and unvaccinated nurses about influenza vaccination
Sampling and recruitment	Sites selected "because one of our original objectives was to compare black nurses with white nurses" (so, implicitly, places with large black populations), but insufficient sample size was attained to make the comparison. Participants were recruited "by a professional focus group facility using the facility's database of participants" (p21). Participants were selected purposively for "racially balanced groups" and to focus on nurses involved in direct patient care. Snowballing was also used. A "modest" financial compensation for expenses was offered. It is stated that all participants had at least 1 year of clinical experience, but

	unclear if this was a criterion.
Setting and context	Mainly hospital settings, with some working in clinics or physician offices. Mainly urban locations.
Sample size	71
Population characteristics	Female 96%; >= 36 years 79%; white 61%, black 38%
Data collection	Focus groups. 4 groups each of vaccinated and unvaccinated participants. Discussion guide covered general attitudes to vaccination, nurses' role in promoting vaccination, and factors affecting their own vaccination behaviour. Groups 1 hour long, led by trained moderator, in English. Sessions took place in a room with a one-way mirror and observers took notes during sessions.
Data analysis	Transcripts and notes were reviewed by researchers and themes identified.
Limitations (author)	Small sample, in only two locations, and not representative.
Limitations (reviewer)	Relatively small amount of data. Limited information on context. Note that this appears to be one of the studies included in Nowak et al.'s analysis (listed there as FG10), so there is some overlap in the data.

Yassi et al. 2010

Study aims	To explore HCWs' views on how to improve vaccine uptake
Sampling and recruitment	Sites were chosen for diversity in vaccine uptake rates, and for convenience with respect to location and organisation size. Study was advertised through posters, brochures, email. Participants registered by telephone and were paid C$55 for participation. No information on sampling with respect to individual participants (although stated in discussion that only HCWs with direct patient contact were included).
Setting and context	Long-term care, acute care, community care facilities
Sample size	83
Population characteristics	Female n=76, male n=7; occupations incl. registered nurses, licensed practical nurses, unit clerks, physicians, care aides, dietary staff, housekeeping and kitchen staff, occupational therapists, librarians, hairdressers, laboratory staff, home support workers, psychiatric support workers, recreational aides
Data collection	Focus groups with mixed occupational groups. Questions based on literature and from previous survey, with focus on organisational and individual reasons for vaccination.
Data analysis	Focus groups recorded and analysed using NVivo and separately using editing analysis style. Themes were not specified a priori. Analysis conducted by two researchers independently.
Limitations (author)	Small sample and may not be representative. Only included HCWs with direct patient contact. Data on occupational group not collected. "No controlling for" facility size or location. Individuals not selected based on vaccination status.
Limitations (reviewer)	Fairly limited reporting of both methods and data.

Appendix D. Quality assessment tool for qualitative studies

1. Abstract and title: Did they provide a clear description of the study?

Good Structured abstract with full information and clear title.

Fair Abstract with most of the information.

Poor Inadequate abstract.

Very Poor No abstract.

2. Introduction and aims: Was there a good background and clear statement of the aims of the research?

Good Full but concise background to discussion/study containing up-to-date literature review and highlighting gaps in knowledge. Clear statement of aim AND objectives including research questions.

Fair Some background and literature review. Research questions outlined.

Poor Some background but no aim/objectives/questions, OR Aims/objectives but inadequate background.

Very Poor No mention of aims/objectives. No background or literature review.

3. Method and data: Is the method appropriate and clearly explained?

Good Method is appropriate and described clearly (e.g., questionnaires included). Clear details of the data collection and recording.

Fair Method appropriate, description could be better. Data described.

Poor Questionable whether method is appropriate. Method described inadequately. Little description of data.

Very Poor No mention of method, AND/OR Method inappropriate, AND/OR No details of data.

4. Sampling: Was the sampling strategy appropriate to address the aims?

Good Details (age/gender/race/context) of who was studied and how they were recruited. Why this group was targeted. The sample size was justified for the study. Response rates shown and explained.

Fair Sample size justified. Most information given, but some missing.

Poor Sampling mentioned but few descriptive details.

Very Poor No details of sample.

5. Data analysis: Was the description of the data analysis sufficiently rigorous?

Good Clear description of how analysis was done. Description of how themes derived/respondent validation or triangulation.

Fair Descriptive discussion of analysis.

Poor Minimal details about analysis.

Very Poor No discussion of analysis.

6. Ethics and bias: Have ethical issues been addressed, and what has necessary ethical approval gained? Has the relationship between researchers and participants been adequately considered?

Good Ethics: Where necessary issues of confidentiality, sensitivity, and consent were addressed. Bias: Researcher was reflexive and/or aware of own bias.

Fair Lip service was paid to above (i.e., these issues were acknowledged).

Poor Brief mention of issues.

Very Poor No mention of issues.

7. Results: Is there a clear statement of the findings?

Good Findings explicit, easy to understand, and in logical progression. Tables, if present, are explained in text. Results relate directly to aims. Sufficient data are presented to support findings.

Fair Findings mentioned but more explanation could be given. Data presented relate directly to results.

Poor Findings presented haphazardly, not explained, and do not progress logically from results.

Very Poor Findings not mentioned or do not relate to aims.

8. Transferability or generalisability: Are the findings of this study transferable (generalisable) to a wider population?

Good Context and setting of the study is described sufficiently to allow comparison with other contexts and settings, plus high score in Question 4 (sampling).

Fair Some context and setting described, but more needed to replicate or compare the study with others, PLUS fair score or higher in Question 4.

Poor Minimal description of context/setting.

Very Poor No description of context/setting.

9. Implications and usefulness: How important are these findings to policy and practice?

Good Contributes something new and/or different in terms of understanding/insight or perspective. Suggests ideas for further research. Suggests implications for policy and/or practice.

Fair Two of the above.

Poor Only one of the above.

Very Poor None of the above.

Appendix E. Results of quality assessment for the qualitative studies

Study identifier	1. Abstract and title	2. Introduction and aims	3. Method and data	4. Sampling	5. Data analysis	6. Ethics and bias	7. Results	8. Transferability	9. Implications
Clarke 2007	Good	Good	Good	Poor	Fair	Fair	Good	Poor	Fair
Hill et al. 2015	Good	Good	Poor	Poor	Good	Poor	Good	Poor	Fair
Hwang and Lim 2014	Fair	Poor	Fair	Poor	Poor	Fair	Fair	Poor	Fair
Isaacson et al. 2009	Good	Fair	Good	Fair	Fair	Poor	Poor	Fair	Fair
Kalayil et al. 2015	Good	Fair	Fair	Good	Fair	Poor	Fair	Fair	Fair
Khodyakov et al. 2014	Good	Fair	Fair	Good	Good	Poor	Fair	Fair	Poor
Leask et al. 2010	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair
Lehmann et al. 2016	Good	Good	Fair	Fair	Poor	Fair	Good	Fair	Fair
Lim and Seale 2014	Fair	Fair	Good	Fair	Fair	Poor	Fair	Poor	Fair
Lindley et al. 2014	Good	Fair	Poor	Good	Poor	Poor	Good	Fair	Poor
Manuel et al. 2002	Good	Fair	Poor	Poor	Fair	Very poor	Fair	Poor	Poor
Nowak et al. 2015	Good	Good	Poor	Poor	Very poor	Very poor	Fair	Poor	Fair
Pianosi et al. 2013	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Poor
Pierrynowski Gallant et al. 2009	Good	Good	Fair	Fair	Good	Fair	Good	Fair	Good
Prematunge et al. 2014	Good	Fair	Good	Fair	Fair	Poor	Fair	Poor	Fair
Quach et al. 2013b	Good	Fair	Fair	Fair	Good	Poor	Good	Poor	Fair
Quinn 2014	Fair	Fair	Poor	Poor	Poor	Fair	Fair	Poor	Good
Raftopoulos 2008	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair
Real et al. 2013	Fair	Fair	Poor	Very poor	Poor	Poor	Poor	Poor	Fair

Rhudy et al. 2010	Good	Good	Good	Fair	Good	Poor	Fair	Fair	Good
Seale et al. 2012	Good	Fair	Good	Good	Fair	Poor	Fair	Poor	Fair
Seale et al. 2016	Good	Fair	Good	Fair	Fair	Poor	Fair	Poor	Fair
Seymour 2014	Good	Good	Good	Fair	Good	Fair	Good	Poor	Fair
Willis and Wortley 2007	Good	Fair	Good	Good	Fair	Very poor	Fair	Poor	Fair
Yassi et al. 2010	Fair	Fair	Fair	Poor	Fair	Very poor	Fair	Poor	Poor

Appendix F. Illustrative quotes from implementation and context section

This Appendix includes illustrative quotes from the intervention studies, organised by the same headings as in the "Data on implementation and context" section of the main report[5].

5.1.1. Infrastructure and resources

5.1.1.1. Issues across intervention types

Capturing accurate data, minimizing human error and identifying employees that got vaccinated elsewhere were difficult to execute. It is likely that these challenges will continue to present themselves in a policy-based approach like vaccinate-or-mask and are not unique to a voluntary campaign. (Marwaha et al. 2016)

While it was not possible to analyse the "potentiating" effect of these three approaches implemented in conjunction, it is likely that a comprehensive policy will have more impact than single approaches in isolation. (Chamoux et al. 2006; our translation)

Since each intervention for this study was considered to be effective on the basis of prior published experiences, the implementation of a combination of interventions was felt to be important in achieving success. (Honda et al. 2013)

5.1.1.2. Increased access

Our immunisation program was implemented with only a small increase in resourcing, used to increase vaccine availability as well as developing a social marketing campaign and database support for timely reporting throughout the program. (Heinrich-Morrison et al. 2015)

On average, [organisations] reported spending less than 30 minutes on displaying posters and distributing flyers, less than 1 hour for planning in-service training, and less than 1 hour for organizing Vaccine Days. … the estimated cost to conduct both the educational campaign and Vaccine Day interventions in a facility with 100 employees was [US]$1150. (Kimura et al. 2007)

Although the drill was associated with improved vaccination rates, the extensive resources needed to conduct the drill (eg, daily meetings with numerous senior hospital administrators) precluded us from running another drill in 2006. (Kuntz et al. 2008)

The unwillingness of one-quarter of HCP to wait for more than 10 minutes indicated that high vaccination rates require highly convenient access and minimal effort for HCP. (Quan et al. 2012)

5.1.1.3. Incentives, increased awareness and education

The learnings from preparatory work for this Trial demonstrated that: … 2. organizational commitment to the program from managers, leads and senior managers is required; 3. greater trust in the organization leaders who are implementing the program is required; 4. departmental silos must be removed and inter-professional/department co-operation encouraged. (Chambers et al. 2015)

[5] All author quotes unless otherwise stated.

It is probable that the specifics of the lecture and educational material played only a minor part in the success of the intervention. Our impression is that the program's success resulted from the general effect of raising the immunization issue and recommendation repeatedly and from different directions. (Abramson et al. 2010)

[P]erhaps training is not necessary to increase vaccination rates, simply identifying an appropriate champion is sufficient. (Slaunwhite et al. 2009)

5.1.1.4. Soft mandates

[T]he content of each intervention also required a labor-intensive and time-consuming effort by the departments of infection prevention and occupational health. (Honda et al. 2013)

Taken collectively, the implementation of a HCW DFP [declination form programme] for influenza vaccination is of minimal cost (less than a full work week on average across the entire vaccination season of approximately 6 months), but does require some staffing dedication and resources. (LaVela et al. 2015)

Besides planning the interventional strategies, a routine daily meeting was held during the vaccination period to review the real-time vaccination rate, make calls for real-time feedback, and establish the medical interview to improve adherence to the vaccination policy. (Honda et al. 2013)

The institution of a real-time noncompliance tracking tool was pivotal in ensuring participation, because staff members were held directly accountable to their supervisors rather than to Occupational Health. (Quan et al. 2012)

Leveraging and compl[e]menting existing programs were discussed as an important component of easing a DFP into place. This offers a number of important advantages such as capitalizing on existing resources and reducing the likelihood of duplication. (LaVela et al. 2015)

5.1.1.5. Hard mandates

A significant amount of human and financial resources are required for this effort, including employee time and cost of vaccine and supplies. (Rakita et al. 2010)

All medical requests required extensive investigation into history including discussions with both employees and their health care providers as deemed appropriate, literature searches and allergist/specialist referral as needed before rendering a decision regarding exemption status. (Leibu and Maslow 2015)

5.1.2. Facilitators and barriers to vaccine acceptance: personal

5.1.2.1. All interventions: Facilitators

[R]egression analysis also found the expected strong association between having received an immunization in the previous year and present immunization status. (Abramson et al. 2010)

We found that convenience was an essential factor in HCP vaccination, even for those who had already decided to receive the vaccine. (Quan et al. 2012)

5.1.2.2. All interventions: Barriers

Barriers to vaccination, particularly the perception that immunisation does not work, that staff may not be at risk of influenza and adverse effects of immunisation, should be addressed. (Heinrich-Morrison et al. 2015)

[I]t is necessary to overcome many HCP misconceptions about the influenza vaccine. For example, in this study, concern for vaccine safety remained a major reason among those who declined vaccination. (Quan et al. 2012)

Exemption requests often reflected misinformation about the vaccine and about influenza among employees and among their physicians. Several requests cited chemotherapy or an immunosuppressed state as reasons not to get the vaccine, even though these groups are at high risk for complications from influenza and are specifically recommended to be vaccinated. Several requests cited pregnancy, although the vaccine is recommended during pregnancy. (Babcock et al. 2010)

It was also of concern that 7 pregnant nurses identified their obstetricians as sources of advice to avoid influenza vaccination. This occurred despite the fact that pregnant women are one of the populations targeted by the CDC as being at increased risk for severe complications from influenza infection. (Ribner et al. 2008)

Sadly, many employees only addressed concern for potential illness from vaccine reaction in themselves and without concern for patients and coworkers, which were the main goal for the vaccine campaign. (Leibu and Maslow 2015)

The most frequently cited reasons for declining influenza vaccination were related to HCWs' misconceptions and fears regarding influenza vaccine efficacy, benefits and toxicity […] Unfortunately, it was not possible to completely reverse HCWs' misconceptions despite substantial educational efforts. (Ajenjo et al. 2010)

5.1.2.3. Soft mandates

The declination form did assist us in identifying personnel who might require targeted education or other interventions to overcome barriers to vaccination acceptance. (Ribner et al. 2008)

One explanation for the success of the DFP is that it required far more involved interactions between vaccinating staff and potential HCW vaccine recipients rather than accepting a simple no. (LaVela et al. 2015)

5.1.2.4. Hard mandates

[S]ome requests stated opposition to a mandatory policy, not to vaccination itself. (Babcock et al. 2010)

Five HCWs voluntarily left, and 2 were terminated during the 2005-2006 influenza season. Since then, only 2 HCWs have left as a result of the influenza vaccination requirement. (Rakita et al. 2010)

5.1.3. Types of HCW

Physicians were also significantly more likely to believe to be at increased risk for influenza and to believe in the effectiveness of the vaccine. (Leitmeyer et al. 2006)

Inconvenience was the most common reason persons would not become immunized. […] Medical students reported cost as a deterrent to immunization more often. (Ohrt and McKinney 1992)

Physicians […] noted scheduling conflicts as the reason for not getting vaccinated. (Honda et al. 2013)

[T]he effect of knowledge and attitude on conversion was substantially more pronounced among nurses, suggesting that also nurses need to be convinced of their risk and the value of the vaccine before they decide to become vaccinated. (Leitmeyer et al. 2006)

Nurses were least likely to select the reason "afraid of needles" or "fear of getting influenza from the vaccine" and were more likely to write in objections to being coerced or pressured into vaccination than were all other groups. (Ribner et al. 2008)

Misconceptions about influenza vaccination were prevalent among pediatric staff, particularly nurses. Active promotion and educational efforts based on the results of an attitude survey were successful in increasing the rate of immunization of physicians but not nurses and other HCWs. (Tapiainen et al. 2005)

It further showed that programs should not be moralizing, exclusively factual, and providing top-down scientific knowledge (which may lead to rejection), but need to be adapted to target occupational groups. (Rothan-Tondeur et al. 2011)

On the basis of these findings, we suggest that interventions should be tailored to the specific job category to make efficient use of available resources. (Zimmerman et al. 2009)

Doctors may be disinclined to accept health-related messages from non-medical managers. […] Therefore, it seems reasonable to suppose that a more complex and science-based promotion campaign delivered by medical peers would be more powerful. […] Unfortunately, this approach is likely to cost the NHS more than the fairly typical promotion strategy used in this study. (Smedley et al. 2002)

During our planning, the question arose as to whether the requirement should be limited just to HCWs with direct patient contact. Our decision to extend it to all HCWs greatly simplified tracking, and it eliminated the often difficult question of what constitutes direct patient contact. This decision also provided a sense of fairness among HCWs. (Rakita et al. 2010)

5.1.4. Facilitators and barriers to vaccine acceptance: organisational

5.1.4.1. Leadership

In this instance, the involvement of hospital leadership and human resources personnel was necessary to achieve near-complete vaccination. (Quan et al. 2012)

Senior leadership support was critical to the program's success and its continuation. (Smith and Van Cleave 2012)

[T]he supportive, involved local leadership at site 1 […] resulted in 100% participation. (LaVela et al. 2015)

Implementing these strategies, however, required strong leadership at the institutional level, with increased recognition of the importance of vaccination of HCWs by the institution and financial support. (Honda et al. 2013)

Our study demonstrates for the first time that the vaccination of the chief or associate professor of the unit significantly increases the vaccination rate of the medical staff […] probably by a leader effect. (Sartor et al. 2004)

[There was] emphasis on leadership role modeling as a central part of the campaign for 2008-2009. The theme "Follow the Leader" was selected. (Hood and Smith 2009)

One of the key requirements for the success of such a program is to have strong support from the leadership of the healthcare institution. Many objections to implementation of the program were raised, and without a strong endorsement from the CEO, president, and governing board, it is unlikely that the program would have been successful. (Rakita et al. 2010)

Senior leadership supported our initiative by aligning institutional goals with the 2007 Joint Commission requirement to increase HCW influenza vaccination rates. (Frenzel et al. 2016)

However, the drill required the cooperation of personnel from many different departments, thereby demonstrating to hospital administrators the effort needed to develop a more effective vaccination program. (Kuntz et al. 2008)

Management not being involved in the program may have possibly decreased resistance and increased staff responsiveness. (Abramson et al. 2010)

5.1.4.2. Peer influence and group effects

The vaccinations at same-service areas by familiar nurses from within the service area could also have contributed to the higher influenza vaccination rates. (Lee and Fong 2007)

[N]urse champions, who vaccinated their peers, had closer working relationships with their coworkers than the most visible proponents of previous influenza vaccination campaigns (eg, infection control professionals). Mobile vaccination teams administered only a small percentage of vaccinations, perhaps because other delivery approaches were so successful. (Kuntz et al. 2008)

Having a team of clinical RN champions to implement the program at the department level encouraged other employees to receive the vaccine. Some employees preferred vaccination by a peer. (Samms et al. 2004)

Involving HCWs in the transmission of educational messages seems to have produced good results. (Llupià et al. 2010)

[A]n influenza vaccination campaign aimed at HCWs using tried and tested processes together with new strategies aimed at promoting peer-to-peer communication for the transmission of messages. (Llupià et al. 2010)

That said, we know that the untrained champions still promoted the influenza vaccination campaign within their respective units even though they were not trained in how to administer the vaccination. (Slaunwhite et al. 2009)

Most of the pictures on the Web page were of small groups and were taken by the staff of the mobile units, suggesting that this had a ‘‘snowball’’ effect on vaccination. The staff of the mobile carts reported that in wards in which someone knew of the Web page, recruitment was easier and HCWs encouraged each other to be vaccinated so they could appear in the posted picture. (Llupià et al. 2010)

Its objective was to give personal satisfaction to the vaccinated HCWs before giving them collective satisfaction: the rubber bracelets indicated that the HCW belonged to a group, the group of vaccinated HCWs combating flu; and the Kit 2 posters showed that the HCS had succeeded in this combat. (Rothan-Tondeur et al. 2011)

5.1.4.3. Staff turnover

[T]he turnover of program managers in both the Control and Intervention Groups created problems with the collection of both program implementation details and immunization rates. (Chambers et al. 2015)

We were also able to identify barriers and facilitators to immunization. Included was staff turnover, a barrier that has received little attention in the literature. (Nace et al. 2011)

5.1.4.4. Organisational culture

Various challenges need to be overcome in order to implement a successful mandatory vaccination program, including cultural issues and concerns about the efficacy of the vaccine. (Honda et al. 2013)

Although vaccination mandates may be ethically justified, they may also conflict with increasing focus on continuous quality improvement/total quality management in health care, which emphasizes systems rather than individuals and rewards rather than punitive measures to improve quality and outcomes. (Drees et al. 2015)

The team chose not to include incentives because this was not part of the organization’s culture of caring. (Hood and Smith 2009)

HCWs were familiar with the requirement, and new employees are presented with the requirement at the time of hiring. Thus, influenza vaccination has become routine and is integrated into our culture of safety. (Rakita et al. 2010)

[W]ithin organization political challenges to influenza immunization of healthcare personal must be resolved including labelling activities to increase rates as a “program” and managing the program like other “programs” in the organization. (Chambers et al. 2015)

5.1.4.5. Hard mandates

In 2001, Canadian Union of Public Employees Local 416 presented an application to the Ontario Superior Court of Justice declaring compulsory vaccination to be contrary to the Canadian Charter of Rights and Freedoms. (Ksienski 2014)

On November 30, 2012, the Deputy Minister of Health announced that the punitive aspect of the Policy was in abeyance in order to facilitate educational efforts and ongoing stakeholder consultations. (Ksienski 2014)

When considering implementation of this type of program, it is important to consider the resistance that may be encountered by unions and the resulting litigation. The costs related to this litigation may be considerable. (Rakita et al. 2010)

Early communication with union members may be beneficial. (Rakita et al. 2010)

The 1 union representing nursing was involved early in planning and was an effective and supportive partner. We strongly recommend that union representation participate throughout the process. (Smith and Van Cleave 2012)

Legal counsel assisted the review team in developing standardized interview questions and criteria, which provided a consistent defensible framework. (Smith and Van Cleave 2012)

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