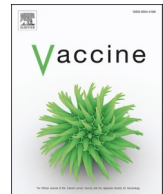




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Review

A systematic review of barriers and enablers associated with uptake of influenza vaccine among care home staff

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ABSTRACT

Barriers and enablers to vaccination of care home (CH) staff should be identified in order to develop interventions to address them that increase uptake and protect residents. We aimed to synthesis the evidence describing the barriers and enablers that affect the influenza vaccination uptake of care home (CH) staff.

Method: We searched PubMed, MEDLINE, EMBASE, CINAHL, PsycINFO, AMED, IBSS, SCOPUS to identify quantitative, qualitative or mixed-method studies. Data related to health or social care workers in CHs reported barriers or enablers were extracted and mapped to the Theoretical Domains Framework (TDF); the data within each domain were grouped and categorized into key factors affecting influenza vaccine uptake among CH staff.

Results: We screened 4025 studies; 42 studies met our inclusion criteria. Thirty-four (81 %) were surveys. Five theoretical domains were frequently reported as mediators of influenza vaccine uptake: *Beliefs about consequences* (32 studies), *Environmental context and resources* (30 studies), *Emotions* (26 studies), *Social influences* (25 studies), *Knowledge* (22 studies). The low acceptance rate of the influenza vaccine among CH staff can be attributed to multiple factors, including insufficient understanding of the vaccine, its efficacy, or misconceptions about the vaccine (knowledge), perceiving the vaccine as ineffective and unsafe (beliefs about consequences), fear of influenza vaccine and its side effects (emotions), and experiencing limited accessibility to the vaccine (environmental context and resources).

Conclusion: Interventions aimed at increasing influenza vaccine uptake among CH staff should focus on addressing the barriers identified in this review. These interventions should include components such as enhancing knowledge by providing accurate information about vaccine benefits and safety, addressing negative beliefs by challenging misconceptions, managing concerns and fears through open communication, and improving accessibility to the vaccine through convenient on-site options. This review provides a foundation for the development of tailored Interventions to improve influenza vaccine uptake among CH staff.

1. Introduction

Influenza infection is a serious health risk for older people due to their overall frailty, immune function deterioration, nutritional deficiencies [1], and the possibility of infection transfer from staff and visitors in care homes (CHs) [2]. In fact, more than 90 % of influenza-associated deaths occur among older people [3], with influenza responsible for 2.5–8.1 % of deaths among those over 75 years old [4]. During the 2019/20 influenza season, Public Health England (PHE) reported 3,936 acute respiratory infections outbreaks with 69.9 % of them occurring in CHs [5]. Almost a quarter of these outbreaks were caused

by influenza viruses [6]. Influenza outbreaks in CHs have been associated with an increased risk of hospitalization and death among residents, especially those with underlying health conditions. It has been estimated that influenza was responsible for a significant proportion of hospitalizations and deaths in CH residents, both with and without comorbid conditions [7–8].

During the winter season, a notable percentage of CH staff (ranging from 10 to 30 %) tend to be infected with influenza, which could potentially lead to the introduction of the virus in CHs [9,10], with nearly 50 % of infected staff still being contagious even when afebrile [11]. CH staff can be a source of infection and increase the risk of an

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influenza outbreak since many of them continue to work despite being infected [12]. This may be attributed to financial limitations, as many CH staff are dissatisfied with their compensation [13] and may not be able to afford taking time off work. CH staff are at high risk for influenza virus infection and act as a reservoir for the influenza virus, participating in the transmission of influenza to CHs [14].

Therefore, influenza vaccination is necessary for CH staff, as protection weakens and virus strains change on a regular basis [15]. The seasonal influenza vaccine has been proven effective and safe [16,17], and shown to be the best method currently available for reducing the consequences of influenza [18]. Health authorities and national organizations recommend influenza vaccination for individuals who provide care for those with medical conditions as a critical patient safety measure [19–21].

However, the influenza vaccination rate for healthcare workers (HCWs) is often below recommended levels in most countries [22,23], despite persistent recommendations and public health regulations on immunizations globally [24–26]. Notably, influenza vaccination rates for CH staff are lower than those in all other healthcare settings (e.g., hospitals) [24,27–30], putting CH residents, who are vulnerable to influenza and its complications, at serious risk of infection.

The impact of CH staff's vaccination on reducing influenza among CH residents remains a controversial issue, primarily due to the limited availability of scientific evidence and the low quality of research studies [31]. While the existing evidence might not strongly support CH staff vaccination for protecting CH residents [32,33], there is also a lack of evidence against its effectiveness [34]. However, one review indicates that a higher influenza vaccination rate among CH staff reduces all-cause mortality among CH residents [35], while also ensuring work stability by reducing staff sickness absence and related job interruption [36,37]. To help mitigate the risk of outbreaks and alleviate the associated burden, it is necessary to ensure that CH staff who provide assistance to elderly individuals receive vaccinations [38]. Furthermore, influenza vaccination has also been estimated to be a cost-effective preventative measure across a range of different health systems [39,40].

Many systematic reviews have explored determinants associated with epidemic and seasonal influenza vaccination in HCW population in general [41–52], but no reviews have been specific for CH staff. Identifying the barriers and enablers related to influenza vaccine uptake among workers in these settings is necessary to inform the design of an intervention since many factors differ from one health care setting to another.

To improve the influenza vaccination rate for CH staff, intervention design is recommended to be based on a theory to enhance the likelihood success of the intervention [45]. There are various theories focused on changing behaviour, many of which with overlapping constructs. The Theoretical Domains Framework (TDF) is a synthesis of 33 theories organised into 14 theoretical domains [53–54]. The TDF has been shown to be an effective tool for determining factors influencing behaviour, barriers to changing behaviour, and how internal and external factors influence individuals' decisions [55]. Additionally, the TDF is also linked to a taxonomy of behaviour change techniques, which can be used to develop interventions, as well as evaluating these interventions [56]. In this systematic review, we used the TDF as a lens through which to understand the barriers and enablers affecting the uptake of influenza vaccine among CH staff.

1.1. Aims and objective

To inform the design and development of a CH staff intervention to improve influenza vaccination uptake, the aim is to undertake a narrative synthesis of the literature to identify reported barriers and enablers and then to map them to the relevant domains of the TDF.

2. Method

2.1. Search strategy

This systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO: CRD42021248384). A scoping review was performed to inform the development of the search strategy, identify data extraction tools, select the quality assessment tools and establish inclusion and exclusion criteria.

We searched the following databases: PubMed Central, CINAHL (EBSCO), PsycINFO (EBSCO), AMED (EBSCO), MEDLINE (Ovid), EMBASE (Ovid), IBSS (International Bibliography of the Social Sciences), and Scopus in May 2021. The search was updated in February 2023 and one additional study included. A combination of subject heading and key words derived from the review question were used, such as “care home,” “long term care facility,” “staff,” “influenza,” “vaccination,” “immunization,” “barrier,” “enabler,” “knowledge” and “attitude”. A detailed search strategy for PubMed (Appendix A) was developed and adapted for the other databases. The reference list of included articles and relevant systematic reviews were searched to elicit further articles. The search result was exported to EndNote and duplicates removed.

2.2. Inclusion and exclusion criteria

We included all primary studies explicitly reporting factors (barriers or enablers) that influence the influenza vaccine uptake among CH staff regardless of the research methodology and study design. We excluded studies not published in English as well as those where the vaccine concerned was not the seasonal influenza vaccine (e.g., Covid, H1N1). We included only studies that reported the results for CH staff separately. Reviews, conference abstracts and studies reporting only non-modifiable determinants (e.g., age, gender, ethnicity) were excluded.

2.3. Study selection

Three steps were applied to identify the eligible studies. Firstly, following duplication removal, two independent authors (FA and AB) screened the titles of all studies identified in the search. Any disagreement during titles screening was resolved through discussion. Secondly, the abstracts of relevant or unclear titles were screened by the same authors. If there was disagreement during abstract screening or an abstract showed insufficient data, the full text was retrieved to assess its eligibility. Finally, the process of screening the full texts was divided among the authors (FA, MT, SC, AP) to identify eligible studies for inclusion in the review. The results of this process were compared and discussed among the team to ensure consistency and accuracy in the selection of eligible studies.

2.4. Data extraction

One reviewer (FA) extracted the following data: first author, titles, year of study, study objectives, study design (e.g., survey, interview), type of CH (e.g., nursing, residential), ownership of CH (e.g., for profit, public), number and size of CH that participated in the study, number of participants and response rate, vaccination rate and type of participants (e.g., nurses, nursing assistants). Barriers and enablers were also extracted from the studies and mapped to the TDF domains. To ensure the accuracy of the data extraction, a second reviewer (DW) checked a sample of 20 % of papers. If the study included data for other healthcare settings (e.g., hospitals), only data related to CH staff was extracted. The computer software program NVivo was used to facilitate the extraction and mapping of barriers and enablers.

2.5. Quality assessment

The Critical Appraisal Skill Program (CASP) [57] was applied for qualitative studies, whereas the Center for Evidence-based Management (CEBMa) [58] critical appraisal checklist was applied for cross-sectional studies. The quality assessment was carried out by one reviewer (FA), with a 20 % sample of studies assessed independently by a second reviewer (MT). Agreement was not directly measured, however, only small disagreements over the quality of the study existed and were addressed by discussion.

2.6. Data synthesis

One reviewer (FA), trained in the use of the TDF, mapped the barriers and enablers to relevant TDF domains. A behavioural scientist (SS) checked mapping for 20 % of the included studies. Any disagreement was resolved through discussion until consensus was reached. We reported the frequency of the TDF domains to provide a summary of the domains that were most frequently mentioned across studies. The data

within each TDF domain were categorized into common patterns of barriers and enablers. Two reviewers (FA and MT) checked the agreement of the extracted data with the assigned categories and determined whether the data were appropriately allocated to barriers or enablers to influenza vaccine uptake.

3. Results

3.1. Results of the search

The database search retrieved 6352 articles (Fig. 1). Following the removal of duplicate articles, a total of 3828 studies were excluded based on screening of their titles and abstracts. One hundred and ninety-seven studies were reviewed in full text. Of these, 155 studies were excluded and examples of reasons for exclusion are presented in Fig. 1. In total, 42 studies met our inclusion criteria. The level of agreement between the reviewers at titles, abstract and full text screening was 81.8 %, 89.9 % and 92 %, respectively, with Cohen's k 0.12, 0.71 and 0.83, respectively. No further studies identified from searching the reference

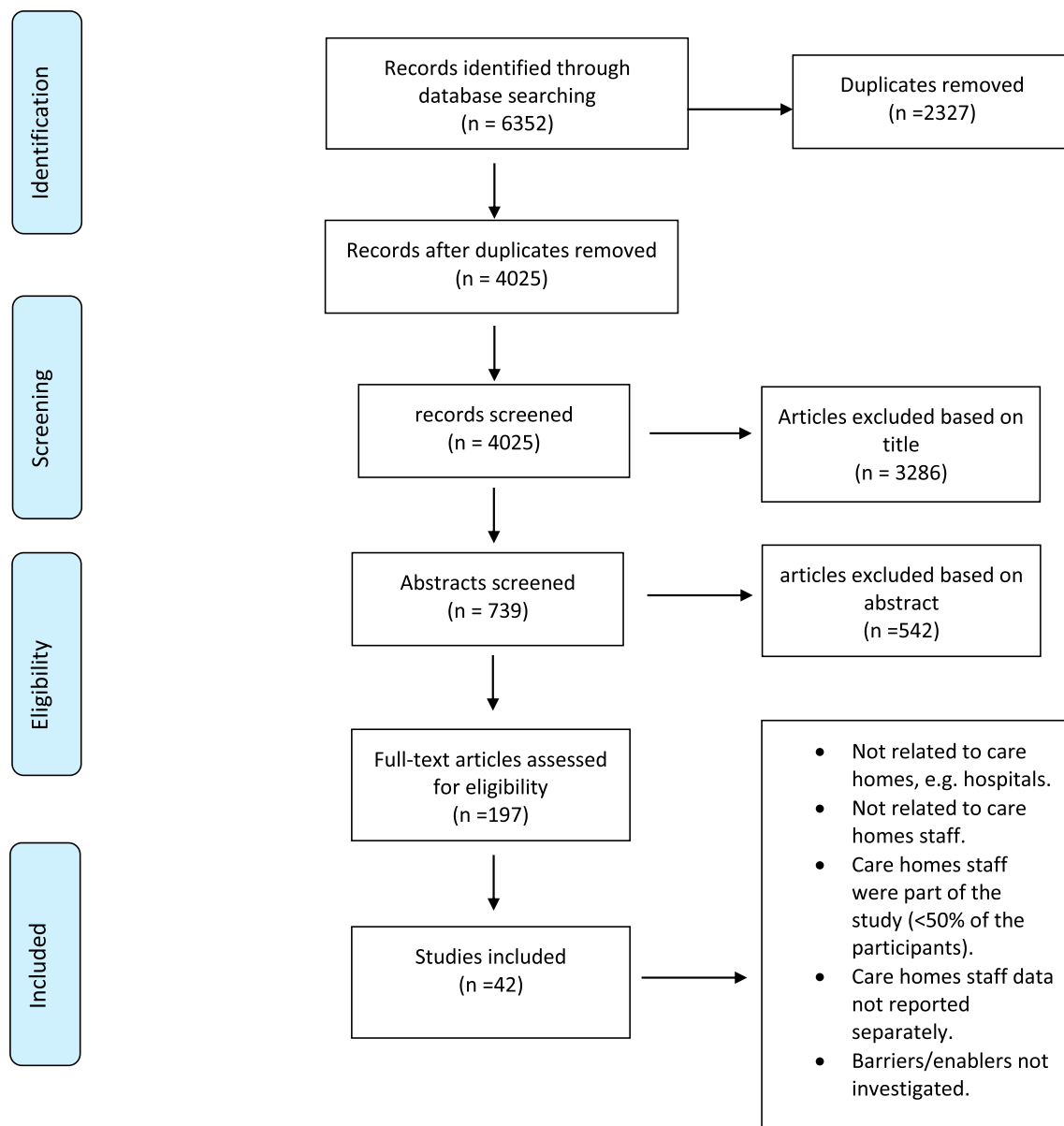


Fig. 1. PRISMA Extension for Systematic Review – flow diagram.

list of the included studies and the relevant systematic reviews.

3.2. Study design and characteristics

Study characteristics are summarized in Table 1. All of the studies were conducted in high-income countries (United States 13 [59–71], Ireland 5 [72–76], Canada 4 [77–80], Australia 4 [81–84], Hong Kong 4 [29,85–87], Italy 3 [88–90], Belgium 2 [91,92], France 2 [93,94], Netherlands 2 [95,96], Germany 1 [97], UK 1 [100], Israel 1 [98]). The included articles were published between 1993 and 2022, with half of the articles (n = 20) published from 2015 to 2022. The sample size ranged from 9 to 2,226 participants. The participants of the included studies comprise a mixed sample of health care professionals involved directly (e.g., nurses, nursing aid) and indirectly (e.g., managers, catering, maintenance) in the care of CH residents. Most studies (n = 31) utilized quantitative methods (i.e., data collected via surveys), seven studies had a qualitative study design (i.e., interviews or focus group discussion), and four studies used mixed method design. The reported barriers and enablers did not vary across different study designs.

3.3. Quality assessment

The quality assessment of the quantitative studies is summarized in Table 2. Regarding the quantitative studies, most had a clear research question, used appropriate study design, and clearly described the method of subjects' selection. There is a range of questionnaire validity and reliability assessments across the included studies. One study examined content validity and internal consistency [88], while another utilized data from a pre-validated survey [69]. In two studies, the questionnaires were based on previously published questionnaires [91,92], whereas three studies utilized pre-tested questionnaires but did not report any information on their validity [93,97,98]. Additionally, eight studies included in the review reported conducting a sample size calculation and aimed to recruit all eligible participants [78,85,87,91,93,94,98,99]. There are concerns in terms of quality due to the possibility of selection bias, representativeness of the sample, and lack of pre-study calculation of statistical power. Such quality concerns can lead to a restricted judgment on whether a satisfactory response rate was achieved or not. Another concern relates to the lack of use of a validated and reliable survey instrument. Some studies lacked sufficient details because they were embedded within a larger study design.

The quality assessment of the qualitative studies is presented in Table 3. The qualitative content of four studies was part of interventional studies [59,64,67,68,100], whereas four studies used mixed-methods [78,87,90,91]. Therefore, the quality assessment was focused on the qualitative part of the studies. All studies explicitly stated the aim of the research. The qualitative methodology, the research design and data collection were appropriate for most of the included studies. Some studies described the recruitment strategy inadequately, failed to examine the relationship between the researcher and the participants, and did not address any potential bias during the formulation of the research questions and data collection process. Some studies described the ethical issues insufficiently and did not describe the method used for the analysis. Although some studies had a clear statement of the findings, these findings were authors' interpretations -without the use of participants' quotes- which may affect the credibility of the findings.

3.4. Barriers and enablers

During the data extraction phase, we identified a total of 691 barriers and enablers influencing influenza vaccine uptake among CH staff. These barriers and enablers were then mapped to the 12 domains of the Theoretical Domains Framework (TDF). Through further analysis, we categorized them into 71 barriers and 62 enablers specifically related to influenza vaccine uptake. The TDF domains most frequently mapped to were Belief about consequences (e.g., belief about the effectiveness of

the influenza vaccine) (32 studies); Environmental context and resources (e.g., accessibility to vaccine (30 studies); Social influence (e.g., influence of colleagues) (25 studies); Emotion (e.g., fear of side effects) (26 studies); and Knowledge (e.g., Lack of knowledge about the vaccine the efficacy) (22 studies). No barriers or enablers were identified in the domain of "Skills" and "Beliefs about capabilities". The following sections will provide a detailed description of the TDF domains including the specific barriers and enablers within each domain that impact the influenza vaccine uptake. The domains were arranged in descending order according to the number of studies that reported factors related to each domain (Appendix B).

3.4.1. Belief about consequences

CH staff who were reluctant to accept the influenza vaccine lacked belief in its effectiveness [66,71,72,74,77,78,81,90,93,61,62,86–88] and were concerned about the side effects and safety of the vaccine [60,62,66,68,78,81,72–76,86–88,90–93]. The perception that the influenza vaccine is not necessary [60,81,72,73,90–92], influenza is not serious [73,77,81,86,88,91,92,98], and a lack of concern about getting influenza act as further critical barriers to the uptake of the influenza vaccine [86,88,92,98]. Previous experience with influenza vaccination side effects [29,73,75,78,90] and the belief that the influenza vaccine lacks value, usefulness, or benefits for oneself or others [73,79,88,90,92,98] are also significant barriers that prevent CH staff from accepting the influenza vaccine. Enablers to the uptake of the influenza vaccine were the staff's perception of spreading influenza to others [70,91,92], and recognizing the risk of influenza [63,70,72,74,75,91,92,96,98].

3.4.2. Environmental context and resources

Environmental context and resources were identified as barriers and enablers of the influenza vaccination. Financial resources for CH and staff are an important factor for staff influenza vaccination rate in CHs. Financial constraints [68,69,81,93] or lack of funds for vaccination [83,84] makes it difficult for CHs to provide a free onsite influenza vaccine service or improve the accessibility to the vaccine [59,60,76,88] which acts as a barrier to influenza vaccine uptake. Enablers to influenza vaccine uptake include accessibility of the influenza vaccine [64,81,91,98,73,74], availability of the influenza vaccine at a suitable and flexible time [91,96], and adequate provision of the influenza vaccine [71,96]. Countries with financial constraints encountered barriers that impacted influenza vaccination rates among CH staff, including the United States [60,61,69,71], Australia [81,83,84], and France [93]. In addition, countries facing challenges related to influenza vaccine access, such as Australia [84], Hong Kong [87], Ireland [76], Belgium [91], Italy [88], and the United States [59,65,100], also experienced difficulties in promoting influenza vaccination among CH staff. Many studies showed that a shortage of influenza vaccine supply reduced the vaccination rate among CHs [59,65,68,100]. Other studies reported that refusing the influenza vaccine due to the presence of a health condition [73,82,87,90,97,99] or allergy [66] prevented staff from getting vaccinated. A high turnover of CH staff decreases the vaccination rate among staff and prevents organizations from tracking vaccination uptake [68,71,100].

3.4.3. Emotion

Worries about the influenza vaccine [73], fear of side effects [29,60,61,66,71,72,75,76,85,87,88,90,92,99], or fear of contracting influenza from the vaccine [60,71,90,97] were significant barriers to its uptake. Vaccinated staff expressed less concern about the vaccine and its side effects than non-vaccinated staff [77,81]. In many studies, fear of needles was a reason for refusing the influenza vaccine [61,62,66,68,71,74,76,81,87,90,92,97,99,100]. Some staff expressed frustration when they felt care from the organization towards its staff was lacking which may have acted as a barrier to accept the influenza vaccine [75,78,80]. Mandating the influenza vaccine could exacerbate

Table 1
Studies characteristics of the included studies:

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Nace (2007) [59]	US	"A needs analysis conducted to determine the barriers to, and drivers of, staff immunization"	observation and semi-structured interviews	Nursing & residential homes	non-profit/public care homes	1/300 bed	unclear number interviewed	from 54.0 % in 1996, to high of 95.5 % in 2003. 86 % in 2005.	Nursing 59 %, Dietary 15 %, Housekeeping 4 %, Laundry 2 %, Maintenance 6 %, Activities, social work, wellness 7 %, Administration 7 %
Halpin (2019) [72]	Ireland	"to investigate HCWs' attitudes towards, and beliefs about, seasonal influenza vaccination in a residential care facility for older adults"	survey	Nursing & residential homes	non-profit/public care homes	1/50 residents	95 questionnaires were distributed, RR: 35 (37 %)	57 %	Healthcare assistant: 12 (34 %), Nurses: 9 (26 %), Housekeeping staff: 6 (17 %), Catering: 3 (9 %), Management: 2 (6 %), Allied healthcare professionals: 2 (6 %), Administration: 1 (3 %), directly and indirectly healthcare providers
Moretti (2020) [88]	Italy	"a. To describe adherence and attitudes of NH staff towards flu vaccination; b. To explore staff hesitancy and its relationship with the attitude towards flu vaccination"	survey	Nursing home	non-profit/public care homes	4 nursing homes/ 437 persons	437 distributed questionnaires, RR: 166 (38 %)	Only 5/166 (3.0 %) declared having a flu vaccination each year, and 16/166 (9.6 %) reported to have had at least one flu shot in the last three years	Staff managers/ Leadership—Administrator, Medical Director, Director of Nursing: 5 (3.0 %). Direct care staff—Physicians, Healthcare Assistants, Healthcare Technicians, physical therapists: 88 (53.0 %). Nurses: 31 (18.7 %). Other healthcare providers—Occupational/Speech/Respiratory therapists, dieticians/nutritionists, animators, Social Worker, Psychologist: 18 (10.8 %). Administrative staff: 9 (5.4 %) Support staff—Food Service/Dietary, Housekeeping, Laundry Service, Maintenance: 8 (4.8 %). Missing: 7 (4.2 %). HCW and all other professionals
Boey (2018) [91]	Belgium	"to determine demographic, behavioural and organisational factors that are associated with vaccination uptake in HCWs in both hospitals and nursing homes"	mixed method / survey and semi-structured interviews	Nursing home	not specified	14 nursing homes	2,266 nursing home staff, RR: 635 (27.9 %)	Vaccinated in 2014: 52.6 %. Vaccinated in 2015: 55.9 %	Physician: 1 (0.2 %), Nurse: 60 (9.4), Nursing assistant: 103 (16.2 %), Nursing Aides: 240 (37.8 %), Other HCWs: 71 (11.2 %), Administrative, facilities and logistics: 160 (25.2 %)
Kenny (2020) [73]	Ireland	"to identify the determinants associated with the self-reported receipt of the influenza vaccine by HCWs in long-term care facilities"	cross-sectional survey	not specified	non-profit/public care homes	21 LTCFs	372/1,094 (34 %)	46.5 %	nurses (35.5 %), general support staff (33.1 %), health and social care professionals (9.9 %), management and administration (9.4 %), medical and dental (0.3 %), non-specified category of other patient and client care workers (10.2 %), all categories of HCWs
King (2019) [74]	Ireland	"to understand key factors that promote or inhibit HCW vaccination uptake within LTCF"	survey	not specified	for-profit/private & non-profit/public	8 LTCFs	236, RR: (51 %)	50 %	nurses: 26.5 % (n = 58), health and social care worker: 41.5 % (n = 91), support: 16 %, admin and management: 8 %, prefer not to say: 7 %, other: 5 %
Akker (2009) [95]	Netherlands	"To assess whether nursing homes (NHs) made organizational improvements to increase influenza vaccination rates in healthcare workers (HCWs) and to quantify the beliefs of	survey	Nursing home	not specified	310 NHs	185/310 (RR: 59.7 %)	19 %	NHs Administrators

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Wong (2018) [29]	Hong Kong	<i>NH administrators on the arguments used in favor of implementation of mandatory influenza vaccination of HCWs</i> "to compare the influenza vaccination pattern between clinical and long term care facility (LTCF) nurses"	survey	not specified	not specified	any LTCF worker in Hong Kong	sample size: 830 from 2014 to 18/ RR: not reported	32 %	nurses
Kimura (2007) [60]	US	"to ascertain the reasons for the low influenza vaccine coverage of health care workers and used this information to design and test interventions to improve their vaccination rates"	survey	not specified	for-profit/ private & non-profit/ public	30 LTCFs	1020 (45 %) of 2271 questionnaires were returned	30 % in 2000–01/ 34 % in 2001–02	Nurse: 275 (27 %), Nursing assistant: 564 (55 %), Housekeeping staff: 127 (12 %), Rehabilitation therapist: 54 (5 %), direct resident contact (nurses, nursing assistants, rehabilitation therapists, and housekeeping staff)
Tannenbaum (1993) [77]	Canada	"to develop a program aimed at increasing the acceptance of influenza vaccine among nursing home personnel"	survey	Nursing home	not specified	1	RR: 197 (73.5 %)	pre-trial: control home:16.7 %, intervention homes: 12/76 (15.8 %) (post-trial: control home: 13 (9.8 %), intervention home 25.9 %)	Nurses: 23 (17 %), Nursing assistance: 8 (6 %), Orderly: 51 (51 %), other professionals: 9 (7 %), others(Others: Kitchen staff, maintenance workers, laundry staff, security guard, housecleaning staff: 37 (28 %)
Lee (2017) [85]	Hong Kong	"to evaluate the implementation of respiratory protection measures among infection control officers (ICOs) and health care workers (HCWs) in these homes in Hong Kong"	cross-sectional survey	residential homes	for-profit/ private & non-profit/ public	87 OAHs/no of beds 107.2 ± 63.0	1,763 HCWs, RR: 74.5 %	54.8 %	registered nurses: 74 (4.2 %), enrolled nurse: 156 (8.8 %), health worker: 386 (21.9 %), Care worker: 704 (39.9 %), allied health professionals and assistants: 380 (21.6 %), missing: 63 (3.6 %)
Hauri (2006) [97]	Germany	"1-to determine influenza vaccine coverage among staff of LTCFs in Hesse, Germany. 2- to identify the factors that influence vaccine uptake by staff and the effectiveness of various measures adopted to increase vaccine uptake"	cross-sectional survey	not specified	for-profit/ private & non-profit/ public	36	905/2,574, RR:35 %	22 %	skilled nursing staff, domestic and cleaning staff, support staff, nonsupport staff, nursing trainees, food preparation or distribution staff and administrative staff.
Manuel (2002) [78]	Canada	"to investigate the health behaviour associated with influenza vaccination among health care workers in long term care facilities"	mixed method/ focus group- cross-sectional survey	not specified	not specified	2 LTCFs for survey/ one LTCF for focus group	231/401, RR:58, two focus groups 7 and 9 staff respectively	39 %	nursing staff 44 (19 %), healthcare aide 85(37 %), maintenance or housekeeping 49(21 %), activity aide 19 (8 %), management 24(10 %)
Lorini (2020) [89]	Italy	"to address whether HL and vaccine confidence affect influenza vaccination uptake among staff of NHs. The research queries are the following: i. Does HL influence vaccination uptake among	cross-sectional survey	Nursing home	for-profit/ private & non-profit/ public	28	710	9.6 % always get vaccinated, 16 % in 2016–2017 and 16.6 % 2017–2018	Medical doctors *Nurses: 93 (13.1 %) Physiotherapists: 37 (5.2 %)Assistants/aides: 364 (51.3 %)Health educators: 25 (3.5 %) Other clinical staff: 40 (5.6 %) Cleaning staff: 45

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
									(6.3 %)Other nonclinical staff: 60 (8.5 %)
Hutt (2010) [64]	US	staff of NHs?ii. Does vaccine confidence influence vaccination uptake among staff of NHs? iii. Are HL and vaccine confidence related?" "to determine whether a comprehensive ap- proach to implementing national consensus guidelines for nursing home acquired pneumonia (NHAP), including influenza and pneumococcal vaccination, improves resident subject and staff vaccination rates"	interviews	Nursing home	profit/ private care homes	16	Twenty-two interviews with 31 participants	baseline vaccination rate: 40 % in intervention homes, 0 % in control homes. Post-intervention: greater than 50 % in the intervention homes	16 director of nursing, 2assistant DONs, 9 nurses, 2 staff development coordinators, 2 administrators
Mody (2006) [65]	US	"To assess the response of long-term care facilities (LTCFs) to the 2004–2005 influenza vaccine shortage and the impact on resident and healthcare worker (HCW) immunization rates"	A cross-sectional survey	not specified	for-profit/ private & non-profit/ public	380/total of 38,447 beds	380/820, RR:46.3 %	38.4 %	Not reported
Thomas (1993) [66]	US	"to investigate staff attitudes towards influenza vaccination in a long-term-care setting and intervene to increase staff compliance with influenza vaccination"	survey	not specified	not specified	1/300 bed	173/195, RR: 89 %	8 %	nurses and aides (98) and dietary workers (37). Environmental service workers (22), maintenance employees (13), administration (13), and special services employees (12) make up the rest of the staff
Boey (2020) [92]	Belgium	"to evaluated the usefulness of a ready-to-use instruction manual and its impact on vaccination uptake, attitudes toward influenza vaccination and reasons for vaccine acceptance"	survey	Nursing & residential homes	not specified	11/ median number of 121 beds (range: 65–161)	645/1250, RR: 51.4 %	mean vaccination coverage 54 % pre-intervention, 68 % post-intervention.	nurses (23.6 %), nursing aides (33.7 % %), Pharmacists, audiologists, physiotherapists, paramedics, psychologists (11.6 %), Medical technical staff, administrative, facilities and logistics (28.6 %), Other HCWs, unknown function (2.5 %)
Nace (2011) [100]	US	"1-to improve immunization rates among health care workers for influenza and among residents for influenza and pneumococcal vaccines in a network of collaborating nursing homes. 2- to identify barriers to immunization by conducting focus groups in collaborating nursing homes to help improve immunization rates in subsequent studies"	focus group	not specified	non-profit/ public care homes	6 (ranged between 59 and 202 beds)	Six LTC facilities, at least 4 staff members from each LTCF, not reported	range between: 14.3 %-56.9 % (2002: vaccination rate in all 6 facilities: 34.2 %	Not reported
Sand (2007) [68]	US	"To improve staff immunization rates for influenza in long-term care facilities"	A quality improvement project (meetings)	not specified	for-profit/ private & non-profit/ public	15 LTCF / 50 to 2,000 beds	three to eight members per facility	range 17 % to 66 % before Quality Improvement	managers, administrators, nurses, physicians, and front-line workers

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Sullivan (2008) [79]	Canada	"to assess the level of and reasons for decisional conflict about receiving the influenza vaccine in a population of direct nursing care providers"	cross-sectional survey	not specified	not specified	2	In Organization One: 76/202, RR: 38 %, In Organization Two:104/202, RR:51 %	76 % In Organization One, 64 % In Organization Two	organization one: registered nurses, licensed vocational nurses, and registered practical nurses 31 %, 38 % nursing assistants, missing 30 %. Organization two: registered nurses, licensed vocational nurses, and registered practical nurses 38 %, 62 % nursing assistants,
Groenewold (2012) [69]	US	"To estimate influenza vaccination coverage among nursing assistants (NAs) working in US nursing homes, and to identify demographic and occupational predictors of vaccination status among NAs"	Cross-sectional survey	Nursing & residential homes	for-profit/ private & non-profit/ public	790	sample size of 2873, 53.4 %	37.1 %	nursing assistants
Halliday (2003) [81]	Australia	"To examine the self-reported uptake of influenza vaccine by staff in residential aged care facilities in the Australian Capital Territory (ACT), and the factors influencing vaccine uptake by staff"	cross-sectional survey	not specified	not specified	19	587/1,177, RR: 50 %	28 %	nursing (69 %), administration (10 %), domestic (6 %), food handling (9 %), maintenance (3 %) and others (3 %)
Daugherty (2015) [70]	US	"to describe influenza vaccination rates and attitudes toward influenza and the influenza vaccine among long-term care employees in 37 homes"	survey	Nursing home	for-profit/ private & non-profit/ public	37	1,965	53.9 %	RN:256 (13.0). LPN: 342 (17.4). CAN: 837 (42.6). Other: 531 (27.0)
Lai (2020) [82]	Australia	"to determine influenza vaccine uptake rate among ACWs in Australia and examine the demographic predictors of vaccine uptake"	survey	not specified	not specified	7	146/668, RR:22 %	48 %	registered nurse, pastoral care, manager, workplace trainer, caterer, and administrative staff, nursing assistant and specialised dementia carers, aged carers (85 %), nursing (7 %), managerial, training and administrative staff (6 %), and others (2 %)
Shroufi (2009) [99]	UK	"1- to establish the uptake of influenza vaccine amongst care home staff with a direct health or caring role in Greater Nottingham care homes with nursing. 2- to investigate care home clinical staff's knowledge, attitudes and beliefs associated with vaccine uptake"	survey	Nursing home	not specified	58 for CHs survey. Staff survey: A random sample of 24 care homes was selected to be surveyed by placing all care homes in the area on a database.	169/219, RR:77 %	17 %	122 care assistants, 35 registered nurses and 12 matrons.
Shahar (2017) [98]	Israel	"to explore factors that affect the intention of nurses at a long-term care facility to	survey	not specified	not specified	1	150/170, RR:88 %	42 %	nurses

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Ofstead (2017) [71]	US	<i>receive the influenza vaccine and whether the health belief model predicts this intention</i> <i>"to develop and evaluate an intervention program designed to increase influenza uptake among HCPs in LTCFs"</i>	survey	Nursing home	for-profit/ private & non-profit/ public	4/ >90 beds	323/584, RR:55 %	50 %	nursing assistants (CNAs), licensed practical nurses (LPNs) and registered nurses (RNs)
Quinn (2014) [75]	Ireland	<i>"to present an insight into the issues concerning nurses with regard to the seasonal influenza vaccine"</i>	semi-structured interviews	residential homes	non-profit/ public care homes	1	11	not reported	nurses
Goldstein (2004) [61]	US	<i>"To determine the attitudes, policies, and barriers for requiring annual versus voluntary influenza vaccinations for the staff of healthcare institutions in North Carolina. - to identify potential barriers to employee vaccinations"</i>	survey	Nursing home	not specified	91	91/99, RR:91.9 %	not reported	the infection control individual or the individual most knowledgeable about immunization practices
O'Connor (2015) [76]	Ireland	<i>"to assess the preparedness of LTCFs in the HSE East area at the start of the 2013/2014 influenza season for an influenza/ILI, outbreak and to identify how the Department of Public Health could support these facilities"</i>	survey	Nursing & residential homes	for-profit/ private & non-profit/ public	97	97 /166, RR:58 %	range 0–94 %	Director of Nursing or general manager
Chan (2013) [86]	Hong Kong	<i>"to examine the prevalence and associated factors of influenza vaccination in Chinese nHCWs"</i>	cross-sectional survey	Nursing home	not specified	58	1,300/1398, RR:93 %	55.9 %	nursing home healthcare workers
O'Neil (2017) [62]	US	<i>"to assess knowledge, attitudes and practices (KAP) regarding infection prevention policies and influenza vaccination among staff at a LTC facility"</i>	survey	Nursing & residential homes	not specified	1/120bed	73/170, RR:42.9 %	not reported	Nurse 22 (30.1), Patient care technician 7 (9.6), Physical therapist/PTA 7 (9.6), Occupational therapist 4 (5.5), Recreation therapist 2 (2.7), Administrator 3 (4.1), Social worker 4 (5.5), Food services worker 6 (8.2), Environmental services worker 3 (4.1), Facilities worker 4 (5.5), Dietician 1 (1.4), Did not answer 10 (13.7)
Lorini (2020) [90]	Italy	<i>"to understand the choice architecture of influenza vaccination acceptance or refusal among the staff of nursing homes and to promote vaccination acceptance using the nudge approach"</i>	mixed-method/ cross-sectional survey	Nursing home	not specified	111 NHs	212/527 (RR: 40.2 %) for qualitative questionnaires in intervention group- 2135 (RR:47.8 %) in intervention and comparison group for the Cross-Sectional Study	22.3 %	all the staff members

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Chen (2010) [87]	Hong Kong	"1-to increase uptake of influenza vaccination among RCHE staff in Hong Kong. 2-to explore the factors affecting the acceptance or refusal of vaccination among staff of RCHEs"	mixed-method/ six focus group interviews- cross-sectional survey	residential homes	not specified	16 in focus group, 21 intervention homes, 20 control homes	36 HCWs in the focus group, 1419, RR: 82.7 %	The participating RCHEs had varying staff vaccination rates ranging from 36.7 % to 92.3 % (in focus group), in intervention homes: 39.4 %, in control homes: 36.3 % 20 % self-report by staff (Median IV coverage for all sampled establishments for the season 2015–2016 was estimated at 18.2 % ranging from 0 % to a maximum of 69.2 %)	six (20.6 %) were persons in charge, 11 (38.0 %) were nurses (registered nurses or enrolled nurses), six (20.7 %) were HCWs, A five (17.3 %) were care workers B and one (3.4 %) was supporting staff not providing direct care to residents
Elias (2017) [93]	France	"to estimate the influenza vaccination coverage for the 2015–2016 winter season in NH workers in Ille-et-Vilaine, a department of the Brittany region, located in western France. Secondary objectives aim to assess the factors related to IV among NH workers"	cross-sectional survey	Nursing home	for-profit/ private & non-profit/ public	40 NHs/33 (85 %) participated in this survey/a median number of 71 beds (min 28; max 270)	480/485, RR: 99 %	20 % self-report by staff (Median IV coverage for all sampled establishments for the season 2015–2016 was estimated at 18.2 % ranging from 0 % to a maximum of 69.2 %)	HCW (physicians, nurses or pharmacists) (42.9 %) or facilities and logistics staff (35.7 %). Administrative positions were held by 11 % of workers.
Huhtinen (2019) [83]	Australia	"to identify the perceived barriers to the implementation of the Australian guidelines on influenza outbreak management with RACF staff in an inner city Sydney region"	survey	Nursing & residential homes	for-profit/ private & non-profit/ public	28/ranged from 41 to 140 (median 66)	28/61, RR: 46 %	not reported	Director of nursing: 4 (14 %), Facility manager: 14 (50 %), Senior registered nurse: 9 (32 %), Other: CEO: 1 (4 %)
Yassi (2010) [80]	Canada	"1-to explore the views of BC health care workers regarding how best to promote vaccine uptake. 2-to explore the motivators and barriers to HCWs being vaccinated"	focus groups	not specified	not specified	Overall 76 participants, 45 HCWs from long- term care, 23 from acute care and 15 from community care facilities	83 HCWs	not reported	registered nurses, licensed practical nurses, unit clerks, physicians, care aides, dietary staff, housekeeping and kitchen staff, occupational therapists, librarians, hairdressers, lab- oratory staff, home support workers, psychiatric support workers and recreational aides
Moran (2019) [84]	Australia	"to examine the current climate around influenza vaccinations for Australian HCWs and aged care staff by exploring the attitudes of key stakeholders"	semi-structured interviews	not specified	not specified	9	Overall, 22 participants, Nine were from ACFs, seven from hospitals, four from government departments and two from relevant peak bodies	not reported	infection control officers, managers of healthcare facilities and health department leaders
Akker (2009) [96]	Netherlands	"to assess which demographical, behavioural and organisational determinants were associated with influenza vaccine uptake in HCWs"	survey	Nursing home	not specified	32/mean capacity of 161 beds per nursing home	1,125/1,889, RR: 60 %	32.6 %	5 % physicians, 15 % nurses, 58 % nursing assistants, other 21.5 %
Yue (2019) [63]	US	"to describe attitudes toward vaccination and assess workplace interventions associated with influenza vaccination among a	survey	Nursing & residential homes	not specified	not reported	332	77.1 %	Physicians, dentists, nurse practitioners, physician assistants, nurses, allied health professionals, pharmacists, and students in a medical-related field: 66 (20 %), Technicians/technologists,

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Table 1 (continued)

First author/ year of study	Country of study	Research question/aim/ objectives	Study design	Type of care home	Ownership of care home/ facility	Number of homes/ size of home	Number of participants staff/sample size/RR	Vaccination rate	Type of participants/staff
Sophie Vaux (2022) [94]	France	<i>national sample of healthcare personnel working in LTC facilities"</i> "to provide updated data on NH HCW vaccination coverage in France, to identify determinants of vaccination status, and to indicate measures which appear to increase vaccination coverage in these settings."	cross-sectional survey	Nursing home	for-profit/ private & non-profit/ public	589	1 189/589 NH (49.5%)	30.6 %	emergency medical technicians, paramedics, and assistants/aides: 234 (52.6 %), Administrative support staff/ managers, housekeeping and food service staff, and other nonclinical support staff: 32 (27.4 %) Physicians, Nurses, Nursing assistants, Other paramedical personnel, Non- medical professionals

Table 2

Quality assessment of quantitative studies (CEBMA).

Study	1	2	3	4	5	6	7	8	9	10	11
Halpin (2019) [72]	Y	Y	Y	Y	N	N	N	N	Y	N	N
Moretti (2020) [88]	Y	Y	Y	Y	C	N	C	Y	Y	Y	N
Boey (2018) [91]	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N
Kenny (2020) [73]	Y	Y	Y	N	Y	N	C	C	Y	Y	N
King (2019) [74]	Y	Y	Y	N	Y	N	C	C	Y	Y	N
Akker (2009) [95]	Y	Y	Y	N	Y	N	C	C	Y	Y	Y
Wong (2018) [29]	Y	Y	N	C	N	N	C	C	Y	Y	Y
Kimura (2007) [60]	Y	Y	Y	N	Y	N	N	C	Y	N	N
Tannenbaum(1993) [77]	Y	Y	N	Y	N	N	Y	C	Y	N	Y
Lee (2017) [85]	Y	Y	C	C	Y	Y	Y	C	N	N	Y
Hauri (2006) [97]	Y	Y	Y	N	Y	N	N	Y	Y	Y	N
Manuel (2002) [78]	Y	Y	N	Y	N	Y	C	C	Y	Y	Y
Lorini (2020) [89]	Y	Y	Y	Y	N	N	C	C	Y	Y	Y
Mody (2006) [65]	Y	Y	Y	N	Y	N	C	C	Y	N	Y
Thomas (1993) [66]	Y	Y	Y	Y	N	N	Y	C	N	N	Y
Boey (2020) [92]	Y	Y	Y	N	N	N	C	Y	Y	Y	Y
Sullivan (2008) [79]	Y	Y	Y	Y	N	N	C	C	Y	N	Y
Groenewold (2012) [69]	Y	Y	Y	N	Y	N	C	Y	Y	Y	Y
Halliday (2003) [81]	Y	Y	Y	N	Y	N	C	C	Y	Y	N
Daugherty (2015) [70]	Y	Y	Y	Y	N	N	C	C	Y	N	Y
Lai (2020) [82]	Y	Y	Y	Y	N	N	N	C	Y	Y	Y
Shroufi (2009) [99]	Y	Y	Y	N	Y	Y	C	Y	Y	Y	N
Shahar (2017) [98]	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N
Ofstead (2017) [71]	Y	Y	Y	Y	N	N	C	C	N	N	N
Goldstein (2004) [61]	Y	Y	Y	N	N	N	Y	C	N	N	Y
O'Connor(2015) [76]	Y	Y	Y	N	Y	N	C	C	Y	N	Y
Chan (2013) [86]	Y	Y	Y	Y	N	N	Y	C	Y	Y	Y
O'Neil (2017) [62]	Y	Y	Y	Y	N	N	N	C	N	N	Y
Lorini (2020) [90]	Y	Y	Y	Y	N	N	C	C	Y	N	Y
Chen (2010) [87]	Y	Y	Y	N	Y	Y	C	C	Y	Y	Y
Elias (2017) [93]	Y	Y	Y	Y	C	Y	Y	Y	Y	Y	Y
Huhtinen (2019) [83]	Y	Y	Y	Y	N	N	N	C	N	N	Y
Akker (2009) [96]	Y	Y	Y	N	C	N	C	C	Y	Y	N
Yue (2019) [63]	Y	Y	Y	Y	Y	N	C	C	Y	Y	Y
Vaux (2022) [94]	Y	Y	Y	N	Y	Y	C	C	Y	Y	Y

1. Did the study address a clearly focused question / issue? 2. Is the research method (study design) appropriate for answering the research question? 3. Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described? 4. Could the way the sample was obtained introduce (selection) bias? 5. Was the sample of subject's representative with regard to the population to which the findings will be referred? 6. Was the sample size based on pre-study considerations of statistical power? 7. Was a satisfactory response rate achieved? 8. Are the measurements (questionnaires) likely to be valid and reliable? 9. Was the statistical significance assessed? 10. Are confidence intervals given for the main results? 11. Could there be confounding factors that haven't been accounted for? Y: Yes, N: No, C: Can't tell. * A mixed-methods study.

negative emotions for some staff due to feelings of loss of autonomy [75].

3.4.4. Social influence

Doctor-staff communication was discussed in many studies. A recommendation by a doctor to be vaccinated with the influenza vaccine promotes staff uptake [64,72,73,78,81,88,90,93,96,97,99]. Workplace support was an enabler in getting the influenza vaccine [64,72,74,78,80,81,91,92,94,97-99], and absence of support was a barrier [59,81]. Encouragement from colleagues [73,75,78,80,90,91,96,98,99] and family members [29,78,81,90,91,96] was an essential factor in accepting the influenza vaccine. Lack of trust or low confidence in government or administration recommendations was a barrier to getting the influenza vaccine [78,100]. Feeling supported in making a decision to receive the influenza vaccine [73,96] and providing personalized information were perceived to be enablers in

Table 3
Quality assessment of quantitative studies (CASP):

Study	1	2	3	4	5	6	7	8	9
Nace (2007) [59]	Y	Y	C	C	C	N	N	N	N
Boey* (2018) [91]	Y	Y	Y	Y	Y	Y	Y	N	C
Manuel* (2002) [78]	Y	Y	Y	C	Y	C	C	C	Y
Hutt (2010) [64]	Y	Y	Y	C	Y	C	Y	C	C
Nace (2011) [100]	Y	Y	Y	C	Y	C	N	N	C
Sand (2007) [68]	Y	Y	Y	C	C	C	C	C	Y
Quinn (2014) [75]	Y	Y	Y	Y	Y	C	Y	Y	Y
Lorini* (2020) [90]	Y	Y	Y	Y	Y	C	Y	Y	Y
Chen* (2010) [87]	Y	Y	Y	Y	Y	Y	Y	C	C
Yassi (2010) [80]	Y	Y	Y	Y	Y	Y	C	Y	Y
Moran (2019) [84]	Y	Y	Y	Y	Y	Y	Y	Y	Y

1. Was a clear statement on the aims of the research provided? 2. Was the qualitative methodology appropriate? 3. Was the research design appropriate for the aims of the research? 4. Was the recruitment strategy appropriate for the aims of the research? 5. Was the data collected in a manner that addressed the research issue? 6. Has the relationship between researcher and participants been adequately considered? 7. Have ethical issues been considered? 8. Was data analysis sufficiently rigorous? 9. Was a clear statement of the findings provided? Y: Yes N: No, C: Can't tell. * A mixed-methods study.

many studies [75,84,91,94], especially if given by a trusted person [71,73,75]. In addition, the media had the ability to influence staff decisions, raise awareness, and encourage influenza vaccine uptake [75,87,93,96,99].

3.4.5. Knowledge

Lack of knowledge about the influenza vaccine [59,68,75,79,87,90,91], its efficacy [86,91], frequency of the vaccine [96], the adverse effects [75,78,86], and lack of awareness of the need to vaccinate [72,73,76,78,81,90,100,101] were barriers to influenza vaccine uptake. Some studies reported that a limited understanding of influenza was a barrier to the influenza vaccine uptake, particularly with regards to awareness of the risk and transmission of influenza [59,68,90,91]. Receiving sufficient information on influenza and the influenza vaccine was thought to improve influenza vaccine acceptance [71,75,81,94,96,99] whilst those who had not been provided with sufficient information were vaccinated less often than those who had [68,73,75,80,83,90,96,100]. Many studies showed that awareness of the influenza vaccination recommendations was associated with higher uptake of the influenza vaccine [53,61,64,65,79].

3.4.6. Social/professional role and identity

Sixteen studies reported barriers and enablers within this domain. Recognition that getting the vaccine was an obligation of staff's social and professional role toward residents, workplace, and others is seen as an important factor [62,71,74,75,78,84,95,90–92]. CH staff who were not fully convinced and committed to their obligation to receive the influenza vaccine were less likely to get vaccinated against influenza [73,79,88,90].

3.4.7. Goals

All of the factors related to the "Goals" domain were reported to be enablers to get vaccinated against influenza. The most critical factor that encouraged staff to be vaccinated was their priority goal to protect themselves [62,66,81,87,72,73,90–92], their families [62,72,91,92], and the residents [62,66,72,81,87,91,92]. In addition, receiving the vaccine was seen as a way to avoid sickness absence [71,72].

3.4.8. Optimism

Staff were pessimistic and expressed a negative attitude towards the effectiveness [73,85,90,92] and safety [73,78,90] of the influenza vaccine, which act as potential barriers to accepting the influenza vaccine. In addition, having confidence in one's immunity can serve as a potential barrier to uptake the influenza vaccine [75,90,100].

3.4.9. Intention

The enabler identified as motivation to get the influenza vaccine was the presence of CH staff's intention to receive the influenza vaccine next year [62,66,73,79,91]. On the other hand, if CH staff lack the intention to receive the vaccine, it acts as a barrier and reduces the likelihood of them getting vaccinated.

3.4.10. Reinforcement

In the context of promoting influenza vaccination among healthcare CH staff, some of the enablers identified in the "reinforcement" domain. In four studies, positive reinforcement (e.g., social reward, incentives) was seen as a significant encouragement for vaccination [63,69,71,91]. There was strong opposition to mandatory influenza vaccination to promote vaccination uptake among care home staff [80,88].

3.4.11. Memory, attention and decision processes

Some CH staff cited forgetfulness as the reason for not receiving the influenza vaccine [60,88,90,92] enablers to receive the vaccine were receiving reminders [81,87,91].

3.4.12. Behavioral regulation

In one study, providing feedback on performance was identified as a factor that could help increase the rate of influenza vaccination among CH staff [71]. However, when there was no feedback given, it was seen as a potential barrier to improving vaccination rates [59].

4. Discussion

This systematic review found that although there are signs that CH staff are accepting the influenza vaccine and have positive attitudes towards it, there are also significant barriers that impede them from accessing the influenza vaccine. The results of this systematic review support the conclusions drawn from previous reviews [102], which state that the behavior surrounding vaccination is complicated and influenced by numerous factors. Our findings regarding individuals' views on vaccination align with previous systematic reviews from other health care settings, including concerns about side effects, beliefs in efficacy, and safety [42–44,49,50,52].

Using a comprehensive theoretical framework for understanding the behaviours of CH staff toward the influenza vaccine is helpful in providing a structured method for recognizing barriers and enablers and designing interventions aimed at improving influenza vaccine uptake [56,103].

After conducting this synthesis using the TDF, specific barriers and enablers were categorized that could be useful in targeting areas for potential interventions in the future. In addition, this review lays the groundwork for developing a customized and complex intervention to improve influenza vaccine uptake among CH staff by connecting the barriers that can be changed to the appropriate behavior change techniques (BCTs).

The majority of the studies included in this review have reported the presence of misconceptions regarding the vaccine, including concerns about its safety or effectiveness. These findings agree with other similar reviews conducted in various healthcare settings [42,50]. Interestingly, healthcare workers who were hesitant to receive the influenza vaccine expressed similar concerns as those observed during the COVID-19 pandemic, such as worries about the safety, efficacy, and potential side effects of the vaccine [104]. This suggests that educational interventions should be prioritized and should include a range of informative materials, such as leaflets, posters, and videos. These resources can effectively address potential concerns and contribute to a comprehensive understanding of influenza vaccination among care home staff [105,106]. Furthermore, encouraging open and honest communication between staff and management about their concerns and experiences with the vaccine was seen as an enabler to accept the vaccine [107].

It was observed that there is a relationship between the desire to

protect themselves, their family and the patients they are caring for and acceptance of the influenza vaccine and the willingness to receive the influenza vaccine. These findings are consistent with the outcomes of previous systematic reviews conducted on the topic [43]. Therefore, incorporating information on the protective benefits of vaccines for CH staff, their relatives, and patients into educational interventions may serve as an important component of any vaccination advocacy initiative. Additionally, it is important to highlight both the potential benefits and limitations of influenza vaccines within these interventions. Acknowledging the current evidence on vaccine effectiveness, including its variations and uncertainties, can contribute to a more transparent and informed communication strategy. This approach can effectively contribute to enhancing awareness and promoting positive vaccination behaviors within the CH settings [52,108].

This review also found that having a reliable person who could provide accurate information about vaccinations was an enabler to accept the influenza vaccine. It has been found that healthcare providers may not have the time to search for information from national public health institutes [109], and this highlights the importance of providing information about the influenza vaccine, using engaging media to disseminate the information, and having a trustworthy point of contact to convey the information to the healthcare workers [105,106,110].

The low uptake of the influenza vaccine among CH staff can also be attributed to several environmental and organizational factors such as financial constraints, vaccine shortage, whereas providing financial support for CHs to make the vaccine accessible and available to staff were reported to improve influenza vaccination rate [30]. A significant barrier to influenza vaccination uptake among healthcare workers in hospital settings is the lack of accessible and convenient vaccination services [42,111]. However, research has indicated that healthcare personnel who work in CHs face greater barriers in accessing influenza vaccination compared to those who work in other healthcare settings [27].

There is a need for health systems to be more involved in supporting this sector by offering incentives or reimbursements to ensure that CHs and vaccine providers have the resources they need to provide the vaccine [112]. In addition, ensure a stable and consistent supply of the vaccine, which can be done through better planning and coordination with vaccine providers and distributors may therefore be beneficial in improving influenza vaccine rate [113].

The adverse reaction to the influenza vaccine or allergy to eggs could prevent CH staff from getting the vaccine were presented in the Environmental context and resources domain because this requires restructuring the physical environment, e.g., by offering alternative vaccines or medical interventions for staff who are experiencing this.

One of the most important motivators to get the vaccine is a supportive environment for the CH staff to get vaccinated and improving the accessibility and availability of the vaccine, especially through providing a free onsite vaccine service in a flexible schedule [59,114,115]. Also, provide support and resources to CHs to track and monitor the vaccination rate of their staff, even with high turnover rates. This can include using electronic health records or other tracking systems to monitor vaccine uptake and ensure that all staff are receiving the vaccine.

The act of getting vaccinated is a behaviour that is a complex and requires consideration of various factors, including attitudes, beliefs, motivation, perceived risk, and social and organizational influences [116]. Therefore, it is essential to understand the complex nature of vaccination and its determinants in order to develop effective strategies to encourage vaccination uptake.

Interventions aimed at increasing access to influenza vaccine, raising awareness about the vaccine, and providing incentives were found to have limited effectiveness when implemented individually [117]. Combined interventions are required as many studies indicated that a greater uptake of vaccinations among healthcare workers was achieved through the implementation of multiple interventions across various

domains [48,108,118,119].

CHs can differ in terms of their context, residents, staff characteristics, services provided, and size. Furthermore, CHs can vary significantly between countries, and even within the same country, due to distinctive regulations at the national or regional level, as well as the unique needs of each geographical area [118]. Therefore, when developing interventions, theory can be used to understand factors influencing behaviour change and to determine appropriate techniques. Evidence helps decide which behaviours to target, effective behaviour change techniques, and modes of delivery. Practical considerations, such as resource availability and acceptability in the targeted setting, must also be considered [56].

4.1. Strengths and limitations

This systematic review has several strengths. Firstly, including qualitative and quantitative research provides a comprehensive understanding of the complex nature of vaccine uptake behaviour among CH staff, and highlights the valuable insights that can be gained from both approaches. Secondly, the TDF was used to gain a thorough comprehension of the factors that prevent or facilitate the uptake of the influenza vaccine among CH staff. The TDF's inclusion in the study provides a strong foundation for developing an intervention that is both evidence and theory-based.

Our study solely included studies conducted in English and predominantly consisted of research carried out in North America and European countries. As a consequence, there is a potential restriction on the general applicability of our findings to alternative settings, particularly with regard to organizational culture. In our study, we included factors from surveys that were considered relevant even if they were indicated by less than 10 % of the participants. We made this decision because our aim was to provide a comprehensive overview of the barriers and enablers to the influenza vaccine uptake among CH staff. By considering all factors, even those endorsed by a small proportion of participants, we sought to ensure that we captured a broad range of perspectives and potential influences on the phenomenon under investigation. Many studies included in this systematic review relied on surveys to explore barriers and enablers to influenza vaccine uptake among CH staff. While this methodology allows for standardized data collection, it also introduces the possibility of bias as the pre-determined questions may reflect the authors' beliefs.

4.2. Recommendations for future research

The findings of this review emphasize the importance of developing interventions that target multiple levels, including individual and organizational factors. One potential approach is to use the TDF domains identified in this review to develop a taxonomy of behaviour change techniques (BCTs) that are likely to be effective in promoting influenza vaccination uptake among CH staff. This taxonomy could then be used in collaboration with stakeholders to identify the most appropriate BCTs and tailor interventions to the specific needs and context of CHs. APEASE (Affordability, Practicability, Effectiveness and cost-effectiveness, Acceptability, Side effects/safety, Equity) could be used as a framework for assessing the feasibility and appropriateness of these interventions, ensuring that they are effective, practical, and acceptable to the CH staff and other relevant stakeholders [120]. Finally, the interventions could be tested in feasibility and definitive trials to evaluate their effectiveness and potential for implementation on a larger scale.

5. Conclusion

This systematic review provides a comprehensive overview of the barriers and enablers affecting the uptake of influenza vaccine among CH staff. Multiple theoretical domains are likely to play a significant role in influencing vaccination uptake among CHs staff. Several barriers and

enablers were identified at the individual, organizational levels. The findings of this review emphasize the importance of understanding the complex nature of vaccination behaviour and developing strategies that combine various interventions across different domains.

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Appendix A. PubMed database search strategy

Query	Results
Search: (((((((nursing home[MeSH Terms]) AND (long term care[MeSH Terms])) AND (facilities, skilled nursing[MeSH Terms])) AND (facilities, residential[MeSH Terms])) OR ((care or hospice or rest or elderly or geriatric or aged) AND (home* or facilit* or setting* or institution* or organisation*))) AND ((health care provider [MeSH Terms]) OR (staff or worker* or employee* or personnel* or professional* or caregiver* or workforce or practitioner* or technician* or auxiliar* or assistant* or aide*))) AND (((influenza) OR (flu)) AND (vaccin* or immuniz* or immunit* or inoculation* or shot* or jab)) AND ((Barrier* or obstacle* or knowledge or attitude* or behavi* or refusal or Rejection or belief* or doubt* or hesitanc* or distrust or trust or mistrust or rumo* or misinformation* or misconception* or view* or opinion* or objector* or reject* or controvers* or oppos* dilemma or criticis* or Perception* or experience*) OR (Enabler* or facilitat* or Motivat* or Intervention* or encourag* or promot* or enhanc* or advocate or support* or improv* or increas* or utilisation or utilization))) NOT ((H1N1[Title]) OR (swine[Title]) OR (avian[Title]) OR (child*[Title]) OR (pediatric*[Title]) OR (adolescen*[Title]) OR (neonatal*[Title]) OR (cancer[Title]) OR (diabet*[Title]) OR (molecul*[Title]) OR (conference[Title]) OR (*systematic review*[Title]) OR (quickstats[Title]) OR (news[Title]))	1,151

Appendix B. Theoretical domains Framework, barriers and enablers to influenza vaccine uptake

Theoretical domain framework	Key factors	Barriers	Enablers
Environmental context and resources (30 studies)	Financial resources	<ul style="list-style-type: none"> Lack of fund or financial resources [61,71,81,93] Lack of fund for vaccination programs [83,84] No health insurance [69] Unavailability of free vaccine at work place [60] 	<ul style="list-style-type: none"> Free of charge influenza vaccination [64,81,94,97,99] Free onsite influenza vaccine [71,82]
	Accessibility to vaccine	<ul style="list-style-type: none"> Poor accessibility to vaccination services [59,76,88] Poor accessibility related to work time/shifts [68,84,87,91,100] Lack of time to get influenza vaccine [60,88,90,100] Vaccination taking long time [61] Vaccination at not suitable time [72] 	<ul style="list-style-type: none"> Easily access to vaccine [64,81,91,73,74] Availability of vaccine at work site [99] Vaccination at convenient time [91] Offered at flexible day and time [96] Vaccination offered many times [71,96] HCWs have enough time [73]
	Time		
	Availability of influenza vaccine	<ul style="list-style-type: none"> Lack/shortage of vaccine supply [59,65,68,100] 	
	Organizational vaccination policy	<ul style="list-style-type: none"> Vaccination policy enforced [61] Not required by employer [29,71] Lack of vaccination policy [71] 	<ul style="list-style-type: none"> Mandatory policy for vaccination Vaccination policy [79,99] or requirement [71]
	Adverse reaction to vaccine	Egg allergy [66]	No allergic reaction [74]
	Health condition	Presence of other health condition [73,82,87,99]	
	Medical contraindication	Medical contraindication [90,97]	
	Staff turnover	Staff turnover [68,71,100]	
	GP role	Not vaccinated by their GP [99]	registration with GP [99]
Belief about consequences (32 studies)	organisational culture		organisational culture/climate [73]
	Belief about the effectiveness of the influenza vaccine	Perception that vaccination is not effective in preventing influenza [66,71,72,74,77,78,81,90,93,61,62,86–88]	Belief that flu vaccine is effective [62–63,70,72,78,81,87,90,92–93,95–96,100]
	Belief about the side effects of the influenza vaccine	<ul style="list-style-type: none"> General wrong belief about side effects [60,66,68,81,90,92,93,73–76,86–88] Belief that influenza vaccine weaken immune system [91,92] Will get influenza from the vaccine [60,71,72,75,78,91,92] or cause influenza symptoms [68] 	The belief that influenza vaccine does not have side effects [70,72,74,78,96,98]
	Belief about the safety of the influenza vaccine	Distrust of influenza vaccine safety [60,62,87,98]	Perception that flu vaccine is safe [62,63,81,87,90]
	Perceived necessity of the influenza vaccine	<ul style="list-style-type: none"> Perception that vaccination not necessary [73,91,92] Never get flu [60,81,90,92,100] No need for the vaccine [71,72] Fit and healthy [73] 	
	Perceived susceptibility to the influenza	Lack of concerns about getting influenza [86,88,92,98]	<ul style="list-style-type: none"> The belief that oneself or HCWs at risk of getting influenza [63,70,72,74,91,92,96,98] The belief that (others) residents [63,70,75] or family [91] at risk of getting influenza

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Theoretical domain framework	Key factors	Barriers	Enablers	
Social influence (25 studies)	Beliefs about the seriousness of the influenza	<ul style="list-style-type: none"> Perception that influenza is not dangerous or [73,86,88,91,92,98] Perception that influenza is not serious for residents [77,81] 	Belief that influenza is sever/dangerous condition for me [63,96,98] or for the elderly [63,72,73,91,92,96]	
	Saliency of consequences	bad experiences with influenza vaccination [29,73,75,78,90]	bad experiences with influenza [72,78,84,90,93,97]	
	Perceived susceptibility to spread influenza		belief about possibility to infect others [70,91,92]	
	Perceived benefit of the influenza vaccine	Belief that the influenza vaccine is not valuable/useful/beneficial for me [73,79,88,92,98] or for others [73,90]	Belief that flu vaccine is valuable/useful/beneficial for yourself and others [63,72,78,96,98]	
	Doctor-staff communication	Lake of doctor/GP recommendation [81,88,93]	Doctor recommendation to get influenza vaccine [64,72,73,78,81,88,90,93,96,97,99]	
	Work and supervisor's role	Lack of recommendation and support from workplace/employer/supervisors [59,81]	Encouragement and support from workplace/ employer/supervisors [64,72,74,78,80,81,91,92,94,97-99]	
	Influence of colleagues	Lack of encouragement from colleagues [73,75,80]	Encouragement from colleagues [73,75,78,80,90,91,96,98,99]	
	Influence of family or close contact	Negative experiences happened to close contacts [75]	support from family members or close contact [29,78,81,90,91,96]	
	Government role	Lack of trust in government and administration [78,100]	trust in government recommendations [78]	
	Media role		Using media to prompt influenza vaccine [75,87,93,96,99]	
Emotion (26 studies)	communication		personalized communication [75,84,91,94]	
	Social comparisons		Comparison with others [100]	
	Perceived support	Lack of perceived support on receiving influenza vaccine decision [79]	perceived support on receiving influenza vaccine decision [73,96]	
	Role models		trusted role model [71,73,75]	
	Fear/concern of side effects	<ul style="list-style-type: none"> General fear or concern of side effects [29,60,61,66,71,72,75,76,85,87,88,90,92,99] Fear of getting influenza from vaccine [60,71,90,97] 	Absence of concern about side effects [77,81]	
	Fear/concern of needles	Fear of needles [61,62,66,68,71,74,76,81,87,90,92,97,99,100]		
	Fear or concern of influenza vaccine	Fear or concern of influenza vaccine [73]		
	Compassion with care home staff	Lack of sympathy with CHs staff [78]		
	Concern about influenza	Absence of concern about influenza [86]		
	Working condition autonomy of care home staff	Feeling organization not caring about staff [75,78,80]	Job satisfaction [69]	
Knowledge (22 studies)	Perception of powerless and anger of mandating vaccination [75]			
	Knowledge about influenza vaccine	Lack of knowledge about: the vaccine [59,68,75,79,90,91] the efficacy [86,91] or the side effects of the vaccine [75,78,86] or misconceptions about vaccine [87,91]	knowledge about influenza vaccine [75,96,98]	
	Knowledge about influenza	Lack of knowledge about the risk of influenza [90], transmission [90] and contracting influenza [59,68,86,90,91]	knowledge about influenza [96], risk of contracting and transmit of influenza [90]	
	Awareness about the importance of influenza vaccine	Lack of awareness about the need [72,76,81] or the importance of influenza vaccination [53,61,68,70,75]	awareness about the importance of influenza vaccine [72,75,90,96]	
	Education and provision of information	<ul style="list-style-type: none"> Lack of clarity of information [75,100] Insufficiently informed about flu and vaccine [75,90] Lack of scientific information [80] Don't believe evidence [73] Lack of provision of information [68,75,80,83,96] Insufficient information [75,80] 	<ul style="list-style-type: none"> Provision of education materials [75,81,94,96] Sufficiently informed [71,75,96,99] 	
	Awareness about influenza vaccine recommendations	Lack of awareness about the influenza vaccination recommendations [73]	Awareness of influenza vaccination recommendation [53,61,64,65,79,86]	
	knowledge of the frequency of the vaccination	Lack of knowledge about the frequency of influenza vaccination [96]	knowledge of the frequency of the vaccination [93]	
	awareness of the availability of the influenza vaccine	Lack of awareness of the availability of the influenza vaccine [99]	awareness about the availability of the flu vaccine [73]	
	Social/professional role and identity (16 studies)	Professional roles toward residents	Lack of awareness of professional role [90] toward residents [88]	Awareness of professional role toward residents [62,75,78,84,95,91,92]
		responsibility of staff to get vaccinated	Lack of belief in the role and responsibility of HCW to get vaccinated [73,79,88,90]	<ul style="list-style-type: none"> Belief in the need/responsibility of staff to get vaccinated [91,96] every year [74] Belief that vaccination is their duty [79]
Social role and responsibility		Lack of awareness/lack of social role to protect others [88,90]	Awareness of social role to protect others [62,75,78,89,90]	
Organizational commitment			Awareness of professional role toward workplace [71,74,91,92]	
Goals (11 studies)	Cultural identity	Lack of believe in immunization [68]		
	Vaccine protection		Goal priority: <ul style="list-style-type: none"> Self-protection [62,66,81,87,72,73,90-92] 	

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Theoretical domain framework	Key factors	Barriers	Enablers
			<ul style="list-style-type: none"> • Family protection [62,72,91,92] • Residents' protection [62,66,72,81,87,91,92] • Others protection [62,71,73,98] Avoid sickness absence [71,72]
Optimism (12 studies)	Goal related to work commitment action planning Optimism about the efficacy of influenza vaccine Value of the influenza vaccines Trust vaccine	Lack of confidence in the efficacy of influenza vaccine [73,85,90,92] Pessimism about the value/usefulness of vaccines [91]	Having action plan [73] Confidence in the efficacy of the influenza vaccine [89–91] Optimism about the value of influenza vaccine [78] Trust vaccine safety [89]
Intentions (10 studies)	Identity Intention to get vaccinated conscious decision	Confidence in own immunity [75,90,100] No intention to get the vaccine [66,74,97,98]	Intention to get vaccinated [62,66,73,79,91] Feeling of freedom of choice [91,92,96]
Reinforcement (8 studies)	Reward	<ul style="list-style-type: none"> • Incentives [73] • Lack of incentives [59] Mandating influenza vaccine [80,88]	Reward for getting vaccine [63,69,91] Incentives [71]
Memory, Attention and Decision Processes (7 studies)	legislation Inner feeling Forgetting attention to vaccination Prompts/cues	Forgetting to get the vaccine [60,88,90,92] Lack of attention to vaccination [81,90]	Feel of making difference [73] Reminders [81,87,91]
Behavioural regulation (2 studies)	feedback on performance	Lack of feedback on performance [59]	Feedback on performance [71]
Skill (0 studies)			
Beliefs about Capabilities (0 studies)			

References

- [1] Pop-Vicas A, Gravenstein S. Influenza in the elderly - A mini-review. *Gerontology* 2011;57:397–404.
- [2] Strausbaugh LJ, Sukumar SR, Joseph CL. Infectious disease outbreaks in nursing homes: An unappreciated hazard for frail elderly persons. *Clin Infect Dis* 2003;36: 870–6.
- [3] Thompson WW, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. *Am Med Assoc* 2003;289:179–86.
- [4] Hardelid P, Pebody R, Andrews N. Mortality caused by influenza and respiratory syncytial virus by age group in England and Wales 1999–2010. *Influenza Other Respi Viruses* 2013;7:35–45.
- [5] England, PH. Surveillance of influenza and other respiratory viruses in the United Kingdom : Winter 2019 to 2020. *Phe* (2020).
- [6] Utsumi M, Makimoto K, Quroshi N, Ashida N. Types of infectious outbreaks and their impact in elderly care facilities: A review of the literature. *Age Ageing* 2010; 39:299–305.
- [7] Gaillat J, et al. Morbidity and mortality associated with influenza exposure in long-term care facilities for dependant elderly people. *Eur J Clin Microbiol Infect Dis* 2009;28:1077–86.
- [8] Ellis SE, Coffey CS, Mitchel EF, Dittus RS, Griffin MR. Influenza- and respiratory syncytial virus-associated morbidity and mortality in the nursing home population. *J Am Geriatr Soc* 2003;51:761–7.
- [9] Kawana A, et al. 'Syndromic surveillance within a hospital' for the early detection of a nosocomial outbreak of acute respiratory infection. *Jpn J Infect Dis* 2006;59: 377–9.
- [10] K.A., B. et al. Antiviral prophylaxis in the management of an influenza outbreak in an aged care facility. *Commun Dis Intell.*2004;28:396–400.
- [11] Ridgway JP, et al. Influenza among afebrile and vaccinated healthcare workers. *Clin Infect Dis* 2015;60:1591–5.
- [12] Influenza outbreak in an Ontario long-term care home - January 2005 - Canada. ca. <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-cdr/monthly-issue/2006-32/influenza-outbreak-ontario-long-term-care-home-january-2005.html>.
- [13] Parsons SK, Simmons WP, Penn K, Furlough M. Determinants of satisfaction and turnover among nursing assistants. The results of a statewide survey. *J Gerontol Nurs* 2003;29:51–8.
- [14] Voirin N, Barret B, Metzger MH, Vanhems P. Hospital-acquired influenza: a synthesis using the Outbreak Reports and Intervention Studies of Nosocomial Infection (ORION) statement. *J Hosp Infect* 2009;71:1–14.
- [15] Influenza (Flu) | CDC. <https://www.cdc.gov/flu/index.htm>.
- [16] Jackson LA, et al. Safety, efficacy, and immunogenicity of an inactivated influenza vaccine in healthy adults: A randomized, placebo-controlled trial over two influenza seasons. *BMC Infect Dis* 2010;10:1–14.
- [17] CDC Seasonal Flu Vaccine Effectiveness Studies | CDC. <https://www.cdc.gov/flu/vaccines-work/effectiveness-studies.htm>.
- [18] Gasparini R, Amicizia D, Lai PL, Bragazzi NL, Panatto D. Compounds with anti-influenza activity: Present and future of strategies for the optimal treatment and management of influenza. Part I: Influenza life-cycle and currently available drugs. *J Prev Med Hyg* 2014;55:69–85.
- [19] Global Influenza Programme. <https://www.who.int/teams/global-influenza-programme/vaccines/vaccine-use>.
- [20] Seasonal Flu Vaccines | CDC. <https://www.cdc.gov/flu/prevent/flushot.htm>.
- [21] Flu vaccine - NHS. <https://www.nhs.uk/conditions/vaccinations/flu-influenza-vaccine/>.
- [22] Influenza vaccination coverage, health care workers - European Health Information Gateway. <https://gateway.euro.who.int/en/indicators/inf10-influenza-vaccination-coverage-health-care-workers/visualizations/#id=31630&tab=notes>.
- [23] Mereckiene, J. Seasonal influenza vaccination in Europe – Vaccination recommendations and coverage rates for eight influenza seasons (2007–2008 to 2014–2015). <https://www.ecdc.europa.eu/en/publications-data/seasonal-influenza-vaccination-europe-vaccination-recommendations-and-coverage-2007-2015>.
- [24] Influenza Vaccination Coverage Among Health Care Personnel — United States, 2020–21 Influenza Season | FluVaxView | Seasonal Influenza (Flu) | CDC. https://www.cdc.gov/flu/fluvoxview/hcp-coverage_1920-21-estimates.htm.
- [25] ECDC. Seasonal influenza vaccination and antiviral use in EU/EEA Member States. *Ecdc* (2018).
- [26] Public Health England (PHE). Seasonal influenza vaccine uptake in healthcare workers (HCWs) in England: winter season 2019 to 2020. 1–25 (2020).
- [27] Chan CP, Lee SS, Wong NS. Adherence of nurses to annual seasonal influenza vaccination over a 5-year period. *J Hosp Infect* 2021;112:6–15.
- [28] Razzaghi H, Srivastav A, De Perio MA, Laney A Scott, Black CL. Influenza and COVID-19 Vaccination Coverage Among Health Care Personnel-United States, 2021–22. *Morb Mortal Wkly Rep* 2021;71:1319–26.
- [29] Wong NS, Lee S, Lee SS. Differing pattern of influenza vaccination uptake in nurses between clinical and long term care facilities setting, 2014–2018. *Int J Infect Dis* 2018;75:8–10.
- [30] O'Lorcain P, Cotter S, Walsh C. Influenza vaccine uptake among healthcare workers and residents in public health care facilities in Ireland over nine influenza seasons (2011–2012 to 2019–2020). *Vaccine* 2021;39:5954–62.
- [31] Dini G, et al. Influenza vaccination in healthcare workers: A comprehensive critical appraisal of the literature. *Hum Vaccines Immunother* 2018;14:772–89.

- [32] Thomas RE, Jefferson T, Lasserson TJ. Influenza vaccination for healthcare workers who work with the elderly: A Cochrane review. *Health Technol Assess (Rockv)* 2011;14:493–588.
- [33] Dolan GP, et al. Vaccination of healthcare workers to protect patients at increased risk of acute respiratory disease: Summary of a systematic review. *Influenza Other Respi Viruses* 2013;7:93–6.
- [34] Lansbury LE, Brown CS, Nguyen-Van-Tam JS. Influenza in long-term care facilities. *Influenza Other Respi Viruses* 2017;11:356–66.
- [35] Ahmed F, Lindley MC, Alred N, Weinbaum CM, Grohskopf L. Effect of influenza vaccination of healthcare personnel on morbidity and mortality among patients: Systematic review and grading of evidence. *Clin Infect Dis* 2014;58:50–7.
- [36] Imai C, et al. A systematic review and meta-analysis of the direct epidemiological and economic effects of seasonal influenza vaccination on healthcare workers. *PLoS One* 2018;13:1–12.
- [37] Pereira M, Williams S, Restrck L, Cullinan P, Hopkinson NS. Healthcare worker influenza vaccination and sickness absence – An ecological study. *Clin Med J R Coll Physicians London* 2017;17:484–9.
- [38] Frentzel E, et al. Recommendations for mandatory influenza vaccinations for health care personnel from AMDA's infection advisory subcommittee. *J Am Med Dir Assoc* 2020;21:25–28.e2.
- [39] Peasah SK, Azziz-Baumgartner E, Breesse J, Meltzer MI, Widdowson MA. Influenza cost and cost-effectiveness studies globally - A review. *Vaccine* 2013;31:5339–48.
- [40] Burls A, et al. Vaccinating healthcare workers against influenza to protect the vulnerable-Is it a good use of healthcare resources? A systematic review of the evidence and an economic evaluation. *Vaccine* 2006;24:4212–21.
- [41] Collange F, Verger P, Launay O, Pulcini C. Knowledge, attitudes, beliefs and behaviors of general practitioners/family physicians toward their own vaccination: A systematic review. *Hum Vaccines Immunother* 2016;12:1282–92.
- [42] Hollmeyer HG, Hayden F, Poland G, Buchholz U. Influenza vaccination of health care workers in hospitals-A review of studies on attitudes and predictors. *Vaccine* 2009;27:3935–44.
- [43] Vasilevska M, Ku J, Fisman DN. Factors Associated with Healthcare Worker Acceptance of Vaccination: A Systematic Review and Meta-analysis. *Infect Control Hosp Epidemiol* 2014;35:699–708.
- [44] Hofmann F, Ferracin C, Marsh G, Dumas R. Influenza vaccination of healthcare workers: A literature review of attitudes and beliefs. *Infection* 2006;34:142–7.
- [45] Bish A, Yardley L, Nicoll A, Michie S. Factors associated with uptake of vaccination against pandemic influenza: A systematic review. *Vaccine* 2011;29:6472–84.
- [46] Prematunge C, et al. Factors influencing pandemic influenza vaccination of healthcare workers-A systematic review. *Vaccine* 2012;30:4733–43.
- [47] Schmid P, Rauber D, Betsch C, Lidolt G, Denker ML. Barriers of influenza vaccination intention and behavior - A systematic review of influenza vaccine hesitancy, 2005–2016. *PLoS One* 2017;12.
- [48] To KW, Lai A, Lee KCK, Koh D, Lee SS. Increasing the coverage of influenza vaccination in healthcare workers: review of challenges and solutions. *J Hosp Infect* 2016;94:133–42.
- [49] Riphagen-Dalhuisen J, Gefenaite G, Hak E. Predictors of seasonal influenza vaccination among healthcare workers in hospitals: A descriptive meta-analysis. *Occup Environ Med* 2012;69:230–5.
- [50] Zhang J, While AE, Norman IJ. Knowledge and attitudes regarding influenza vaccination among nurses: A research review. *Vaccine* 2010;28:7207–14.
- [51] Guillari A, et al. Influenza vaccination and healthcare workers: Barriers and predisposing factors. A literature review. *Acta Biomed* 2021;92.
- [52] Lorenc T, Marshall D, Wright K, Sutcliffe K, Sowden A. Seasonal influenza vaccination of healthcare workers: Systematic review of qualitative evidence. *BMC Health Serv Res* 2017;17:1–9.
- [53] Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. on behalf of the "Psychological T. G. Making psychological theory useful for implementing evidence based practice: a consensus approach. 26–33 (2005) doi:10.1136/qshc.2004.011155.
- [54] Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci* 2012;7:37.
- [55] Atkins L, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implement Sci* 2017;12:1–18.
- [56] French SD, et al. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. *Implement Sci* 2012;7:1–8.
- [57] Critical Appraisal Skills Programme(CASP).CASP Qualitative Checklist. http://media.wix.com/ugd/dded87_29c5b002d99342f788c6ac670e49f274.pdf. Accessed 15 Dec 2015. No Title.
- [58] (No Title). <https://cebma.org/wp-content/uploads/Critical-Appraisal-Questions-for-a-Cross-Sectional-Study-July-2014-1.pdf>.
- [59] Nace DA, Hoffman EL, Resnick NM, Handler SM. Achieving and sustaining high rates of influenza immunization among long-term care staff. *J Am Med Dir Assoc* 2007;8:128–33.
- [60] Kimura AC, Nguyen CN, Higa JI, Hurwitz EL, Vugia DJ. The effectiveness of vaccine day and educational interventions on influenza vaccine coverage among health care workers at long-term care facilities. *Am J Public Health* 2007;97:684–90.
- [61] Adam O. Goldstein, MD, MPH; Jean E. Kincade, PhD, RN; George Gamble, PhD; Rachel S. Bearman, M. Policies and practices for improving influenza immunization rates among healthcare workers. 25, (2004).
- [62] O'Neil CA, Kim L, Prill MM, Stone ND, Garg S. Preventing respiratory viral transmission in long-term care: knowledge, attitudes, and practices of healthcare personnel. *Infect Control Hosp Epidemiol* 2017;38:1449–56.
- [63] Yue X, Carla Black SB, Donahue S, de Marie A, Perio AS, Laney SG. Workplace interventions and vaccination-related attitudes associated with influenza vaccination coverage among healthcare personnel working in long-term care facilities, 2015–2016 influenza season. *J Am Med Dir Assoc* 2019;20:718–24.
- [64] Hutt E, Radcliff TA, Oman KS, Regina Fink J, Ruscin M, Linnebur S, et al. Impact of NHAAP guideline implementation intervention on staff and resident vaccination rates. *J Am Med Dir Assoc* 2010;11:365–70.
- [65] Lona Mody, MD, Kenneth M. Langa, MD, PhD, and Preeti N. Malani, M. Impact of the 2004-2005 Influenza Vaccine Shortage on Immunization Practices in Long-Term Care Facilities Lona. *Bone* 2012;23:1–7.
- [66] Thomas DR, Winsted B, Koontz C. Improving Neglected Influenza Vaccination Among Healthcare Workers in Long-Term Care. (1993).
- [67] Nace DA, Perera S, Handler SM, Muder R, Hoffman EL. Increasing influenza and pneumococcal immunization rates in a nursing home network. *J Am Med Dir Assoc* 2011;12:678–84.
- [68] Sand KL, Lynn J, Bardenheier B, Seow H, Nace DA. Increasing influenza immunization for long-term care facility staff using quality improvement. *J Am Geriatr Soc* 2007;55:1741–7.
- [69] Groenewold M, Baron S, Tak SW, Allred N. Influenza vaccination coverage among US nursing home nursing assistants: The role of working conditions. *J Am Med Dir Assoc* 2012;13(85):e17–85.e23.
- [70] Jill D, Daugherty MPH, PhD SC, Blake MA, PhD JM, Grosholz MA, et al. Influenza vaccination rates and beliefs about vaccination among nursing home employees. *Am J Infect Control* 2015;43:100–6.
- [71] Ofstead CL, Amelang MR, Wetzler HP, Tan L. Moving the needle on nursing staff influenza vaccination in long-term care: Results of an evidence-based intervention. *Vaccine* 2017;35:2390–5.
- [72] Halpin C, Reid B. Attitudes and beliefs of healthcare workers about influenza vaccination. *Nurs Older People* 2019;31.
- [73] Kenny E, McNamara Á, Noone C, Byrne M. Barriers to seasonal influenza vaccine uptake among health care workers in long-term care facilities: A cross-sectional analysis. *Br J Health Psychol* 2020;25:519–39.
- [74] King A, Doherty T, Quintyne KI, Brabazon E. Beliefs and attitudes of health workers to influenza vaccination: a survey. *Nurs Resid Care* 2019;21:676–81.
- [75] Quinn G. Nurses' experiences of the seasonal influenza vaccine in residential care. *Br J Nurs* 2014;23:942–8.
- [76] O'Connor L, Boland M, Murphy H. Preparedness of elderly long-term care facilities in HSE East for influenza outbreaks. *Ir Med J* 2015;108.
- [77] Tannenbaum TN, Thomas D, Baumgarten M, Saintonge F, Roban I. Evaluation of an influenza vaccination program for nursing home staff. *Can J Public Heal* 1993;84:60–2.
- [78] Manuel DG, Henry B, Hockin J, Naus M. Health behavior associated with influenza vaccination among healthcare workers in long-term-care facilities. (2002).
- [79] Shannon M. Sullivan, MSc, Donna Pierrynowski-Gallant, PhD, RN, Larry Chambers, PhD, FACE, Annette O'Connor, PhD, Sherry Bowman, BN, RN, Shelly McNeil, MD, Robert Strang, MD, and Frank Knoefel, M. Influenza Vaccination and Decisional Conflict Among Regulated and Unregulated Direct Nursing Care Providers in Long-Term-Care Homes. 56, (2008).
- [80] Yassi A, Lockhart K, Buxton JA, McDonald I. Vaccination of health care workers for influenza: promote safety culture, not coercion. *Can J Public Heal* 2010;101:S41–S45.
- [81] Halliday L, Thomson JA, Roberts L, Bowen S, Mead C. Influenza vaccination of staff in aged care facilities in the ACT: How can we improve the uptake of influenza vaccine? *Aust N Z J Public Health* 2003;27:70–5.
- [82] Lai E, Tan HY, Kunasekaran M, Chughtai AA, Trent M, Christopher Poulos CRM. Influenza vaccine coverage and predictors of vaccination among aged care workers in Sydney Australia. *Vaccine* 2020;38:1968–74.
- [83] Huhtinen E, Quinn E, Hess I, Najjar Z, Gupta L. Understanding barriers to effective management of influenza outbreaks by residential aged care facilities. *Australas J Ageing* 2019;38:60–3.
- [84] Moran A, Agalioitis M, Seale H. The views of key stakeholders around mandatory influenza vaccination of hospital and aged care staff: Examining the current climate in Australia. *Vaccine* 2019;37:705–10.
- [85] Lee DTF, Yu D, Ip M, Tang JYM. Evaluation on the implementation of respiratory protection measures in old age homes. *Clin Interv Aging* 2017;12:1429–38.
- [86] Tuen-Ching Chan, Ivan Fan-Ngai Hung, James Ka-Hay Luk, Patrick Chiu-Yat Woo, Leung-Wing Chu, Felix Hon-Wai Chan. Prevalence of influenza vaccination and associated factors in chinese nursing home healthcare workers. *Qual Life Res.* 2013;22:1621–1632.
- [87] Chen H, Ng S, King ME, Carol Fong WP, Ng KHS, Ho S, et al. Promotion of seasonal influenza vaccination among staff in residential care homes for elderly in Hong Kong. *Health Infect* 2010;15(4):121–5.
- [88] Moretti F, Visentin D, Bovolenta E, Rimondini M, Majori S, Mazzi M, et al. Attitudes of nursing home staff towards influenza vaccination: Opinions and factors influencing hesitancy. *Int J Environ Res Public Health* 2020;17.
- [89] Lorini C, Collini F, Gasparini F, Paolini D, Grazzini M, Ierardi F, et al. Health literacy, vaccine confidence and influenza vaccination uptake among nursing home staff: A cross-sectional study conducted in Tuscany. *Vaccines* 2020;8.
- [90] Lorini C, Ierardi F, Gatteschi C, Galletti G, Collini F, Peracca L, et al. Promoting influenza vaccination among staff of nursing homes according to behavioral insights: Analyzing the choice architecture during a nudge-based intervention. *Vaccines* 2020;8:1–20.

- [91] Boey L, Bral C, Roelants M, De Schryver A, Godderis L, Karel Hoppenbrouwers CV. Attitudes, beliefs, determinants and organisational barriers behind the low seasonal influenza vaccination uptake in healthcare workers – A cross-sectional survey. *Vaccine* 2018;36:3351–8.
- [92] Boey L, Roelants M, Vandermeulen C. Increased vaccine uptake and less perceived barriers toward vaccination in long-term care facilities that use multi-intervention manual for influenza campaigns. *Hum Vaccines Immunother* 2020;17:1–8.
- [93] Elias C, Fournier A, Vasiliu A, Beix N, Demillac R, Tillaut H, et al. Seasonal influenza vaccination coverage and its determinants among nursing homes personnel in western France. *BMC Public Health* 2017;17:1–10.
- [94] Vaux S, et al. Influenza vaccination coverage of professionals working in nursing homes in France and related determinants, 2018–2019 season: a cross-sectional survey. *BMC Public Health* 2022;22:1–11.
- [95] Looijmans-Van Den Akker I, Marsaoui B, Hak E, Van Delden JJM. Beliefs on mandatory influenza vaccination of health care workers in nursing homes: A questionnaire study from the Netherlands. *J Am Geriatr Soc* 2009;57:2253–6.
- [96] Looijmans-van den Akker I, van Delden JJM, Verheij TJM, van Essen GA, van der Sande MAB, Hulscher ME, et al. Which determinants should be targeted to increase influenza vaccination uptake among health care workers in nursing homes? *Vaccine* 2009;27:4724–30.
- [97] Hauri AM, Uphoff H, Gussmann V, Gawrich, S. Factors that affect influenza vaccine uptake among staff of long-term care facilities. (2006).
- [98] Shahar I, Mendelson G, Ben Natan M. Intention to receive the seasonal influenza vaccine among nurses working in a long-term care facility. *Int J Nurs Pract* 2017;23:1–6.
- [99] Shroufi A, et al. Influenza vaccine uptake among staff in care homes in Nottinghamshire: A random cluster sample survey. *Public Health* 2009;123:645–9.
- [100] David A. Nace, MD, MPH, Subashan Perera, PhD, Steven M. Handler, MD, MS, Robert Muder, MD, and Erika L. Hoffman, M. Increasing Influenza and Pneumococcal Immunization Rates in a Nursing Home Network. *Physiol Behav* 2016;176:139–148.
- [101] Elias C, et al. Seasonal influenza vaccination coverage and its determinants among nursing homes personnel in western France. *BMC Public Health* 2017;17:1–10.
- [102] Corace KM, et al. Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine* 2016;34:3235–42.
- [103] Serda M, et al. Changing provider behavior: an overview of systematic reviews of interventions. *Med Care* 2001;39:2–45.
- [104] Peterson CJ, Lee B, Nugent K. COVID-19 vaccination hesitancy among healthcare workers—A review. *Vaccines* 2022;10:1–30.
- [105] Looijmans-van den Akker I, et al. Effects of a multi-faceted program to increase influenza vaccine uptake among health care workers in nursing homes: A cluster randomised controlled trial. *Vaccine* 2010;28:5086–92.
- [106] Study THEV. Randomised active programs on healthcare workers' flu vaccination in geriatric health care settings in France: The vesta study 2011;15:126–132.
- [107] Kassianos G, et al. Key policy and programmatic factors to improve influenza vaccination rates based on the experience from four high-performing countries. *Drugs Context* 2021;9:1–13.
- [108] Prematunge C, et al. Qualitative motivators and barriers to pandemic vs. seasonal influenza vaccination among healthcare workers: A content analysis. *Vaccine* 2014;32:7128–34.
- [109] Paterson P, et al. Vaccine hesitancy and healthcare providers. *Vaccine* 2016;34:6700–6.
- [110] Chambers LW, et al. A new approach to improving healthcare personnel influenza immunization programs: A randomized controlled trial. *PLoS One* 2015;10:1–14.
- [111] Denise LC, John C. Why are healthcare workers so resistant to the acceptance of influenza vaccine? A review of the literature to examine factors that influence vaccine acceptance. *Int J Caring Sci* 2012;5:26–35.
- [112] Penfold RB, et al. Financing and systems barriers to seasonal influenza vaccine delivery in community settings. *Vaccine* 2011;29:9632–9.
- [113] The NHS influenza immunisation programme 2022 to 2023. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1081646/Tripartite_annual_flu_letter_2022_to_2023_V2.pdf (2023).
- [114] Russell ML. Influenza vaccination in Alberta long-term care facilities. *C Can Med Assoc J* 2001;164:1423–7.
- [115] Henry B, Naus M, Stirling R. Impact of influenza vaccination policies on staff coverage in long-term care facilities. *Int Congr Ser* 2001;1219:671–5.
- [116] Corace K, Garber G. When knowledge is not enough: Changing behavior to change vaccination results. *Hum Vaccines Immunother* 2014;10:2623–4.
- [117] Lytras T, Kopsachilis F, Mouratidou E, Papamichail D, Bonovas S. Interventions to increase seasonal influenza vaccine coverage in healthcare workers: A systematic review and meta-regression analysis. *Hum Vaccines Immunother* 2016;12:671–81.
- [118] Bechini A, et al. Utility of healthcare system-based interventions in improving the uptake of influenza vaccination in healthcare workers at long-term care facilities: A systematic review. *Vaccines* 2020;8:1–14.
- [119] Rashid H, et al. Assessing interventions to improve influenza vaccine uptake among health care workers. *Health Aff* 2016;35:284–92.
- [120] Michie S, Atkins L, West R. The Behaviour Change Wheel: A Guide to Designing Interventions. *The Behavior Change Wheel: Book Launch Event*; 2014.