Impact of COVID-19 pandemic on health workers sentiment towards influenza vaccination: A literature review

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ABSTRACT

INTRODUCTION The COVID-19 era highlighted vaccine hesitancy (VH) among health workers (HWs) as a major hurdle to optimum immunization practices. Through the identification of relevant determinants, barriers, and interventions to counteract VH, this literature review examines the impact of the COVID-19 pandemic on HWs' influenza vaccination sentiment.

METHODS Studies were identified by searching the PubMed database for articles published between August 2019 and July 2022. The search was restricted to articles in English that were original studies or meta-analyses or reviews. They were included in the review if they covered influenza VH among HWs during the COVID-19 pandemic. Inductive content analysis was used to identify themes that illustrate facilitators, barriers, and consideration. Risk of bias was not assessed.

RESULTS Of 924 articles identified, 20 were selected. Of these, 15 were conducted in Europe and focused on healthcare staff, primarily in hospital settings. Within the COVID-19 context, physicians and residents were more willing than nurses to adhere to influenza vaccination. Young HWs, particularly males and those with chronic comorbidities, demonstrated the highest acceptance of the influenza vaccine. HWs' immunization history is associated with higher influenza vaccine adherence. Factors determining HW's acceptance of flu immunization were: healthcare staff's knowledge of the influenza vaccine, concerns about protecting themselves or others, and the rising perception of risk and fear from COVID-19 infection. Main barriers were negative perceptions about vaccine safety and effectiveness, insufficient time for vaccine uptake, and confidence in natural or acquired immunity. In the context of the pandemic, awareness campaigns and targeting vaccine affordability and accessibility were the most adopted interventions to increase vaccine acceptance amongst HWs.

CONCLUSIONS In the context of COVID-19, confidence in influenza vaccines and the perception of risk from COVID-19 infection have increased among healthcare staff. To further explore the impact of the pandemic on HWs' sentiment toward influenza vaccination, conducting new empirical studies are strongly recommended.

INTRODUCTION

Immunization of health workers (HWs) has become a top priority during the COVID-19 pandemic. According to the Centers for Disease Control and Prevention (CDC), 'reducing the risk of patients catching influenza from health professionals, protecting healthcare staff and their families against influenza, and reducing health professionals' absenteeism and consequently costs on the National Health Service', are key reasons for the cost-effectiveness of influenza vaccination strategies among HWs[1]. Although the burden of influenza illnesses had declined in the COVID-19 era, the CDC reported that '9 million sick people, 4 million visits to a healthcare provider, 100000 hospitalizations, and 5000 deaths' were attributed to influenza during the 2021–2022 season[2]. Throughout the COVID-19 pandemic, influenza vaccination coverage showed remarkable variation across nations (90% vs 24% in the US and Portugal, respectively)[1]. Therefore, it is plausible that vaccine hesitancy (VH) among

HWs is one of the major hurdles to optimum immunization practices.

Despite the awareness amongst health professionals of the importance of immunization against infectious diseases, there are an array of factors and barriers to influenza vaccine uptake[1,3]. Vaccine hesitancy (VH) is defined here as 'delay in acceptance or refusal of vaccines despite availability of vaccination services', and exists on a continuous spectrum between complete refusal and complete acceptance[3].This article investigates the impact of the COVID-19 pandemic on the sentiment of influenza vaccination among HWs. To do so, various determinants, barriers and interventions pertaining to vaccine hesitancy are identified. This scoping review is part of a broad project exploring vaccine hesitancy among health workers run by the World Federation of Public Health Associations (WFPHA)[4].

METHODS

The aim of this scoping review was to examine the impact of the COVID-19 pandemic on HWs' influenza vaccination sentiment. To do so, a literature search was conducted using the PubMed database, adopting a Boolean search strategy with the pertinent MeSH terms and keywords. These terms are provided in the Supplementary file Table 1. The search was restricted to articles in English that were original studies or meta-analyses or reviews, and published between August 2019 and July 2022. A PRISMA flow chart depicting the screening and selection process is shown in Figure 1.

Inclusion criteria were: articles had to focus on determinants, barriers or interventions for influenza vaccine hesitancy among health workers (HWs), during the COVID-19 pandemic. The studied population in the included articles was health workers, mainly in hospital settings.

Articles were excluded if: 1) they focused on the general population (or specific subgroups such as pregnant women) but listed HWs as a demographic characteristic, or exclusively focused on medical students; and 2) they were letters, correspondences, or editorials.

Abstracts and potentially relevant full texts for influenza studies were reviewed independently by two authors (RM, FG), with any conflicts resolved by consensus with the third author (ML).

RESULTS

Of the 924 articles screened, 20 studies met the inclusion criteria and were the final sample. Most studies were conducted in Europe (n=15). The majority were in Italy (n=7), followed by Poland (n=2), with Germany, Spain, Greece, Ireland, Cyprus, and Czech Republic one article each. Outside Europe, there was one study each from Iran, China, Lebanon, the United States and Saudi Arabia. There were 13 cross-sectional, 3 retrospective, 1 prospective, 1 prospective and retrospective, 1 comparative descriptive, and 1 predictive. Full details of the included articles are given in Table 1.

We analyzed a wide array of determinants, factors, barriers, and interventions for influenza vaccinations that were raised during the COVID-19 pandemic. Table 2 summarizes these for each country included in the review.

Determinants of vaccine hesitancy

Evidence suggests the determinants of vaccine hesitancy among healthcare staff include age, gender, comorbidities, and profession cadres, in addition to vaccination history.

Figure 1. PRISMA flow chart depicting the screening and selection process

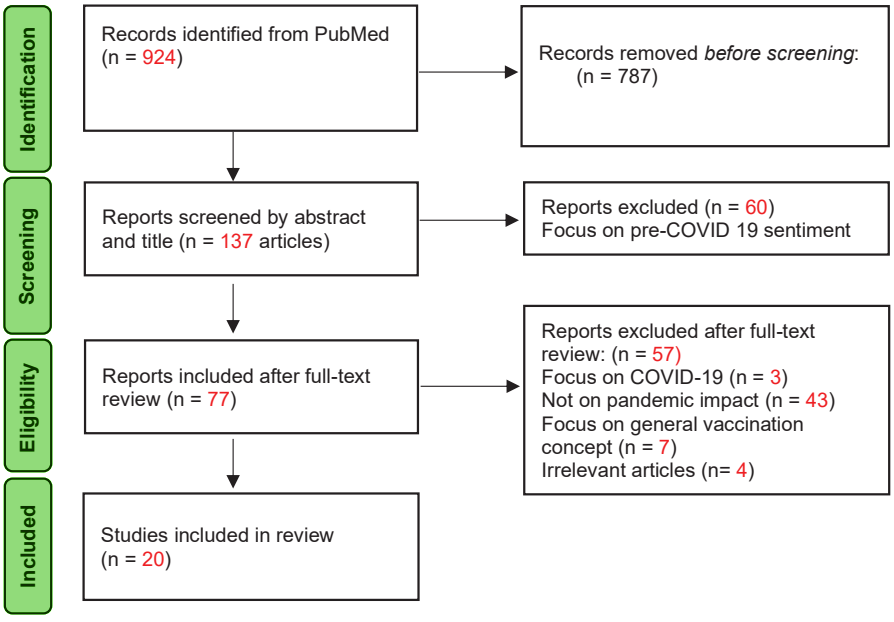

Table 1. Details of the included studies

Authors Year	Country	Study design	Sample profession	Influenza season	Influenza vaccination rates during COVID-19 pandemic
Alharbi et al.[19] 2021	Saudi Arabia	Cross-sectional	Physicians, pharmacists, nurses	2019–2020	48.6% of participating HWs demonstrated adherence to seasonal influenza vaccination while almost 20.8% 'never been previously vaccinated'.
Bertoni et al.[6] 2022	Italy	Retrospective	Health personnel, administrative staff, technicians	2018–2019 2019–2020 2020–2021	Coinciding with the COVID-19 pandemic, the 2020–2021 season had the highest coverage (53.8%) of flu vaccine uptake, where males were two times and physicians were three times more likely to adhere to flu vaccination than their counterparts. This entails a 28.1% rise in 2020–2021 in comparison to the 2018–2019 season with health personnel (+36.1%) and technicians (+23.0%) showing the highest rise, unlike the administrative staff who showed a slight decline (-0.9% in 2020–2021 vs 42.4% in 2018–2019). For pharmacist and physician cadres, influenza immunization rates were stable throughout 2019 and 2020.
Collatuzzo et al.[21] 2021	Italy	Retrospective	HWs	2020–2021 2019–2020	The COVID-19 vaccine hesitancy resulted in a higher 'reporting of potentially adverse conditions (quantitative evidence of hesitancy of HWs) in the 2020–2021 flu campaign compared to the 2019–2020 one', particularly among females and those aged 36–50 years 'reported more often allergies'.
Costantino et al.[11] 2020	Italy	Cross-sectional	HWs	2019–2020	In the 2019–2020 season, protecting patients was the chief reason for adherence to flu immunization among Sicilian HWs. The higher vaccination rates among younger HWs such as residents and trainees were attributed to high levels of awareness and confidence in influenza vaccine. The most significant reason reported was the fear of influenza vaccine-induced complications. Interestingly, positive perception and attitudes towards influenza vaccination among young health staff has influenced rise in older HWs' flu vaccine uptake.
Di Giuseppe et al.[10] 2021	Italy	Cross-sectional	HWs	2020	Influenza vaccine acceptance has increased during the COVID-19 pandemic where almost all (95%) and half (45.8%) of HWs who have been previously and never been vaccinated, respectively, reported willingness for influenza vaccine uptake in 2020–2021 season.
Di Pumpo et al.[24] 2021	Italy	Predictive	Doctors, nursing staff, other healthcare workers, medical residents, administrative staff	2019–2020 2020–2021	The COVID-19 pandemic had a remarkable incentivizing effect increasing flu vaccine uptake (54.46%) among HWs during the 2020–2021 campaign.

Continued

Table 1. Continued

Authors Year	Country	Study design	Sample profession	Influenza season	Influenza vaccination rates during COVID-19 pandemic
Grochowska et al.[8] 2021	Poland	Cross-sectional	Doctors, nurses, medical students, and other allied health professionals	14 Sept. 2020 5 Nov. 2020	62.5% of HWs had higher trust rates in flu vaccines than in the COVID-19 one. However, 83.3% of HWs revealing willingness for flu vaccination (61.6%) also showed inclination towards COVID-19 vaccinations. Notably, acceptance towards flu immunization has doubled during 2020–2021 in comparison to 2019–2020 (61.6% vs 32.9%). On the other hand, 68.7% and 3.1% of participating HWs demonstrated willingness and complete refusal towards COVID-19 vaccine, respectively. Also, in comparison to non-HWs, the health staff are more accepting to COVID-19 vaccine.
Hajiabdolbaghi et al.[23] 2021	Iran	Cross-sectional	HWs	2019	The 'influenza mean vaccination coverage was 29.4%' with difference in acceptance between males and females (35.85% vs 27.31%).
Jedrzejek and Mastalerz-Migas[9] 2022	Poland	Cross-sectional	HWs	2018–2019 2019–2020	Flu vaccination coverage among both nurses (+7%) and physicians (+15.3%) had increased in the 2019–2020 season with a +13.3% rise in the overall vaccination coverage.
Kearns et al.[18] 2022	Ireland	Cross-sectional	HWs, health administration	2020–2021	In 2020, 40% of the unvaccinated HWs at the 2019 flu campaign stated that the pandemic has positively shaped their attitude towards flu vaccines. Additionally, 94% of HWs plan to get a flu injection in 2020 in comparison to 78% of HWs vaccinated in 2019. The COVID-19 pandemic has boosted the adherence to influenza vaccine (28% and 27% agreed and strongly agreed, respectively, to receive flu vaccine 'in light of COVID-19').
Landwehr et al.[13] 2021	United States	Comparative, Descriptive	Onsite employer-based health clinic	2019–20	69% of participating HCs took influenza vaccination during the 2019–2020 flu season with a recognizable rise in vaccine adherence in comparison to the previous season of 2018–2019 (45% vs 37%).
Papageorgiou et al.[15] 2022	Cyprus	Cross-sectional	Private or public sector, either in primary or secondary health care services	2019–20	Influenza immunization coverage was 31.8% where the COVID-19 pandemic had an influential effect on 54.8%. The immunization rates were highest at 'hospital Pediatric wards and ICUs' (43.8% and 38.2%, respectively).
Perrone et al.[7] 2021	Italy	Prospective	HWs	2020	Awareness campaigns assisted in boosting influenza vaccine coverage among HWs (43.1% vs 21.5% in 2020 and 2019, respectively). Such campaigns covered the impact of vaccination to minimize health staff 'absenteeism and disruption of health services, as well as in-hospital influenza outbreaks'. Physicians (mainly residents, ICU, and newborn health staff) and administrative staff embodied the most vaccinated cadre and surged immunization rates (308.3%), respectively.

Continued

Table 1. Continued

Authors Year	Country	Study design	Sample profession	Influenza season	Influenza vaccination rates during COVID-19 pandemic
Rachiotis et al.[17] 2021	Greece	Cross-sectional	Physicians, dentists, pharmacists	2020–2021	There was an enhancement in HWs' flu vaccination rates (74%) mainly among physicians with the 'acceptance of COVID-19 vaccination was the only predictor of influenza vaccination coverage'.
Redondo Marguello et al.[14] 2022	Spain	Cross-sectional	General practitioners (GPs), primary care nurses	2020	The COVID-19 pandemic had surged the HWs' awareness on immunization necessity where physicians and nurses showed 'interest in' getting 'a range of internal and external information sources' as well as attending 'congresses, seminars or training activities of scientific societies', respectively. Notably, previous flu vaccine adherence was high in the 2019 influenza campaign (78% of GPs and 85% of nurses).
Scardina et al.[5] 2021	Italy	Retrospective	HWs	2018–2019 2019–2020 2020–2021	The COVID-19 pandemic has increased the positive HWs' attitude (70.97%) towards flu vaccine given the fear from 'co-circulation of influenza viruses and SARS-CoV-2' where in 2020–2021, there was +230.6% (39.3%) rise in HWs' flu vaccine coverage in comparison to 10.2% and 11.9% in 2018–2019 and 2019–2020 seasons, respectively. Notably, 10.6% of the participating HWs had higher acceptance rates towards influenza vaccine than COVID-19 one.
Stepanek et al.[12] 2021	Czech Republic	Cross-sectional	HWs	2019–2020 COVID-19 era	57.9% of HWs had their first influenza vaccine injection during the COVID-19 pandemic when immunization demand was higher among physicians. And, the fear of mutual infection of flu and COVID-19 represented a strong driving factor.
Stockeler et al.[22] 2021	Germany	Prospective and Retrospective	Emergency department personnel	2016–2017 2020–2021	In Germany, the 2020–2021 season was associated with higher vaccination adherence among emergency department personnel. Additionally, flu vaccine uptake was higher with the following factors: on-site vaccination, previous history of influenza vaccination adherence (at least twice), being a physician or a medical student in addition to acceptance towards COVID-19 vaccine. Interestingly, 'self-reported vaccination coverage' was almost doubled between 2016–2017 and 2020–2021 seasons (31% vs 59%).
Yi et al.[16] 2021	China	Cross-sectional	HWs	2019–2020	In China, 67% was the flu vaccination coverage in the 2019–2020 season where 38.1%, 30.2%, 21.1%, 10.1% of which had 'direct free' immunization, workplace refund following vaccine uptake, self-funded and 'health insurance reimbursement', respectively. Accordingly, providing free vaccination was associated with higher HWs' adherence towards flu vaccination (79% vs 34%). Also, mandatory (80%) and incentivized vaccination (70 %) had higher coverage than in workplaces 'without any intervention measures (39%).

Continued

Table 1. Continued

Authors Year	Country	Study design	Sample profession	Influenza season	Influenza vaccination rates during COVID-19 pandemic
Youssef et al.[20] 2022	Lebanon	Cross-sectional	HWs	2019–2020 2020–2021	HWs showed high awareness (77%) along with high and moderate perception levels on the benefits of flu vaccination. Knowledge on vaccine's safety made HWs 3.305 times more acceptable to get vaccinated than their counterparts. Boosting patients' safety was the Lebanese HWs' main perceived benefits for flu immunization (86.43%). However, safety doubts on flu immunization prevented 18.21% of Lebanese health staff from getting vaccinated. Additionally, 85.6% and 63.3% of Lebanese HWs showed concerns over governmental funding on vaccines believing that it should be offered for free besides concerns on a potential biased vaccine policy favoring the profit of drug companies, respectively. Eventually, 9.1% and 12.8% of Lebanese HWs revealed concerns on immune system overload and potential allergies, respectively.

HWs: health workers.

Age and gender

Evidence from Italy[5-7], and Poland[8] suggests the COVID-19 pandemic has positively influenced young HWs uptake of influenza vaccine. Italians aged <30 years showed an increased vaccination likelihood in 2019–2020[5] and Polish HWs aged 31–40 years had an increased immunization willingness in 2020–2021[8]. This could be attributed to awareness campaigns, as well as the rising knowledge regarding the importance of influenza vaccination[5].

There is consistent evidence among studies analyzed from Italy that males are more likely to accept influenza vaccination during the COVID-19 pandemic[6,7,9,10]. Young (25–35 years) male HWs demonstrated the biggest leap in vaccine adherence during the pandemic[6], where Italian male healthcare staff had higher positive willingness toward flu immunization compared to females (74.7% vs 62.5%, respectively)[10]. However, Costantino et al.[11] reported that 'no significant differences' exist between HWs' genders.

Comorbidities

Evidence suggests that, in the context of the pandemic, healthcare staff with chronic diseases and comorbidities, defined here as hypertension, bronchial asthma, thyroid disorders, diabetes mellitus and rheumatic diseases, alongside sick HWs who are not on long-term medications[12], have higher vaccine acceptance and flu immunization rates particularly in the US[13], Spain[14], Czech Republic[12], and Cyprus[15]. This is evident in the Czech Republic, where flu immunization rates increased to 53.4% from 22.2%[12]. Comorbidities associated with a higher risk for flu complications ultimately act a positive prediction factor for influenza vaccination[13]. Redondo Marguello et al.[14] noted that chronically ill HWs aged ≥65 years had a positive perception of flu vaccine effectiveness and benefits.

HWs' profession cadres

Research shows there has been an increase of influenza vaccine uptake amongst healthcare staff, in particular those within intensive care units (ICUs), due to the COVID-19 pandemic, particularly in Italy[6,7], China[16], Czech Republic[12], and Greece[17]. For example, in China ICUs had increased rates of flu vaccination among HWs compared to other units (70% versus 58%, respectively)[16]. This is further corroborated by Perrone et al.[7] who noted how flu immunization rates were highest within the specialist medicine department, followed by specialist surgery, and administration departments (34%, 13.6%, and 13.1%, respectively).

Moreover, in the context of the pandemic, physicians were found to be more willing to get vaccinated for influenza compared to nurses, mainly in Italy[5,6], Poland[9], Czech Republic[12], Cyprus[15], and Greece[17]. For example, in Cyprus, for the 2019–2020 season, physicians had higher influenza vaccination rates than nurses or other HWs cadres (68.9%, 20%, 29.8%, respectively)[15]. However, a recent cross-sectional study reported that nurses' refusal rate to seasonal influenza vaccination has declined in the COVID-19 context[12]; amongst Italian nurses there was a 28.1% rise in influenza vaccination rate[6]. A similar rise can be seen among paramedical personnel, such as radiology and radiotherapy, but in regard to attitude towards vaccine uptake, with

Table 2. Regional distribution of 4 general versus 24 specific aspects of influenza vaccine hesitancy determinants, enablers, barriers, and interventions among health workers

General	Specific	Total	Country/Countries*
Determinants	Comorbidities	4	United States, Spain, Czech Republic, Cyprus
	Age	4	Italy (n=3), Poland
	Gender	4	Italy
	Profession cadres	7	Italy (n=3), Poland, China, Czech Republic, Greece
	Vaccination history	6	Italy (n=3), Poland, Lebanon, Saudi Arabia
Enablers	Health staff's knowledge on influenza vaccine	6	Italy (n=2), Cyprus, Spain, Saudi Arabia, Lebanon
	Concerns on self and others protection	11	Italy (n=3), Cyprus (n=2), Czech Republic, Poland (n=2), Ireland (n=2), Lebanon
	Rising perception of risk and fear from COVID-19 infection	8	Italy (n=5), Czech Republic (n=2), Poland
	Impact of influenza immunization	4	Italy (n=3), Lebanon
	Confidence in influenza vaccination	6	Italy, Poland, Ireland, Lebanon, Saudi Arabia, Iran
	Vaccine availability	1	Czech Republic
Barriers	Negative perceptions about vaccine safety and effectiveness	10	Italy (n=4), Poland, Germany, Cyprus, Ireland, Saudi Arabia, Lebanon
	Insufficient time for vaccine uptake	8	Italy, United States, China, Ireland, Poland, Spain, Cyprus, Iran
	Confidence in natural or acquired immunity	9	Italy (n=3), Ireland, Poland, China, Iran, Saudi Arabia, Lebanon
	Perspectives and attitudes towards vaccination	2	China, Iran
	Lack of knowledge about immunization	2	Italy, Lebanon
	Lack of trust	2	Poland, Lebanon
	Concerns on vaccine availability, cost, and needle injections	5	Italy, Poland, Ireland, Lebanon, Iran
Interventions	Awareness campaigns	12	Italy (n=5), Poland, United States, Ireland, Germany, China, Czech Republic, Saudi Arabia
	Targeting vaccine affordability and accessibility	11	Italy (n=4), United States, Germany, Ireland, Poland, China, Iran, Lebanon
	Education and training targeting vaccine hesitancy	5	Italy, Ireland, Spain, Saudi Arabia, Lebanon
	Mandatory HW influenza vaccination	6	Italy (n=2), Germany, China, Saudi Arabia, Lebanon
	Promoting vaccine culture in workplace	6	Italy (n=2), Ireland, Poland, Iran, Saudi Arabia
	Incentives approach	4	Italy, United States, Ireland, China

*n=1, unless otherwise stated.

+30.3% reporting a positive attitude towards influenza vaccination during 2020–2021[6].

Non-physicians had a major concern of concomitant infection of influenza and COVID-19, specifically in Italy[7] and Czech Republic[12]. This is evident in the +308.3% increase in participation among administrative staff, during the 2020 influenza vaccination campaign in Italy[7]. However, there are studies that suggest the contrary: the only noticeable decline in influenza vaccine uptake was among health administrators[6,18]. These studies showed a decrease of 3.2% in vaccination uptake among Italian administrative staff[6], with Irish administrative staff reporting the lowest willingness for vaccination uptake[18].

Vaccination history

There is evidence that the COVID-19 pandemic has increased the number of first-time influenza vaccine recipients particularly in Italy[5,6] and Czech Republic[12]. For example, only 16% of the vaccinated Czech Republic HWs received seasonal influenza injections before the last season (2019–2020),

and 25.2% of vaccinated Italian HWs got their first influenza vaccine in 2020–2021[6,12].

Healthcare staff adherence to influenza vaccination is associated with higher likelihood of influenza vaccination uptake amidst the COVID-19 pandemic particularly in Italy[5,10,11], Poland[9], Saudi Arabia[19], and Lebanon[20]. Previously vaccinated HWs were 6 times more likely to get influenza vaccine than their counterparts[20]. Scardina et al.[5] revealed that a recent history of influenza immunization is the utmost variable for predicting influenza vaccine acceptance, which is 'correlated with a higher influenza vaccine attitude score'.

The COVID-19 pandemic had a critical impact on the success of influenza vaccination campaigns mainly in Italy[5,6], Ireland[18], and Lebanon[20]. The majority of Italian HWs in 2020–2021 declared the necessity of influenza vaccination at the time of COVID-19 pandemic[5]. However, Bertoni et al.[6] mentioned that 28.6% of Italian HWs had maintained their positive influenza vaccination status during 2019–2020 and 2020–2021 seasons; only 11.5% of those previously vaccinated did not get vaccinated in 2020.

Enablers of vaccine acceptance

A wide array of factors affects acceptance of influenza vaccines by healthcare staff. These include: HWs' knowledge of influenza vaccine (n=6), HWs' concerns to protect others (family, friends, patients) (n=7), healthcare staff self-protection (n=4), increased perception of risk (n=5), increased fear of COVID-19 infection (n=3), reduction of the burden on healthcare systems (n=4), the role of public health professionals and health authorities (n=4), increased confidence in influenza vaccines in the COVID-19 context (n=6), and vaccine availability (n=1).

Knowledge of influenza vaccine

Research from Italy[10,21], Cyprus[15], Spain[14], Saudi Arabia[19] and Lebanon[20] has shed light on HWs' knowledge on influenza vaccine as a determinant of vaccine hesitancy. Due to the high risk of infection associated with their job, healthcare staff have more knowledge regarding influenza immunization[21]. For instance, Di Giuseppe et al.[10] mentioned that 96.1% of Italian HWs had knowledge about influenza vaccines from reliable sources such as scientific journals (56.5%), Internet (25.3%), and colleagues (20.4%).

Concerns regarding protection

Studies highlighted that, in the context of the pandemic, HWs' concerns to protect others (family, friends, and patients) acted as a major motivator for influenza vaccine acceptance. This was evident in Italy[10,11], Cyprus[15], Czech Republic[12], Poland[9], Ireland[18], and Lebanon[20]. One study[10] reported Italian healthcare staff's sense of responsibility to prevent in-hospital spread of influenza in 2020. Another study[18] noted how vaccinated Irish healthcare staff had concerns over family, patients, and colleagues' protection.

HWs' flu vaccination for self-protection was highlighted in four studies in Italy[10], Poland[9], Ireland[18], and Cyprus[15]. In Italy, 81% of HWs reported self-protection as the reason for vaccination, with 98.1% in Poland, 79% in Ireland, and 77.4% in Cyprus[9,10,15,19].

The protection of themselves and their family was a stronger motive for vaccine uptake amongst female compared to male HWs[12,15]. Male HWs noted that the main motivator was protecting patients, given their self-perception of the increased risk of catching influenza[15].

Perception of risk and fear of COVID-19 infection

Increased perception of risk was reported in Italy[5,6,10,11] and Czech Republic[12]. The COVID-19 pandemic was associated with a 50% increase in vaccination rates[6], where the fear of spreading influenza was the main motivator for young HWs to get vaccinated[12]. Notably, HWs who have never been vaccinated reported less fear of influenza infection compared with those who have been vaccinated before[10].

Evidence from Italy[6], Poland[8] and Czech Republic[12] suggests the fear of COVID-19 infection had an influential effect on increasing the HWs' acceptance of influenza immunization. The COVID-19 death toll contributed to the rise in influenza vaccine[8]. For example, 61% of Czech Republic HWs showed fear of having dual infections (influenza and COVID-19)[12].

Impact of influenza immunization

The impact of influenza immunization to reduce the surge of cases as well as the burden on healthcare systems[10] and decrease staff absenteeism[11], has increased influenza vaccine uptake amongst motivated healthcare staff in Italy[6,10,11] and Lebanon[20]. Approximately 80% of Lebanese HWs believed that influenza immunization would reduce 'co-infection of influenza and COVID-19', ultimately enabling 'health services to better cope with COVID-19 complications'[20], and thus limit confusion associated with the differential diagnosis influenza-like-illnesses[6,10].

Confidence in vaccines

Public health professionals and health authorities have a critical role in boosting influenza vaccine adherence among healthcare staff particularly in Germany[22], Cyprus[15], Ireland[18], and China[16]. For instance, 69% of vaccinated Irish healthcare staff found public health recommendations concerning influenza vaccine to be trustworthy[18].

In the context of the pandemic, confidence in influenza vaccines has increased globally throughout Italy[10], Poland[8], Ireland[18], Lebanon[20], Saudi Arabia[19], and Iran[23]; 66.3% of HWs deemed influenza a preventable infection, wherein concern (or lack thereof) regarding vaccine side effects acted as a predictor of willingness to vaccine uptake[10]. In Poland, Grochowska et al.[8] stated that 62.5% of Polish HWs had increased confidence in influenza vaccination while 3.6% had more confidence in COVID-19 vaccines, and 26.3% trusted both vaccines equally. Eventually, 74.9%, 55.1%, and 53.3%

of Italian HWs reported infection risk, vaccine effectiveness, and safety, respectively, for influenza vaccine adherence[10].

Vaccine availability

Finally, policies securing on-site availability and convenient access to influenza vaccination are an important factor for vaccine adherence[15,16,22], specifically, availability of vaccines in work settings. Stepanek et al.[12] highlighted that Czech Republic HWs, especially those vaccinated in the 2019–20 season, had concerns on the shortage of influenza vaccines at their health facilities.

Barriers to vaccine acceptance

Evidence suggests that acceptance of influenza immunization is higher among healthcare staff with low perception of barriers to vaccination. In Lebanon[20], acceptance was approximately 4 times higher amongst healthcare staff with low perception compared with others. Barriers to influenza vaccine among HWs include: false perceptions, doubts and misinformation about vaccine safety, adverse events, effectiveness; insufficient time for vaccine uptake; confidence in natural or acquired immunity from previous infections; HWs' work expertise and peers' perspectives and attitude towards vaccination; lack of HWs' knowledge regarding immunization; lack of trust in healthcare organizations, health authorities, and pharmaceutical companies; and concerns on vaccine availability, costs and needle injections.

Negative perceptions regarding vaccinations

Negative perceptions are found globally, in Italy[10,11,21,24], Poland (20%)[9], Germany[22], Cyprus[15], Ireland[18], Saudi Arabia (10.7%)[22] and Lebanon[20]. In Germany, in 2020–2021, perceptions on influenza disease and potential immunization adverse effects varied significantly 'between vaccinated and non-vaccinated Emergency Department personnel'[22]. A similar trend was seen among Irish HWs, wherein concerns regarding side effects due to the influenza vaccine varied from 2018 to 2020–2021 (65% vs 30%)[18].

Safety doubts, alongside fear from influenza vaccine-induced complications were particularly important barriers to vaccine uptake in Italy[11], Ireland (11%)[18], Germany[22] and Lebanon (18.21%)[20]. For instance, 9.1% and 12.8% of Lebanese healthcare staff revealed concerns regarding immune system overload alongside potential allergies, respectively[20]. However, it is important to note how all possible side effects due to influenza immunization, with the exception of injection pain, were higher among unvaccinated German HWs compared with their vaccinated counterparts for the 2020–2021 season[22].

False perceptions pertaining to lack of vaccine effectiveness and efficacy were noted in Lebanon (7.86%)[20], Ireland (21%)[18], Cyprus (21.5%)[15], Saudi Arabia[19], and Iran (21%)[23]. In the Saudi Arabian study, 4% of HWs believed that influenza immunization could potentially cause influenza infection[19]. Moreover, confidence regarding influenza vaccine effectiveness was challenged due to perceptions of influenza as a non-dangerous ailment[10,21,24].

Insufficient time for vaccine uptake

Vaccine accessibility, specifically lack of time to go and get vaccinated, was a barrier in Italy[24], United States[13], China (50%)[16], Ireland (32%)[18], Poland (30.4%)[9], Spain[14], Cyprus (3.4%)[15], and Iran[23], indicating that this barrier is widespread. In Spain, the study found that 62% of physicians and 72% of nurses were unable to prioritize preventative measures, such as influenza vaccination, due to the workload[14]. This sentiment is echoed by Yi et al.[16] who highlighted that busy schedules were responsible for the lack of immunization against influenza amongst Chinese healthcare staff in high-risk departments.

Confidence in immunity from previous influenza infections

Confidence in natural or acquired immunity from previous influenza infections was noted as a barrier to vaccination in Italy[10,11,24], Ireland (13%)[18], Poland (17.8%)[9], China (41%)[16], Iran (33.8%)[23], Saudi Arabia[19], and Lebanon (22.8%)[20]. In Lebanon, 80.9% of healthcare staff regarded influenza as a mild infection, with additional few stating that the benefits of preventing influenza infection do not outweigh the barriers to vaccine acceptance and that immunization is not essential for healthy staff, 53.6% and 61.2%, respectively[20].

Work expertise and peers' perspectives

Work expertise and peers' perspectives greatly influence HWs' decision regarding influenza vaccine uptake in China[16] and Iran[23]. The Iranian study found prior immunization experience, as well as negative feedback from non-vaccinated peers, ultimately enhanced HWs' concerns regarding the development of side effects, in particular influenza-like symptoms[23].

Knowledge about vaccination

Lack of healthcare staff's knowledge about vaccination is a barrier to influenza vaccine acceptance in Italy[10] and Lebanon[20]. In Lebanon, approximately 50% of HWs were not aware of the time frame for symptomology following exposure to influenza[20]. Additionally, around 24% of Lebanese HWs were uninformed of the possibility of immunization during active virus circulation[20]. Moreover, in Italy, approximately 54% of HWs were in need of further awareness of influenza immunization[10].

Trust in organizations

Lack of trust in organizations or authorities, such as healthcare organizations, health authorities, or pharmaceutical companies, are an additional barrier to vaccine acceptance. This is particularly evident in Poland[9] and Lebanon[20]. Nearly half of Lebanese HWs did not deem information from official authorities as reliable and had concerns regarding potentially biased vaccine policies that prioritize the profit of pharmaceutical companies[20].

Vaccine availability

Evidence shows vaccine hesitancy is attributed to influenza vaccine availability, costs and needle injections in Italy[5], Poland[9], Ireland[18], Lebanon[20], and Iran[23]. Approximately 83% Lebanese and 25% Italian HWs reported concerns about insufficient vaccine availability, and unaffordable vaccine cost[5,20]. Irish HWs expressed an aversion to the influenza vaccination injection site, or preferred to avoid needle injections altogether[23]. Furthermore, nurses had more concerns regarding injections than physicians (10.7% vs 2.5%)[9].

Barriers to influenza vaccine acceptance among HWs were common in all countries included in this review. A summary of enablers and barriers to vaccination are given Table 3.

Interventions for vaccine hesitancy

Interventions targeting influenza vaccine acceptance among HWs are ample and include: awareness campaigns, with dissemination of high-quality and transparent information on influenza vaccine, education and training targeting vaccine hesitancy; compulsory HWs' influenza vaccination; promoting vaccine culture within workplaces; an incentives approach; and boosting vaccine affordability (defined as free-of-charge) and accessibility.

Awareness campaigns

Amidst the COVID-19 pandemic, awareness campaigns were the most popular intervention to increase influenza vaccine acceptance among HWs in Italy[5-7,10,11], Poland[8,9], United States[13], Ireland[18], Germany[22], China[16], Czech Republic[12], and Saudi Arabia[19]. Educational messages included scientific-based information about the influenza vaccine, such as safety, efficacy, and pros and cons, as well as promotional educational material such as posters and flyers[5,18].

Methods for awareness campaigns have extended to include compulsory sessions for HWs on influenza transmission[18], implementing onsite influenza immunization promotion[13], specific occupational counseling[11], sending informative emails and reminders[5], and running promotional events before seasonal campaigns[19]. This is in addition to the strategy of relying on the 'hospital internal network' to disseminate data on influenza vaccines[12]. Other methods to combat misconceptions regarding influenza vaccine are providing 'educational handouts' or arranging 'lunch-and-learn activities'[13].

Five studies discussed the importance of HWs' education and training to reduce hesitancy towards influenza immunization in Italy[5], Ireland[18], Spain[14], Saudi Arabia[19], and Lebanon[20]. For instance, a broad range of 'information sources' as well as conducting 'seminars or training activities of scientific societies' were preferred by physicians and nurses, respectively[14].

Table 3. Distribution of 7 barriers versus 6 enablers to influenza vaccination among health workers across 20 of the included reference sources

Barriers	Enablers
Negative perceptions about vaccine safety and effectiveness [9-11, 15, 18-23, 24]	Health staff's knowledge on influenza vaccine [10, 14, 19-21]
Insufficient time for vaccine uptake [9, 13-16, 18, 23, 24]	Concerns on self and others protection [6, 8-12 15, 18, 20]
Confidence in natural or acquired immunity [9, 10, 11, 16, 18-20, 23, 24]	Perception of risk and fear from COVID-19 infection [5, 6, 10-12]
Work expertise and peers' perspectives [16, 23]	Impact of influenza immunization [6, 10, 11, 20]
Lack of knowledge about immunization [10, 20]	Confidence in influenza vaccination [8, 10, 15, 16, 18-20, 22, 23]
Lack of trust in organizations [9, 20]	Vaccine availability [12, 15, 16, 22]
Concerns on vaccine availability, cost, and needle injections [5, 9, 18, 20, 23]	

Mandatory vaccination

In the context of the pandemic, of all the strategies targeting vaccine uptake, mandatory influenza vaccination for healthcare staff was one of the most controversial in Italy[10,11], Germany[22], China[16], Saudi Arabia[19], and Lebanon[20]. However, evidence shows that vaccinated healthcare staff are more likely to favor compulsory influenza vaccine policies[22]. In China, 84% of HWs approved mandatory influenza immunization provided that the vaccination was free-of-charge and conveniently accessible[16]. On the other hand, in Germany, unvaccinated HWs were likely to agree that 'mandatory vaccination policies would be a reason to change jobs' as well as noting that 'it would be ethical to not go to work during an influenza pandemic'[22].

Vaccine culture within workplaces

Studies emphasized the importance of promoting influenza vaccine culture in different workplaces in Italy[5,11], Ireland[18], Poland[9], Iran[23], and Saudi Arabia[19]. This encompasses the increase of vaccine availability by making influenza vaccines free-of-charge[19], the immunization of decision-makers and leaders as an approach for vaccine advocacy[5,23], digital educational campaigns[11], and managerial and peer pressure[18]. Evidence seems to suggest that positive perception and attitudes towards influenza vaccination among young healthcare staff leads to an increase in older HWs' influenza vaccine uptake[11].

Incentive approach

The incentive approach has also been utilized to increase influenza vaccine adherence in Italy[7], the United States[13],

Ireland[18], and China[16]. Incentives include cross-departments competition[7], free-of-charge immunization[13], or even vouchers[18]. For example, Chinese healthcare settings that incentivized influenza immunization among staff saw an increase in vaccine uptake (70% vs 39%, vaccine coverage among incentivized and non-incentivized, respectively)[16].

Vaccine affordability and accessibility

In the COVID-19 context, evidence from Italy[5,7,10,21], United States[13], Germany[22], Ireland[18], Poland[9], China[16], Iran[23], and Lebanon[20] shows how vaccine affordability (defined as free-of-charge) and accessibility are instrumental for HWs' immunization adherence. In China, free-of-charge vaccinations are likely to increase influenza immunization adherence by 45%; 79% vs 34% coverage in free-of-charge and non-free-of-charge vaccination policies, respectively[16]. Additionally, in Germany, it has been suggested that the increased influenza vaccination coverage among the emergency department's healthcare staff, during 2020–2021, was attributed to the COVID-19 pandemic[22]. This is thought to be due to the increased availability of immunization clinics on-site[22].

DISCUSSION

The purpose of this review was to summarize evidence regarding the impact of the COVID-19 pandemic on the sentiment surrounding influenza vaccination among HWs. To do so, various determinants, barriers, and interventions for vaccine hesitancy were identified.

Young HWs, specifically males, and HWs with chronic diseases and comorbidities, were associated with higher vaccine acceptance and influenza immunization rates. The pandemic has increased the uptake of influenza vaccination in different healthcare cadres, with physicians more willing to adhere to influenza vaccines. Furthermore, the number of first-time vaccine recipients has increased. However, previous adherence to influenza vaccination was associated with higher likelihood of up-taking influenza vaccination.

Interventions adopted during the COVID-19 pandemic to increase HWs' influenza vaccine acceptance ranged from: awareness campaigns alongside education and training to target hesitancy; mandatory HWs' influenza vaccination; promotion of vaccine culture in workplaces; the incentive approach; and increasing vaccine affordability and accessibility. Evidence suggests targeting and resolving myths surrounding the side effects of influenza vaccination lead to increased immunization adherence[22]. Thus, awareness campaigns should target negative perceptions regarding vaccination ultimately, and increasing trust in influenza immunizations[16]. Regarding training to reduce hesitancy, given the high cognitive awareness of healthcare staff, dissemination high-quality and transparent information was found to be crucial for effective promotion of influenza vaccine uptake. This is particularly important as, for example, in Italy, over half of HWs stated needing further awareness specific to influenza immunization[10]. Free-of-charge vaccines, alongside mandatory vaccination, achieved the highest vaccination coverage in China where 84% of HWs approved mandatory influenza immunization if vaccination is free and conveniently accessible[16]. However, regarding mandatory vaccination policies, given the varied success of this strategy, these are not applicable in all contexts[10].

Factors that motivate healthcare staff acceptance towards influenza vaccines are abundant and directly related to: HWs' knowledge on influenza vaccine; concerns to protect self and others; perceptions of risk; fear of COVID-19 infection; and confidence in health authorities. Notably, HWs have more knowledge regarding influenza immunization due to the nature of their profession. This could be attributed to the positive correlation between vaccine knowledge and 'nationality, educational level, and perception'[15,19]. Moreover, concerns regarding protection (of others and themselves) were noted as an important factor, with HWs reporting a sense of responsibility to family, patients, and colleagues. Fear of spreading influenza, alongside the fear of COVID-19 infection, were determined to be a main motivator for HWs to get vaccinated. The belief that influenza immunization would ultimately reduce the co-infection of influenza and COVID-19, and, therefore, reduce the burden on healthcare systems, was a driving force for immunization.

There is consistent evidence that influenza immunization acceptance is 4 times higher among healthcare staff with low perception of barriers to vaccination[20]. Such barriers range from false perceptions and doubts about vaccine safety to confidence in immunity from previous infections. Regarding confidence in immunity, it has been noted that this sentiment could be attributed to healthcare staff belonging to an age group that has been reported to have a low perceived risk of catching influenza[10,11].

Strengths and limitations

This review has limitations. First, it only included articles written in English. Nevertheless, there was a considerable number of publications on the topic of interest with the majority coming from non-English speaking countries. Thus, the studies included should be reasonably representative. Secondly, given the nature of the review (scoping, as opposed to systematic) – no quantitative analysis was performed, and we did not assess publication bias in the identified studies.

Nonetheless, strengths of the review lie in the narrative synthesis performed alongside identification of barriers. The latter can be addressed by policymakers in future pandemics.

CONCLUSIONS

This literature review showed that the COVID-19 pandemic had a critical impact on the success of influenza campaigns among HWs. Vaccine hesitancy among healthcare workers is a multifactorial phenomenon of utmost importance, especially during the times of a global pandemic. In the COVID-19 context, the confidence in influenza vaccines

alongside the rising perception of risk have increased. A negative relationship between influenza immunization and COVID-19 infection was identified: the belief that the vaccine reduces co-infection of influenza and COVID-19, decreasing the burden on healthcare systems. The most effective intervention for increasing influenza vaccine acceptance among HWs was awareness campaigns as well as targeting vaccine affordability and accessibility. It is strongly recommended to conduct new empirical studies, particularly in low-middle income countries, to provide further evidence on the designated scope.

REFERENCES

1. Guillari A, Polito F, Pucciarelli G, et al. Influenza vaccination and healthcare workers: barriers and predisposing factors. A literature review. Acta Biomed. 2021;92(Suppl2):e2021004. doi:10.23750/abm.v92iS2.11106
2. Centers for Disease Control and Prevention. Influenza (Flu): Preliminary Estimated Influenza Illnesses, Medical visits, Hospitalizations, and Deaths in the United States – 2021-2022 influenza season. CDC; 2022. Accessed March 28, 2023. https://www.cdc.gov/flu/about/burden/2021-2022.htm
3. MacDonald NE, Dubé E. Unpacking vaccine hesitancy among healthcare providers. EBioMedicine. 2015;2(8):792-793. doi:10.1016/j.ebiom.2015.06.028
4. World Federation of Public Health Associations. WFPHA; 2022. Accessed March 28, 2023. https://www.wfpha.org
5. Scardina G, Ceccarelli L, Casigliani V, et al. Evaluation of flu vaccination coverage among healthcare workers during a 3 Years' study period and attitude towards Influenza and potential COVID-19 vaccination in the context of the pandemic. Vaccines. 2021;9(7):769. doi:10.3390/vaccines9070769
6. Bertoni L, Roncadori A, Gentili N, et al. How has COVID-19 pandemic changed flu vaccination attitudes among an Italian cancer center healthcare workers? Hum Vaccin Immunother. 2022;18(1):1978795. doi:10.1080/21645515.2021.1978795
7. Perrone PM, Biganzoli G, Lecce M, et al. Influenza vaccination campaign during the COVID-19 pandemic: The experience of a research and teaching hospital in Milan. Int J Environ Res Public Health. 2021;18(11):5874. doi:10.3390/ijerph18115874
8. Grochowska M, Ratajczak A, Zdunek G, Adamiec A, Waszkiewicz P, Feleszko W. A comparison of the level of acceptance and hesitancy towards the Influenza vaccine and the forthcoming COVID-19 vaccine in the medical community. Vaccines. 2021;9(5):475. doi:10.3390/vaccines9050475
9. Jędrzejek MJ, Mastalerz-Migas A. Influenza vaccination coverage, motivators for, and barriers to Influenza vaccination among healthcare workers in Wroclaw, Poland. Int J Environ Res Public Health. 2022;19(3):1586. doi:10.3390/ijerph19031586
10. Di Giuseppe G, Pelullo CP, Paolantonio A, Della Polla G, Pavia M. Healthcare workers' willingness to receive Influenza vaccination in the context of the COVID-19 pandemic: a survey in Southern Italy. Vaccines. 2021;9(7):766. doi:10.3390/vaccines9070766
11. Costantino C, Ledda C, Squeri R, et al. Attitudes and perception of healthcare workers concerning Influenza vaccination during the 2019/2020 season: a survey of Sicilian university hospitals. Vaccines. 2020;8(4):686. doi:10.3390/vaccines8040686
12. Štěpánek L, Nakládalová M, Vildová H, Boriková A, Janošíková M, Ivanová K. Demand and motivation for Influenza vaccination among healthcare workers before and during the COVID-19 era: a cross-sectional survey. Hum Vaccin Immunother. 2021;17(9):3113-3118. doi:10.1080/21645515.2021.1911212
13. Landwehr K, Trees WJ, Reutman S. A quality improvement project to improve Influenza vaccination rates among employees at an onsite employer-based health clinic. Workplace Health Saf. 2021;69(10):448-454. doi:10.1177/21650799211016906
14. Redondo Margüello E, Trilla A, Munguira ILB, López-Herce AJ, Cotarelo Suárez M. Knowledge, attitudes, beliefs and barriers of healthcare professionals and adults ≥ 65 years about vaccine-preventable diseases in Spain: the ADult Vaccination drIverS and barriErs (ADVISE) study. Hum Vaccin Immunother. 2022;18(1):2025007. doi:10.1080/21645515.2021.2025007
15. Papageorgiou C, Mazeri S, Karaiskakis M, et al. Exploring vaccination coverage and attitudes of health care workers towards Influenza vaccine in Cyprus. Vaccine. 2022;40(12):1775-1782. doi:10.1016/j.vaccine.2022.02.020
16. Yi H, Yang Y, Zhang L, et al. Improved Influenza vaccination coverage among health-care workers: evidence from a web-based survey in China, 2019/2020 season. Hum Vaccin Immunother. 2021;17(7):2185-2189. doi:10.1080/21645515.2020.1859317
17. Rachiotis G, Papagiannis D, Malli F, et al. Determinants of Influenza vaccination coverage among Greek health care workers amid COVID-19 pandemic. Infect Dis Rep. 2021;13(3):757-762. doi:10.3390/idr13030071
18. Kearns EC, Callanan I, O'Reilly A, et al. Changing attitudes towards annual Influenza vaccination amongst staff in a tertiary care Irish university hospital. Ir J Med Sci. 2022;191(2):629-636. doi:10.1007/s11845-021-02636-w
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). Hum Vaccin Immunother. 2021;17(5):1426-1431. doi:10.1080/21645515.2020.1820809
20. Youssef D, Berry A, Youssef J, Abou-Abbas L. Vaccination against Influenza among Lebanese health care workers in the era of coronavirus disease 2019. BMC Public Health. 2022;22(1):120. doi:10.1186/s12889-022-12501-9
21. Collatuzzo G, Melloni R, Zanotti C, et al. Comparing the attitude toward the COVID-19 and the 2020/21 and 2019/20

flu vaccination campaigns among Italian healthcare workers. Vaccines. 2021;9(11):1312. doi:10.3390/vaccines9111312
22. Stöckeler AM, Schuster P, Zimmermann M, Hanses F. Influenza vaccination coverage among emergency department personnel is associated with perception of vaccination and side effects, vaccination availability on site and the COVID-19 pandemic. PloS One. 2021;16(11):e0260213. doi:10.1371/journal.pone.0260213
23. Hajiabdolbaghi M, Havastin NG, Afhami S, et al. Influenza vaccination coverage and obstacles in healthcare workers (HCWs) and the follow up of side effects: a multicenter investigation in Iran. J Prev Med Hyg. 2021;62(2):E377-E381. doi:10.15167/2421-4248/jpmh2021.62.2.1827
24. Di Pumpo M, Vetrugno G, Pascucci D, et al. Is COVID-19 a real incentive for flu vaccination? Let the numbers speak for themselves. Vaccines. 2021;9(3):276. doi:10.3390/vaccines9030276

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DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

AUTHORS' CONTRIBUTIONS
RM prepared the methodology, collected and analyzed the data, wrote the drafts, and prepared the manuscript. FG and AT contributed to the methodology and refined the keywords and inclusion criteria. MC has enhanced, revised and edited the manuscript, focusing on language, and drafted both the regional distribution table and summary of barriers and enablers table. MM conducted supervision and writing. ML contributed by conceptualizing the study, supervision, writing, reviewing and editing the drafts. All authors have read and agreed to the final version of the manuscript.

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