

**AWARENESS AND KNOWLEDGE ABOUT INFLUENZA SEASONAL VACCINE
AMONG HEALTHCARE WORKERS IN KSA: A SYSTEMATIC REVIEW**

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Abstract

Background: Seasonal influenza is a significant public health concern, with healthcare workers (HCWs) playing a crucial role in both prevention and control. In Saudi Arabia (KSA), annual influenza vaccination campaigns target HCWs due to their high exposure to the virus. Despite these efforts, vaccine uptake among HCWs remains suboptimal, often due to gaps in awareness and knowledge. This systematic review aimed to assess the level of awareness and knowledge regarding the seasonal influenza vaccine among HCWs in KSA and identify factors influencing vaccination uptake.

Methods: A comprehensive search was conducted across multiple electronic databases, including PubMed, Scopus, Web of Science, Embase, and Google Scholar, for studies published up to the present. Cross-sectional, cohort, qualitative, and mixed-methods studies focusing on the awareness, knowledge, and attitudes towards the influenza vaccine among HCWs in KSA were included. After screening 182 studies, 12 studies were selected based on inclusion criteria and were reviewed for relevant data.

Results: The review found significant variability in the awareness and knowledge about the seasonal influenza vaccine among HCWs in KSA. Knowledge levels ranged from 37.1% to 89.6%, with the highest knowledge reported in studies focused on healthcare settings with structured educational interventions. Positive attitudes toward vaccination were generally high (up to 89%), yet vaccine uptake remained low in many studies, with vaccination rates varying from 20.8% to

88.3%. Barriers identified included misconceptions about vaccine efficacy, safety concerns, and low-risk perceptions, while facilitators included mandatory vaccination policies and targeted awareness programs.

Conclusion: Despite positive attitudes toward vaccination, HCWs in KSA exhibit substantial gaps in knowledge about the seasonal influenza vaccine, and vaccine uptake remains below optimal levels. Targeted educational campaigns and addressing misconceptions about vaccine safety and efficacy are essential to improving vaccination rates. Interventions should be tailored to specific HCW groups based on demographic and professional factors.

Keywords: Influenza vaccine, healthcare workers, awareness, knowledge, Saudi Arabia, vaccination uptake.

Introduction

The seasonal flu is a respiratory infection that poses a global public health concern because of the problems it may bring and the high death rate that follows, especially in vulnerable populations. As a result, during major outbreaks, health services at all levels have been overwhelmed [1-3]. The risk of influenza infection is much higher for healthcare workers (HCWs) than for persons working in non-healthcare settings, according to a systematic review and meta-analysis [4]. In addition, direct patient care providers (PHCWs) have the potential to spread the disease to their patients, friends, and family [5].

Vaccination against influenza is a crucial measure in preventing the spread of the virus. One effective method of lowering the risk of influenza transmission among patients and their families is to vaccinate healthcare workers [6]. In addition, PHCWs may set a good example for their patients by taking part in self-prevention measures and being vaccinated [7]. Patients with chronic diseases who come to primary healthcare facilities for treatment are more protected against influenza complications if PHCWs are vaccinated against the virus [8]. It is strongly advised that healthcare institutions implement suitable policies and take measures to promote influenza vaccines among healthcare workers [9]. Still, several nations have less-than-ideal immunization rates among HCWs. Greece had a coverage rate of 40.2% among HCWs during the 2017–2018 flu season [10], England 68.7%, the US 78.4%, and other Eastern Mediterranean nations had a low percentage [13].

Despite the fact that the Saudi Ministry of Health offers a seasonal flu vaccine to all patients and PHCWs at no cost [14], only 55.9% of HCWs got the vaccine during the 2017–2018 season [15]. Researching the factors that encourage and discourage vaccination among PHCWs is crucial for increasing the coverage of seasonal influenza vaccines (SIVs). The most often mentioned reasons for wanting to get the vaccination include wanting to protect oneself or one's family [16], whereas the most generally mentioned reasons against getting the vaccine are having insufficient understanding about it and false beliefs about its efficacy and side effects [17].

Methods

Seasonal influenza posed a significant public health challenge worldwide, with healthcare workers (HCWs) playing a critical role in its prevention and control. In Saudi Arabia (KSA), annual influenza vaccination campaigns targeted HCWs due to their heightened exposure to the virus and their potential to spread it to vulnerable patients. Despite these efforts, vaccine uptake among HCWs remained suboptimal, which appeared to stem from gaps in awareness and knowledge about the vaccine. This systematic review aimed to synthesize existing evidence on the level of

awareness and knowledge regarding the seasonal influenza vaccine among HCWs in KSA, identifying barriers and facilitators to vaccine uptake.

Review Question

What was the level of awareness and knowledge about the seasonal influenza vaccine among healthcare workers in Saudi Arabia, and what factors influenced their understanding and attitudes toward vaccination?

Search Strategy

A comprehensive search was conducted in multiple electronic databases, including PubMed, Scopus, Web of Science, Embase, and Google Scholar. The search included studies published in English from the inception of each database to the present. Grey literature, such as conference proceedings and governmental reports, was also reviewed. Boolean operators, truncations, and filters were applied to refine the search results.

Types of Studies Included

This review included cross-sectional studies, cohort studies, qualitative research, and mixed-method studies that assessed awareness, knowledge, or attitudes toward the seasonal influenza vaccine among HCWs in KSA. Editorials, letters, and studies conducted outside KSA were excluded.

Participants

The review focused on healthcare workers, including physicians, nurses, pharmacists, allied health professionals, and administrative staff working in healthcare facilities in KSA. Studies involving non-HCWs or general populations were excluded.

Search Keywords

The search utilized a combination of keywords and Medical Subject Headings (MeSH) terms, including “seasonal influenza vaccine,” “healthcare workers,” “awareness,” “knowledge,” “Saudi Arabia,” “influenza vaccination,” and “perception.” Boolean operators such as AND, OR, and NOT were used to combine terms.

Study Selection Process

Titles and abstracts retrieved from the initial search were screened independently by two reviewers to assess their relevance to the review question. Full-text articles of potentially eligible studies were obtained and evaluated against the inclusion and exclusion criteria. Discrepancies were resolved through discussion or consultation with a third reviewer.

Outcomes

Primary outcomes included the proportion of HCWs with adequate knowledge and awareness about the influenza vaccine. Secondary outcomes included factors influencing awareness and knowledge, such as demographic characteristics, professional roles, and prior vaccination behavior.

Data Extraction and Coding

A standardized data extraction form was used to collect relevant information, including study characteristics (e.g., author, year, study design), participant demographics, knowledge and awareness levels, and influencing factors. Data were coded based on predefined themes related to the review question.

Data Management

Data were managed using reference management software such as EndNote for organizing citations and screening studies. Extracted data were stored in spreadsheets and analyzed using

narrative synthesis or statistical software, depending on the heterogeneity of the included studies. All steps adhered to the PRISMA guidelines to ensure transparency and reproducibility.

Results

The initial search identified a total of 182 studies from PubMed, Embase, Cochrane Library, and CINAHL. There were 89 articles excluded due to their irrelevance. At the end of identification process, 74 articles were screened. Of these, 32 full-text articles were reviewed, and 12 studies were eligible for inclusion in this systematic review (Figure 1).

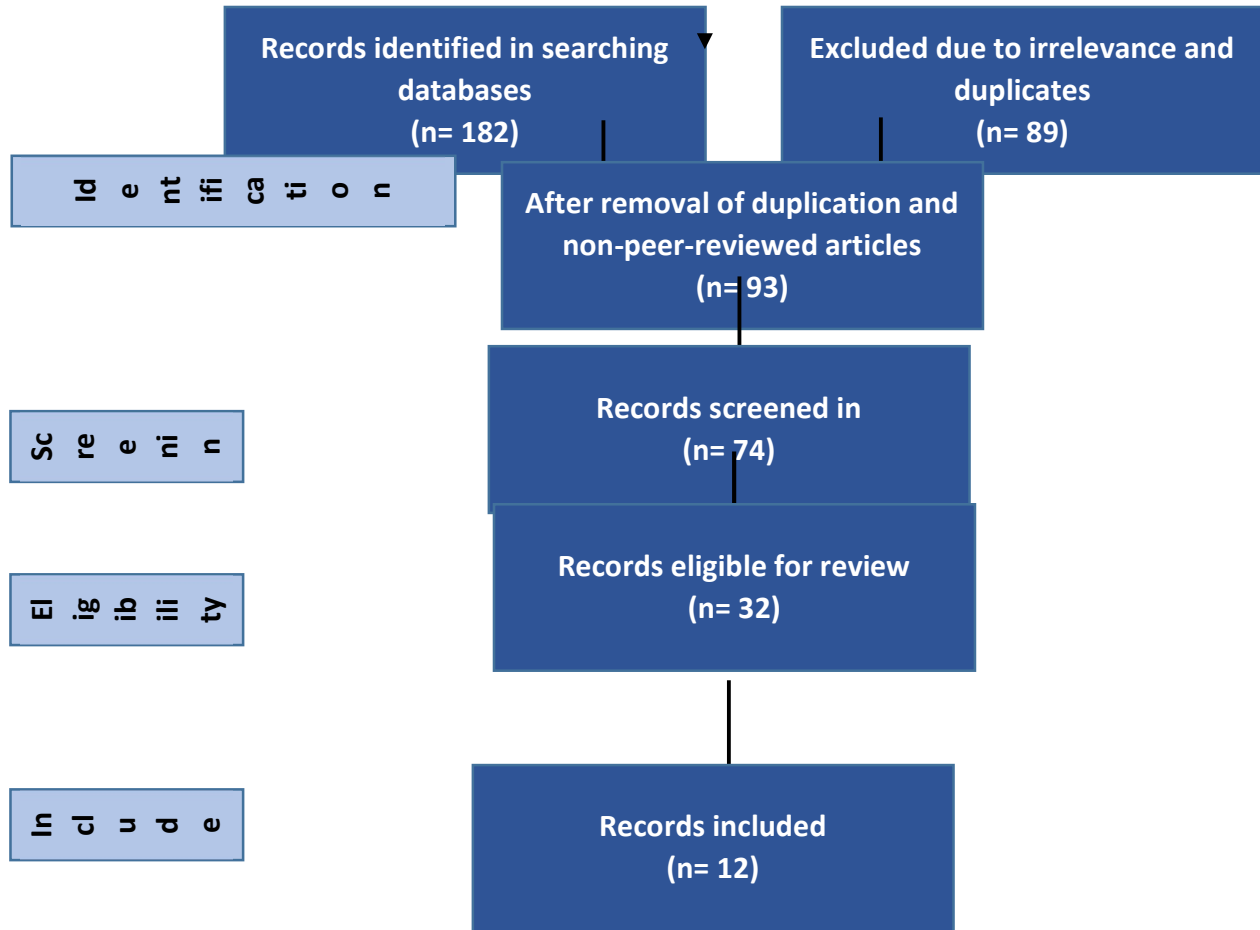


Figure 1: Flow chart of selection process

Table 1 provides an overview of the methodological characteristics of included studies [18-29], highlighting key details of the included studies. The included studies vary in methodological characteristics, demonstrating both similarities and differences across key parameters. Most studies utilized a cross-sectional design, reflecting a preference for this approach in assessing vaccination practices, knowledge, and attitudes among healthcare workers and populations in Saudi Arabia. Sample sizes ranged widely, from as few as 242 participants in Alshammari et al. [29] to 1,273 participants in Almutairi et al. [23], highlighting diversity in study scale. Sampling methods were often unspecified, except in a few cases, such as the use of random sampling by

Alsuhaibani [22] and census sampling by Alsaleem [28]. Questionnaires were the predominant data collection tool, with some studies employing validated instruments, like Alshammari et al. [20] and Alabbad et al. [21], while others relied on self-administered or anonymous formats. In contrast, Al Qahtani et al. [27] diverged from this trend by employing a record-based study design. The studies were conducted in varied settings, including healthcare facilities, hospitals, and primary care centers, reflecting comprehensive coverage of healthcare environments in Saudi Arabia. Despite differences in methodology and scale, the shared focus on vaccination knowledge and practices underscores the common research objective across these studies.

The studies summarized in Table 2 provide a detailed examination of healthcare workers' (HCWs) knowledge, attitudes, practices, and awareness regarding influenza vaccination. While the majority of studies highlight positive attitudes towards vaccination, the uptake remains suboptimal due to various barriers, including misconceptions about vaccine efficacy, safety concerns, and low-risk perceptions.

A consistent theme across the studies is the importance of education and awareness programs to improve vaccine uptake. For example, Rabaan et al. (2020) emphasized addressing concerns about vaccine safety and efficacy, which were significant barriers, and recommended focusing on the influenza risks to increase vaccination levels. Similarly, Alharbi et al. (2021) pointed out that although knowledge and attitudes were generally positive, adherence to vaccination was still hindered by nationality and past vaccination history, suggesting the need for targeted educational campaigns.

In contrast, Almutairi et al. (2024) and Haridi (2017) observed higher vaccine uptake, with Haridi noting that mandatory vaccination policies and awareness programs significantly boosted vaccination rates. However, both studies also highlighted gaps in knowledge and misconceptions, particularly regarding vaccine efficacy and safety. Similarly, Alshammari et al. (2019) reported that misconceptions about vaccine safety and flu symptoms remained substantial barriers despite an improvement in vaccination rates in 2016.

On the other hand, studies like Rehmani & Memon (2010) and Awadalla et al. (2020) identified lower vaccination rates, with Rehmani & Memon emphasizing poor awareness about vaccine effectiveness and recommending educational campaigns targeting HCWs to reduce morbidity and mortality. Awadalla et al. echoed these findings, stressing that knowledge gaps and misconceptions were key barriers to increasing vaccination coverage.

A few studies, such as Alabbad et al. (2018) and Alsuhaibani (2020), showed relatively good knowledge and positive attitudes, with Alabbad noting that trust in the Ministry of Health (MOH) and physicians contributed to high confidence in the vaccine. Alsuhaibani also found that while healthcare workers showed positive attitudes, the perceived low personal risk prevented many from getting vaccinated regularly.

In terms of the main conclusions, there is a consensus on the need for targeted interventions to address specific barriers to vaccination. Al Qahtani et al. (2021) and Alshammari et al. (2014) both underscored the importance of addressing gaps in vaccine knowledge and compliance with guidelines. Almutairi et al. (2024) also noted that despite good knowledge, the vaccine uptake remained low due to barriers such as low-risk perceptions, further reinforcing the need for training, workplace availability, and awareness campaigns.

Table 1: Methodological characteristics of included studies

Author	Year	Region	Setting	Design	Sample Size	Sampling	Scale/Questionnaire
Rabaan et al. [18]	2020	Saudi Arabia	Healthcare facilities	Questionnaire-based	633	Not specified	Self-administered questionnaire
Alharbi et al. [19]	2021	Qassim, Saudi Arabia	Selected hospitals	Cross-sectional	327	Not specified	Self-administered questionnaire
Alshammari et al. [20]	2019	Saudi Arabia	8 major hospitals	Cross-sectional	364	Not specified	Validated questionnaire (31 questions)
Alabbad et al. [21]	2018	Riyadh, Saudi Arabia	King Abdulaziz Medical City	Cross-sectional	300	Not specified	Validated questionnaire
Alsuhaibani [22]	2020	Qassim, Saudi Arabia	Various institutions	Multicenter cross-sectional	523	Random sampling	Validated questionnaire
Almutairi et al. [23]	2024	Saudi Arabia	Ministry of Health facilities	Cross-sectional	1273	Not specified	Self-administered questionnaire
Haridi [24]	2017	Saudi Arabia	King Abdullah Medical City, Makkah	Cross-sectional	447	Convenience sampling	Self-administered anonymous questionnaire covering demographics, vaccine uptake, knowledge, attitudes, etc.
Rehmani & Memon [25]	2010	Saudi Arabia	King Abdul-Aziz Hospital	Cross-sectional	512	Not specified	Anonymous questionnaire assessing vaccination rates, knowledge, attitudes, and beliefs
Awadalla et al. [26]	2020	Southwestern Saudi Arabia	Primary healthcare	Cross-sectional	312	Not specified	Self-administered questionnaire assessing

			centers, Abha				vaccination status, knowledge, motivators, and barriers
Al Qahtani et al. [27]	2021	Saudi Arabia	Prince Sultan Military Medical City, Riyadh	Record-based study	556	Not specified	Data from vaccination database and influenza-like illness screening
Alsaleem [28]	2013	Southwestern Saudi Arabia	Primary healthcare centers, Abha	Cross-sectional	347	Census sampling	Validated self-administered questionnaire covering vaccine intake and associated factors
Alshammari et al. [29]	2014	Saudi Arabia	Six major hospitals	Cross-sectional	242	Convenient sampling	Validated questionnaire covering demographics, attitude, knowledge, current practices, and guideline awareness

Table 2: Results of included studies

Authors	Main Results (Knowledge, Attitude, Practice, Awareness)	Main Conclusion	Notes
Rabaan et al. [18]	Knowledge: No significant effect of education level. Attitude: Vaccine uptake driven by self/family protection. Practice: Uptake increased to 44.1% in 2015. Awareness: Concerns about safety and efficacy prevalent.	Addressing vaccine safety and efficacy concerns and emphasizing influenza risks can improve healthcare workers' vaccination levels.	Data shows variability in uptake by profession; top refusal reason: "vaccine not necessary."
Alharbi et al. [19]	Knowledge: 60.9% good. Attitude: 89% positive; 10.7% negative. Practice: 20.8% never	Good knowledge and positive perceptions, but gaps in adherence remain, with negative perceptions	R-square model showed nationality and previous vaccination history

	vaccinated. Awareness: Complications and vaccine hesitancy linked to nationality and history.	tied to nationality and past vaccination history.	were key predictors for negative perceptions.
Alshammari et al. [20]	Knowledge: 89.6% knew symptoms. Attitude: 84.1% believed vaccine prevents flu. Practice: 67.6% vaccinated. Awareness: Misconceptions about safety and symptoms noted.	Vaccination rates improved in 2016, but misconceptions about safety and flu symptoms remain significant barriers.	Predictors for vaccination: belief in prevention, SCIPV guideline awareness, standing vaccine orders.
Alabbad et al. [21]	Knowledge: 54% knew vaccine lasts 1 year. Attitude: Low hesitancy (17%). Practice: Trusted MOH (97%) and doctors (90%). Awareness: Awareness campaigns and staff were top information sources.	Low hesitancy; confidence in MOH and physicians is high. Awareness campaigns play a significant role in improving vaccine acceptance.	Key refusal reasons: belief that vaccine has no positive effect, unnecessary for healthy individuals, or fear of side effects.
Alsuhaibani [22]	Knowledge: 72.3% believed in vaccine efficacy; 86.6% knew it's annual. Attitude: 70% willing to vaccinate next season. Practice: 48.6% regular vaccination. Awareness: Barriers include "young/healthy" belief.	Suboptimal vaccine coverage; education and easy access are critical to improving uptake, especially for healthcare workers in the influenza season.	Institutions should address barriers like the perception of low personal risk and provide easier access to vaccinations.
Almutairi et al. [23]	Knowledge: 37.1% high; 26.6% moderate. Attitude: 41.2% positive. Practice: 80.2% good practices; 50.8% uptake in 12 months. Awareness: Low-risk perception drives non-uptake.	Despite positive knowledge and attitudes, vaccine uptake remains suboptimal, highlighting the need to bridge the knowledge-behavior gap.	Vaccine uptake influenced by training, workplace availability, and awareness of guidelines; interventions needed to close uptake gaps.
Haridi [24]	Knowledge: Awareness of vaccine guidelines; Attitude: Self-protection and protecting patients; Practice: High vaccine uptake (88.3%) in 2014/15; Awareness:	Good uptake of the influenza vaccine was achieved in the 2014/15 season after mandatory vaccination policy. Awareness programs needed to correct	Focus on education to correct misconceptions and increase awareness in certain HCW groups (e.g.,

	Increased awareness of vaccine.	misconceptions about the vaccine, especially targeting physicians, younger staff, and new recruits.	physicians, younger staff).
Rehmani & Memon [25]	Knowledge: Low knowledge about influenza and vaccination; Attitude: Self-protection is the main motivator; Practice: Low vaccination rate (34.4%); Awareness: Poor awareness about vaccine effectiveness.	Low influenza vaccination coverage among HCWs, with misconceptions prevalent. Educational programs and vaccination campaigns should target different HCW groups to reduce morbidity and mortality.	Emphasizes need for targeted educational campaigns for HCWs to combat misconceptions about vaccine effectiveness.
Awadalla et al. [26]	Knowledge: Inadequate knowledge of SIV and influenza; Attitude: Motivated by awareness of risk; Practice: Suboptimal vaccination coverage (45.5%); Awareness: Gaps in influenza knowledge.	Suboptimal vaccination coverage, with knowledge gaps and misconceptions being key barriers. Awareness and education programs are crucial to increase coverage.	Knowledge gaps and misconceptions about the vaccine contribute to suboptimal coverage. Educational programs focusing on these barriers needed.
Al Qahtani et al. [27]	Knowledge: General knowledge of influenza but varying levels of knowledge across HCWs; Attitude: High motivation to get vaccinated among those who understand vaccine benefits; Practice: 27.3% confirmed vaccination; Awareness: Awareness of vaccine effectiveness.	Influenza vaccine effectiveness was moderate. Vaccine effectiveness varied by strain and HCW characteristics. The study supports quadrivalent vaccines and continued monitoring of HCW vaccination rates.	Highlights the importance of vaccination policies for HCWs and the need for better vaccine effectiveness across different strains.
Alsaleem [28]	Knowledge: Insufficient knowledge about H1N1; Attitude: Personal protection as main motivator; Practice: Low vaccination rate (28.2%); Awareness: Low awareness of vaccine safety.	Low rate of acceptance of H1N1 vaccination and insufficient knowledge about the virus among HCWs. Improved education is needed to increase vaccine uptake, particularly regarding safety and efficacy.	Focuses on the need for improved education regarding the H1N1 vaccine's safety and effectiveness.

Alshammari et al. [29]	Knowledge: Poor knowledge about influenza virus and vaccination; Attitude: Concerns about contracting illness; Practice: Low vaccination rate (38%); Awareness: Lack of awareness of immunization guidelines.	Despite recommendations, vaccination coverage among HCWs remains low. There is a need for education to address misconceptions and improve knowledge of guidelines.	Non-compliance with guidelines and safety concerns were major barriers to vaccination. Educational programs for HCWs are necessary.
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he forest plots for knowledge, attitude, and practice across the studies reveal significant variability. For knowledge, the highest value is 89.6% in Alshammari et al. [20], while the lowest is 37.1% in Almutairi et al. [23]. Regarding attitude, most studies report generally high levels of positive attitude, with the highest being 89% in Alharbi et al. [19]. However, some studies show lower levels of positive attitude, such as 27.3% in Al Qahtani et al. [27]. As for practice, vaccination practices vary considerably, with the highest vaccination rate being 88.3% reported by both Haridi [24] and Almutairi et al. [23]. In contrast, the lowest practice rate is 20.8% in Alharbi et al. [19]. These findings underscore the differences in knowledge, attitude, and practice regarding influenza vaccination among healthcare workers across the studies (Figure 2).

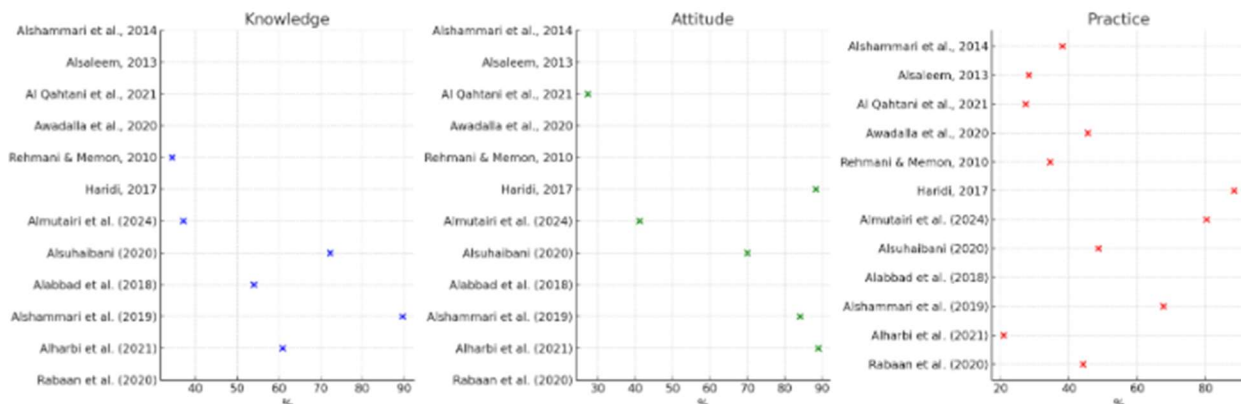


Figure 2: Knowledge, attitude and practice toward influenza vaccine per study

Quality assessment

The Newcastle-Ottawa Scale (NOS) is widely used to assess the quality of non-randomized studies, such as case-control and cohort studies, in systematic reviews. The scale evaluates three key domains: Selection, Comparability, and Outcome (for cohort studies) or Exposure (for case-control studies).

The study by Rabaan et al. [18] focuses on healthcare workers and evaluates their knowledge, attitude, and practice regarding influenza vaccination. In terms of selection, the study involves a broad sample of healthcare workers from various professions. However, the representativeness of the sample is not clearly described, which slightly limits the selection quality. The study does not report on potential biases in the selection process, which is an important aspect for ensuring the generalizability of the results. Regarding comparability, the study does not control for important variables such as age, gender, or occupation, which could have influenced the vaccination uptake rates. In terms of outcome, the measures of knowledge, attitude, and practice are clearly defined,

and the study uses appropriate methods for data collection (surveys and interviews). Overall, this study would score fair on the NOS, with the main limitation being the lack of detailed reporting on the sample's representativeness and the absence of control for confounding variables.

Alharbi et al. [19] conducted a study to assess the knowledge, attitude, and practice of healthcare workers regarding vaccination. The selection process is relatively well-defined, as the study involves healthcare workers, although the representativeness of the sample is not fully detailed. Despite this, the study includes a diverse sample across various professions, which improves the generalizability of the findings. For comparability, the study addresses the role of nationality and prior vaccination history as factors influencing vaccination attitudes, which allows for a more nuanced analysis of potential confounders. This enhances the study's comparability, as these variables are appropriately controlled. The outcome measures are well-defined, and the study uses reliable methods to assess knowledge, attitude, and practice (self-reported surveys). Overall, this study would likely score good on the NOS, with strengths in controlling for confounders and clearly defined outcomes, though it could improve by offering more information on the sample's representativeness.

The study by Alshammari et al. [20] evaluates influenza vaccination among healthcare workers, with a specific focus on knowledge, attitude, and practice. The selection process is robust, as the study involves a large, diverse sample of healthcare workers from multiple professions. The study also provides clear criteria for participant inclusion, though it could have been strengthened by detailing how representative the sample is of the broader healthcare workforce. In terms of comparability, the study takes into account important factors like awareness of guidelines and belief in the effectiveness of vaccination, which are key confounders for vaccination behavior. However, it would benefit from further control over other potential confounders such as personal health history or prior vaccination experiences. For outcome, the study employs well-established methods to assess knowledge, attitude, and vaccination practice. The outcomes are clearly defined, with a detailed analysis of vaccination rates and misconceptions. Overall, the study would likely score good on the NOS, with solid strengths in selection and outcome assessment but some areas for improvement in controlling additional confounders.

Alabbad et al. [21] examine healthcare workers' attitudes and practices regarding the influenza vaccine. The selection of participants is appropriate, as the study includes a variety of healthcare professionals. However, the study does not provide detailed information on how representative the sample is of the larger healthcare workforce, which limits its generalizability. The study's comparability is somewhat limited, as it does not thoroughly explore or control for potential confounders such as healthcare setting or occupation within the healthcare system. The analysis of factors like confidence in medical institutions and physicians is helpful, but more control for variables such as age or previous vaccine experiences would strengthen the comparability. Regarding outcome, the study clearly defines the outcomes of knowledge, attitude, and practice, and the use of surveys is an appropriate method for data collection. While the outcome measures are clear, there is a lack of depth in analyzing why certain factors (like trust in the Ministry of Health) might influence vaccine uptake. The study would likely score fair on the NOS due to its strengths in participant selection and outcome definition, but it falls short in addressing comparability and confounders.

Alsuhaibani [22] assesses healthcare workers' knowledge, attitude, and practice towards influenza vaccination. The selection process is appropriate, involving a diverse sample of healthcare workers, though the study does not clearly describe how representative the sample is of the broader population. This could impact the generalizability of the findings. Regarding comparability, the

study does not explicitly control for confounding variables like prior vaccination history, occupation, or age. While the analysis is robust in assessing barriers to vaccination (e.g., the belief in low personal risk), it could have benefited from a more thorough examination of potential confounders. For outcome, the study defines knowledge, attitude, and practice clearly, and the use of self-reported surveys is appropriate. However, the study could have provided more detailed insights into the reasons behind low vaccination rates despite high levels of knowledge and positive attitudes. Overall, this study would likely score fair on the NOS, with strengths in defining outcomes but limitations in selection and comparability.

Almutairi et al. [23] explore healthcare workers' knowledge, attitude, and practice regarding influenza vaccination. The selection of participants is clear, with a diverse sample of healthcare workers, though the study does not discuss whether the sample is representative of the larger healthcare workforce. This lack of detail impacts the strength of the selection domain. The comparability of the study is moderately strong, as the authors examine factors such as training and availability of vaccines, which may influence vaccine uptake. However, the study could have better controlled for additional confounding factors like age or occupation. The outcome assessment is strong, with clear definitions of knowledge, attitude, and practice. The study uses surveys, which are a reliable method of data collection, but it could have provided more analysis on the barriers to vaccine uptake. Overall, this study would likely score good on the NOS, with strengths in the outcome domain and some weaknesses in selection and comparability.

Haridi [24] evaluates the impact of mandatory vaccination policies on influenza vaccination uptake among healthcare workers. The selection of participants is clear, as it includes healthcare workers, though the study does not provide details on how representative the sample is of the broader healthcare population. This lack of clarity reduces the strength of the selection domain. For comparability, the study is somewhat weak, as it does not control for variables such as healthcare setting or profession, which could influence vaccination rates. The outcome measures are clearly defined, with vaccination rates and attitudes towards vaccination being the primary outcomes. The study uses appropriate methods to collect data, including surveys. However, it could have benefited from more in-depth analysis of factors influencing the effectiveness of the mandatory vaccination policy. Overall, this study would likely score fair on the NOS due to its limited comparability and lack of representativeness in participant selection.

Rehmani and Memon [25] assess healthcare workers' knowledge and attitude towards influenza vaccination. The selection of participants is straightforward, but the study does not provide details on how representative the sample is of the broader healthcare worker population, which limits the strength of the selection domain. In terms of comparability, the study does not address potential confounding variables like profession or prior vaccination history, which are significant factors in vaccine uptake. For outcome, the study defines knowledge, attitude, and vaccination rates clearly, but the reliance on self-reported data could introduce bias. The study concludes that educational interventions are necessary, but it lacks detailed analysis of the reasons behind low vaccination rates. Overall, the study would likely score fair on the NOS due to its limitations in comparability and selection.

Awadalla et al. [26] investigate healthcare workers' knowledge, attitude, and practice regarding influenza vaccination. The selection of participants appears appropriate, but the study lacks clarity on the representativeness of the sample, which affects the selection quality. For comparability, the study does not fully account for confounding variables like prior vaccination history or occupation, which could have influenced the results. The outcome measures are clearly defined, with the use of surveys providing reliable data. However, the study does not explore in-depth the factors

contributing to suboptimal vaccine uptake, and the focus on knowledge gaps and misconceptions could have been expanded. Overall, the study would likely score fair on the NOS, with its strengths in outcome definition but limitations in selection and comparability.

Al Qahtani et al. [27] explore the knowledge, attitude, and practice of healthcare workers regarding influenza vaccination. The selection process is well-defined, with a clear focus on healthcare workers, although it lacks detail on the representativeness of the sample. The comparability is somewhat weak, as the study does not control for important confounding factors like healthcare profession or age. The outcome measures are well-defined, and the study uses appropriate methods to assess knowledge, attitude, and practice. However, the study could have benefited from more detailed analysis of the reasons behind the low vaccination rate (27.3%). Overall, this study would likely score fair on the NOS due to its limited comparability and the lack of information on the representativeness of the sample.

Alsalem [28] evaluates healthcare workers' knowledge, attitude, and practice regarding the H1N1 vaccine. The selection of participants is clear, but the study does not provide sufficient detail on how representative the sample is of the broader healthcare worker population. This lack of clarity affects the selection quality. For comparability, the study does not control for confounders such as prior vaccination history or profession. The outcome measures are clearly defined, with the study using appropriate methods to assess knowledge, attitude, and practice. However, the study could have provided more analysis of the factors contributing to the low vaccination rates despite positive attitudes. Overall, this study would likely score fair on the NOS due to its strengths in outcome definition but limitations in selection and comparability.

Alshammari et al. [29] investigate healthcare workers' knowledge, attitude, and practice regarding influenza vaccination. The selection process is clear, but the study does not provide details on the representativeness of the sample, which limits the quality of the selection. The comparability is somewhat weak, as the study does not address important confounding variables like healthcare profession or previous vaccination history. For outcome, the study defines the measures of knowledge, attitude, and practice clearly, and it uses appropriate methods to collect data. However, the study does not explore in-depth the factors contributing to non-compliance with vaccination guidelines. Overall, this study would likely score fair on the NOS due to its limited comparability and selection.

Discussion

The findings of this review underscore the importance of understanding the various factors that influence healthcare workers' knowledge, attitudes, and practices regarding influenza vaccination. The variability in vaccination rates across studies suggests that while many healthcare workers are knowledgeable about the vaccine's importance, there are still significant gaps in awareness and misconceptions that hinder vaccine uptake. Common barriers identified include concerns about vaccine safety, perceived low personal risk, and a lack of trust in the vaccine's effectiveness. These barriers are compounded by cultural and national differences, which can influence attitudes and willingness to vaccinate. It is essential that healthcare organizations tailor vaccination campaigns to address these concerns, focusing on clear communication, debunking myths, and emphasizing the collective responsibility of healthcare workers in protecting themselves, their patients, and the broader community from influenza.

A systematic review assessed effectiveness of influenza vaccine among healthcare workers found that sixteen studies were included, with a total of 7,971 HWs from nine different nations. There was a combined RR of 0.36 (95% CI: 0.25 to 0.54) for laboratory-confirmed influenza, an incidence of influenza-like illness (ILI) of 0.69 (95% CI: 0.45 to 1.06), an absenteeism rate of 0.63

(95% CI: 0.46 to 0.86), and a -0.18 (95% CI: -0.28 to -0.07) days/person for integrated standardized mean difference of workdays lost. Results from the subgroup analysis showed that across all nations, study populations, and vaccinated age categories, the incidence of laboratory-confirmed influenza drops considerably after vaccination. Vaccinations against influenza have the potential to decrease the number of cases of influenza confirmed by laboratories, as well as absenteeism and missed workdays among healthcare workers. Therefore, it is recommended that healthcare workers (HWs) get more flu shots, since this might be good for businesses and hospitals alike [30].

Worldwide, people are worried about seasonal flu. Globally, an estimated one billion people get influenza each year, with three to five million experiencing severe cases and between 0.29 and 0.65 million succumbing to the virus-related respiratory complications [31, 32]. The risk of influenza infection among health workers (HWs) varies by employment and environment [33], and the dissemination of the virus from infected HWs to the population and nosocomial infections [34, 35] are both enhanced.

The best defense against influenza is a vaccine [36, 37]. Developing and implementing national, seasonal immunization plans for HWs is something that the World Health Organization (WHO) supports, further solidifying the belief that HWs should be vaccinated against influenza as a priority group [37, 38]. Health care workers (HWs), especially those providing direct patient care, are advised by most European nations to get a flu shot annually [39]. Herd immunity has not been achieved because vaccination coverage among HWs is much lower than what is needed, despite recommendations for influenza vaccination of HWs [40]. Although vaccination rates for HWs have risen to 75% in the US [41] and 76.8% in the UK [42], they are still around 30% in a number of other European countries [43] and reached just about 5% in China in 2017 and 2018 [44, 45]. There is a lack of vaccination among HWs for a variety of reasons, including as fear of side effects, doubts about the efficacy of vaccines, ignorance of recommended vaccination schedules, and the false belief that influenza is not a dangerous illness [46, 47].

If we want health workers to have faith in influenza vaccines and for vaccination policies to be rationally developed in the future, we need evidence that these vaccines work [48, 49]. The efficacy of the influenza vaccination in HWs has previously been assessed in many reviews, however these studies have had their drawbacks. In a systematic review, for instance, Ng et al. looked at the effects of seasonal vaccines among HWs using data from just three RCTs; they found no evidence that getting the flu shot lowers the risk of influenza, the frequency of influenza-like illness (ILI) episodes, the number of days a person is sick with ILI, or the amount of sick days taken [50]. A qualitative study devoid of quantitative findings was the subject of an additional examination [51]. The effects on HWs were not included in previous evaluations that looked at patient morbidity and death rates [52, 53].

The quality assessment of the studies highlights the need for stronger research designs to obtain more reliable and generalizable results. Many studies relied on cross-sectional designs, which limit the ability to draw conclusions about causality and long-term trends. Furthermore, issues such as sample selection bias and inconsistent outcome measurement methods were prevalent across the studies, which could affect the validity of the findings. Future research should prioritize longitudinal studies with robust sampling strategies, ensuring a representative sample of healthcare workers from diverse settings. Additionally, improving the methodological rigor of studies, particularly in terms of standardized data collection tools and clearer outcome definitions, would enhance the ability to make informed recommendations for policy and practice. By addressing

these methodological challenges, future studies can provide more definitive insights into the factors that influence vaccination rates and the effectiveness of intervention strategies.

Conclusion

The studies reviewed highlight significant variability in the knowledge, attitude, and vaccination practices regarding influenza vaccination among healthcare workers. Knowledge levels were diverse, with some studies indicating a high understanding of vaccine efficacy and safety, while others showed lower levels of awareness. Attitudes towards vaccination were generally positive in most studies, though some reported lower levels of enthusiasm or reluctance, often linked to misconceptions or concerns about vaccine safety. Vaccination practices also showed considerable variation, with some studies reflecting high vaccination rates among healthcare workers, while others reported significantly lower uptake. These differences underscore the need to address barriers such as misconceptions, lack of awareness, and logistical challenges to improve vaccination rates.

Quality assessments of the studies reveal a moderate to high risk of bias, particularly in terms of sample selection and outcome measurement. Many studies lacked clarity in how participants were chosen, which could affect the generalizability of the results. Additionally, the cross-sectional design of most studies limits the ability to draw causal conclusions. Despite these limitations, the studies provide valuable insights into the factors influencing vaccination rates among healthcare workers. To improve future vaccination uptake, it is crucial to focus on enhancing educational efforts, improving access to vaccines, and addressing concerns about vaccine safety. Future research should aim for stronger methodological designs, better representation of diverse populations, and greater control over potential confounding factors.

References

1. Jorgensen P, Mereckiene J, Cotter S, Johansen K, Tsoлова S, Brown C.. How close are countries of the WHO European Region to achieving the goal of vaccinating 75% of key risk groups against influenza? Results from national surveys on seasonal influenza vaccination programmes, 2008/2009 to 2014/2015. *Vaccine*. 2018;36:442–52.
2. Reed C, Chaves SS, Daily Kirley P, Emerson R, Aragon D, Hancock EB, Butler L, Baumbach J, Hollick G, Bennett NM, et al. Estimating influenza disease burden from population-based surveillance data in the United States. *PLoS One*. 2015;10:e0118369.
3. Van Cauteren D, Vaux S, de Valk H, Le Strat Y, Vaillant V, Lévy-Bruhl D. Burden of influenza, healthcare seeking behaviour and hygiene measures during the A (H1N1) 2009 pandemic in France: a population based study. *BMC Public Health*. 2012;12:947.
4. Kuster SP, Shah PS, Coleman BL, Lam -P-P, Tong A, Wormsbecker A, McGeer A, Sambhara S. Incidence of influenza in healthy adults and healthcare workers: A systematic review and meta-analysis. *PLoS One*. 2011;6:e26239.
5. Music T. Protecting patients, protecting healthcare workers: a review of the role of influenza vaccination. *Int Nurs Rev*. 2012;59:161–67.
6. Hayward AC. Influenza vaccination of healthcare workers is an important approach for reducing transmission of influenza from staff to vulnerable patients. *PLoS One*. 2017;12:e0169023.
7. Frank E, Breyan J, Elon L. Physician disclosure of healthy personal behaviors improves credibility and ability to motivate. *Arch Fam Med*. 2000;9:287–89.
8. Çiftci F, Şen E, Demir N, Çiftci O, Erol S, Kayacan O. Beliefs, attitudes, and activities of healthcare personnel about influenza and pneumococcal vaccines. *Hum Vaccin Immunother*. 2018;14:111–17.

9. Nessler K, Krztoń-Królewiecka A, Chmielowiec T, Jarczewska D, Windak A. Determinants of influenza vaccination coverage rates among primary care patients in Krakow, Poland and the surrounding region. *Vaccine*. 2014;32:7122–27.
10. Maltezou HC, Katerelos P, Protopappa K, Dounias G. Seasonal influenza vaccination in healthcare personnel in Greece: 3-year report. *Future Microbiol*. 2019;14:55–58.
11. Stead M, Critchlow N, Patel R, MacKintosh AM, Sullivan F. Improving uptake of seasonal influenza vaccination by healthcare workers: implementation differences between higher and lower uptake NHS trusts in England. *Infect Dis Health*. 2019;24:3–12.
12. Black CL, Yue X, Ball SW, Fink RV, de Perio MA, Laney AS, Williams WW, Graitcer SB, Fiebelkorn AP, Lu P-J, et al. Influenza vaccination coverage among health care personnel—United States, 2017–18 influenza season. *MMWR Morb Mortal Wkly Rep*. 2018; 67:1050.
13. Abubakar A, Melhem N, Malik M, Dbaibo G, Khan WM, Zaraket H. Seasonal influenza vaccination policies in the Eastern Mediterranean Region: current status and the way forward. *Vaccine*. 2019;37:1601–07.
14. Rehmani R, Memon JI. Knowledge, attitudes and beliefs regarding influenza vaccination among healthcare workers in a Saudi hospital. *Vaccine*. 2010;28:4283–87.
15. Reda Alenazi B, Mohamed Hammad S, Elwan Mohamed A. Prevalence of seasonal influenza vaccination among primary healthcare workers in Arar city, Saudi Arabia. *Electronic Physician*. 2018;10:7217–23.
16. Boey L, Bral C, Roelants M, De Schryver A, Godderis L, Hoppenbrouwers K, Vandermeulen C. Attitudes, beliefs, determinants and organisational barriers behind the low seasonal influenza vaccination uptake in healthcare workers – A cross-sectional survey. *Vaccine*. 2018;36:3351–58.
17. Bali NK, Ashraf M, Ahmad F, Khan UH, Widdowson M-A, Lal RB, Koul PA. Knowledge, attitude, and practices about the seasonal influenza vaccination among healthcare workers in Srinagar, India. *Influenza Other Respi Viruses*. 2013;7:540–45.
18. Rabaan AA, Wyse R, Al-Tawfiq JA, Alahmed SH, Aljeldah MM, Bazzi AM, Asseri AM, Binjomah AZ, Haque S. Influenza vaccine acceptance by healthcare workers in Saudi Arabia: A questionnaire-based analysis. *Infez Med*. 2020 Mar 1;28(1):70-.
19. Alharbi N, Almutiri A, Alotaibi F, Ismail A. Knowledge and healthcare professionals' perceptions of influenza vaccination in the Qassim region, Saudi Arabia (2019-2020). *Human Vaccines & Immunotherapeutics*. 2021 May 4;17(5):1426-31.
20. Alshammari TM, Yusuff KB, Aziz MM, Subaie GM. Healthcare professionals' knowledge, attitude and acceptance of influenza vaccination in Saudi Arabia: a multicenter cross-sectional study. *BMC health services research*. 2019 Dec;19:1-0.
21. Alabbad AA, Alsaad AK, Al Shaalan MA, Alola S, Albanyan EA. Prevalence of influenza vaccine hesitancy at a tertiary care hospital in Riyadh, Saudi Arabia. *Journal of infection and public health*. 2018 Jul 1;11(4):491-9.
22. Alsuhaibani M. Barriers and beliefs among health-care workers regarding seasonal influenza vaccine in Al-Qassim region, Saudi Arabia. *Human Vaccines & Immunotherapeutics*. 2020 Feb 1;16(2):313-20.
23. Almutairi LM, Almusawi MA, Albalawi AM, Hassan MY, Alotaibi AF, Almutairi TM, Alalweet RM, Asiri AM. Knowledge, Attitudes, and Practices Regarding Influenza Vaccination Among Healthcare Workers in Saudi Arabia: A Cross-sectional Study. *Journal of Preventive Medicine and Public Health*. 2024 Nov 8;57(6):586.

24. Haridi HK, Salman KA, Basaif EA, Al-Skaibi DK. Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. *Journal of Hospital Infection*. 2017 Jul 1;96(3):268-75.
25. Rehmani R, Memon JI. Knowledge, attitudes and beliefs regarding influenza vaccination among healthcare workers in a Saudi hospital. *Vaccine*. 2010 Jun 11;28(26):4283-7.
26. Awadalla NJ, Al-Musa HM, Al-Musa KM, Asiri AM, Albariqi AA, Majrashi HM, Alasim AA, Almuslah AS, Alshehri TK, AlFlan MA, Mahfouz AA. Seasonal influenza vaccination among primary health care workers in Southwestern Saudi Arabia. *Human vaccines & immunotherapeutics*. 2020 Feb 1;16(2):321-6.
27. Al Qahtani AA, Selim M, Hamouda NH, Al Delamy AL, Macadangdang C, Al Shammari KH, Al Shamary SF. Seasonal influenza vaccine effectiveness among health-care workers in Prince Sultan Military Medical City, Riyadh, KSA, 2018–2019. *Human vaccines & immunotherapeutics*. 2021 Jan 2;17(1):119-23.
28. Alsaleem MA. Acceptance of H1N1 vaccine among healthcare workers at primary healthcare centres in Abha, KSA. *The Journal Of The Egyptian Public Health Association*. 2013 Apr 1;88(1):32-9.
29. Alshammari TM, AlFehaid LS, AlFraih JK, Aljadhey HS. Health care professionals' awareness of, knowledge about and attitude to influenza vaccination. *Vaccine*. 2014 Oct 14;32(45):5957-61.
30. Li T, Qi X, Li Q, Tang W, Su K, Jia M, Yang W, Xia Y, Xiong Y, Qi L, Feng L. A systematic review and meta-analysis of seasonal influenza vaccination of health workers. *Vaccines*. 2021 Sep 29;9(10):1104.
31. Iuliano, A.D.; Roguski, K.M.; Chang, H.H.; Muscatello, D.J.; Palekar, R.; Tempia, S.; Cohen, C.; Gran, J.M.; Schanzer, D.; Cowling, B.J.; et al. Estimates of global seasonal influenza-associated respiratory mortality: A modelling study. *Lancet* 2018, 391, 1285–1300.
32. Paget, J.; Spreeuwenberg, P.; Charu, V.; Taylor, R.J.; Iuliano, A.D.; Bresee, J.; Simonsen, L.; Viboud, C. Global mortality associated with seasonal influenza epidemics: New burden estimates and predictors from the GLaMOR Project. *J. Glob. Health* 2019, 9, 020421.
33. Lietz, J.; Westermann, C.; Nienhaus, A.; Schablon, A. The Occupational Risk of Influenza A (H1N1) Infection among Healthcare Personnel during the 2009 Pandemic: A Systematic Review and Meta-Analysis of Observational Studies. *PLoS ONE* 2016, 11, e0162061.
34. Srinivasan, A.; Perl, T.M. Respiratory protection against influenza. *JAMA* 2009, 302, 1903–1904.
35. Kuster, S.P.; Shah, P.S.; Coleman, B.L.; Lam, P.P.; Tong, A.; Wormsbecker, A.; McGeer, A. Incidence of influenza in healthy adults and healthcare workers: A systematic review and meta-analysis. *PLoS ONE* 2011, 6, e26239.
36. Durando, P.; Alicino, C.A.-O.; Dini, G.; Barberis, I.; Bagnasco, A.M.; Iudici, R.; Zanini, M.; Martini, M.; Toletone, A.; Paganino, C.; et al. Determinants of adherence to seasonal influenza vaccination among healthcare workers from an Italian region: Results from a cross-sectional study. *BMJ Open* 2016, 6, e010779.
37. World Health Organization. Global Influenza Strategy 2019–2030. Available online: <https://apps.who.int/iris/handle/10665/311184> (accessed on 14 Dec 2024).
38. World Health Organization. Vaccines against influenza WHO position paper—November 2012. *Wkly. Epidemiol. Rec.* 2012, 87, 461–476.

39. Maltezou, H.C.; Botelho-Nevers, E.; Brantsaeter, A.B.; Carlsson, R.M.; Heininger, U.; Hubschen, J.M.; Josefsdottir, K.S.; Kassianos, G.; Kyncl, J.; Ledda, C.; et al. Vaccination of healthcare personnel in Europe: Update to current policies. *Vaccine* 2019, 37, 7576–7584.
40. Dini, G.; Toletone, A.; Sticchi, L.; Orsi, A.; Bragazzi, N.L.; Durando, P. Influenza vaccination in healthcare workers: A comprehensive critical appraisal of the literature. *Hum. Vaccin. Immunother.* 2018, 14, 772–789.
41. Black, C.L.; Yue, X.; Ball, S.W.; Fink, R.V.; de Perio, M.A.; Laney, A.S.; Williams, W.W.; Graitcer, S.B.; Fiebelkorn, A.P.; Lu, P.J.; et al. Influenza Vaccination Coverage Among Health Care Personnel—United States, 2017–2018 Influenza Season. *Morb. Mortal. Wkly. Rep.* 2018, 67, 1050–1054.
42. Public Health England. Seasonal flu Vaccine Uptake in Healthcare Workers: Monthly Data, 2020 to 2021. Available online: <https://www.gov.uk/government/statistics/seasonal-flu-vaccine-uptake-in-healthcare-workers-monthly-data-2020-to-2021>. (accessed on 14 Dec 2024).
43. To, K.W.; Lai, A.; Lee, K.C.; Koh, D.; Lee, S.S. Increasing the coverage of influenza vaccination in healthcare workers: Review of challenges and solutions. *J. Hosp. Infect.* 2016, 94, 133–142.
44. Yu, J.; Ren, X.; Ye, C.; Tian, K.; Feng, L.; Song, Y.; Cowling, B.J.; Li, Z. Influenza Vaccination Coverage among Registered Nurses in China during 2017–2018: An Internet Panel Survey. *Vaccines* 2019, 7, 134.
45. Song, Y.; Zhang, T.; Chen, L.; Yi, B.; Hao, X.; Zhou, S.; Zhang, R.; Greene, C. Increasing seasonal influenza vaccination among high risk groups in China: Do community healthcare workers have a role to play? *Vaccine* 2017, 35, 4060–4063.
46. Vasilevska, M.; Ku, J.; Fisman, D.N. Factors associated with healthcare worker acceptance of vaccination: A systematic review and meta-analysis. *Infect. Control Hosp. Epidemiol.* 2014, 35, 699–708.
47. Haridi, H.K.; Salman, K.A.; Basaif, E.A.; Al-Skaibi, D.K. Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. *J. Hosp. Infect.* 2017, 96, 268–275.
48. Cherian, T.; Morales, K.F.; Mantel, C.; Lambach, P.; Independent Expert Advisory Group for Health Worker Influenza Vaccination. Factors and considerations for establishing and improving seasonal influenza vaccination of health workers: Report from a WHO meeting, January 16–17, Berlin, Germany. *Vaccine* 2019, 37, 6255–6261.
49. Pereira, M.; Williams, S.; Restricker, L.; Cullinan, P.; Hopkinson, N.S. Healthcare worker influenza vaccination and sickness absence—An ecological study. *Clin. Med.* 2017, 17, 484–489.
50. Ng, A.N.M.; Lai, C.K.Y. Effectiveness of seasonal influenza vaccination in healthcare workers: A systematic review. *J. Hosp. Infect.* 2011, 79, 279–286.
51. 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, 732.
52. Lemaitre, M.; Meret, T.; Rothan-Tondeur, M.; Belmin, J.; Lejonec, J.L.; Luquel, L.; Piette, F.; Salom, M.; Verny, M.; Vetel, J.M.; et al. Effect of influenza vaccination of nursing home staff on mortality of residents: A cluster-randomized trial. *J. Am. Geriatr. Soc.* 2009, 57, 1580–1586.
53. Burls, A.; Jordan, R.; Barton, P.; Olowokure, B.; Wake, B.; Albon, E.; Hawker, J. 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, 4212–4221.