



The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers

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Abstract

COVID-19 vaccines were approved in late 2020 and early 2021 for public use in countries across the world. Several studies have now highlighted COVID-19 vaccination hesitancy in the general public. However, little is known about the nature and extent of COVID-19 vaccination hesitancy in healthcare workers worldwide. Thus, the purpose of this study was to conduct a comprehensive worldwide assessment of published evidence on COVID-19 vaccine hesitancy among healthcare workers. A scoping review method was adopted to include a final pool of 35 studies in this review with study sample size ranges from $n = 123$ to 16,158 (average = 2185 participants per study). The prevalence of COVID-19 vaccination hesitancy worldwide in healthcare workers ranged from 4.3 to 72% (average = 22.51% across all studies with 76,471 participants). The majority of the studies found concerns about vaccine safety, efficacy, and potential side effects as top reasons for COVID-19 vaccination hesitancy in healthcare workers. The majority of the studies also found that individuals who were males, of older age, and doctoral degree holders (i.e., physicians) were more likely to accept COVID-19 vaccines. Factors such as the higher perceived risk of getting infected with COVID-19, direct care for patients, and history of influenza vaccination were also found to increase COVID-19 vaccination uptake probability. Given the high prevalence of COVID-19 vaccine hesitancy in healthcare workers, communication and education strategies along with mandates for clinical workers should be considered to increase COVID-19 vaccination uptake in these individuals. Healthcare workers have a key role in reducing the burden of the pandemic, role modeling for preventive behaviors, and also, helping vaccinate others.

Keywords COVID-19 · Vaccine · Healthcare worker · Health professionals · Vaccination

Background

COVID-19 vaccines were approved for use in the general population in late 2020 and early 2021 across different countries. COVID-19 vaccination hesitancy rates in the general population have now been explored across the world and are fairly well established [1–4]. For example, in a recent systematic review, the highest rates for COVID-19 vaccine acceptance in the general population were reported in Ecuador, Malaysia, Indonesia, and China (> 90% for all countries). In contrast, the lowest rates were reported for Kuwait, Jordan, Italy, Russia, Poland, United States, and

France (< 60% for all countries) [4]. In these studies, from the general population, it has been shown that COVID-19 vaccination hesitancy rates differ worldwide by perceived susceptibility to and severity of COVID-19 and several sociodemographic characteristics such as sex, age, education, income, and occupation [2–5].

Recent reports suggest that many healthcare workers (HCWs) are also hesitant about or are delaying getting the COVID-19 vaccine [6–10]. Some reports estimate that the rates of COVID-19 vaccination hesitancy in HCWs may be similar to rates in the general population. For example, a December 2020 Kaiser Family Foundation poll found that 29% of the HCWs were reluctant to get COVID-19 vaccines as opposed to 27% of the individuals in the general population [8]. In contrast, in an early 2021 assessment of skilled nursing facilities across the United States, more than three-fourths (77.8%) of the residents of these facilities compared to a little more than a third (37.5%) of the staff in these facilities received at least one dose of the COVID-19 vaccine

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[9]. These estimates are of concern even though HCWs were designated as priority groups for COVID-19 vaccination across the world [8–10]. Given the scattered scientific evidence and a plethora of media reports, it remains to be known to what extent and why are HCWs hesitant towards obtaining COVID-19 vaccination. Thus, the purpose of this study was to review all published scientific evidence on the extent and reasons for COVID-19 vaccination hesitancy in HCWs. Also, we explored the enabling factors for COVID-19 vaccination across the world to assimilate similarities and differences in HCWs across the world as it relates to COVID-19 vaccination acceptance or willingness.

Methods

We conducted a scoping review to assimilate scientific evidence on COVID-19 vaccine hesitancy in HCWs. A comprehensive search of the scientific literature was conducted by three independent investigators (NB, TM, JK) on PubMed, EBSCO Host, pre-print servers (e.g. medRxiv) and Google Scholar. A Boolean search strategy was employed using the following keywords: “vaccine”, “COVID-19”, “hesitancy”, “refusal”, “vaccination”, “coronavirus”, “nurse”, “doctor”, “healthcare”, “worker”, “health”, “professional”. The order of keywords was changed in repeated searches across databases to extract the final pool of relevant studies. Articles that were included in the final review were screened carefully for suitability and to identify other articles that pertained to the study topic. Additional hand searches were conducted to include articles that cited the initially selected pool of articles. COVID-19 vaccination hesitancy rates data were extracted from studies if participants were “unlikely”, “refused”, “declined”, or “disagreed” with taking a COVID-19 vaccine. Participant responses such as “unsure” and “undecided” were not counted as vaccine hesitant for assessment of COVID-19 vaccination rates among the studies included in this review. Studies finally included in the review were those that were published in the English language, between February 2020– February 2021, and included healthcare workers as sole study participants (e.g., doctors, nurses, allied health professionals, and others) or HCWs who were part of a survey from the public.

Results

The final pool of studies comprised 35 studies (9 from the USA; 4 from France; 3 from Saudi Arabia; 3 from Hong Kong/ China; 2 from Congo; 2 from Malta; 2 from Greece, 2 from Italy, 2 from Canada, and 1 each from other countries as shown in Table 1) [11–45]. The sample size of the studies ranged from 123 to 16,158 participating HCWs (average

study sample = 2185 per study and a total of 76,741 participants across all studies). The prevalence of COVID-19 vaccination hesitancy worldwide in HCWs ranged from 4.3 to 72% (average rate of 22.51% hesitant individuals across studies). The type of HCWs in studies included for this review differed by age, gender, race, education, income, marital status and family structure, profession, and roles in the healthcare setting (e.g., direct patient contact versus others) [11–45]

In the studies where reasons for COVID-19 vaccination hesitancy were assessed, the vast majority (> 75%) of the studies found concerns about safety, efficacy, and side effects as the top three major reasons for COVID-19 vaccination hesitancy among HCWs. Other reasons for COVID-19 vaccination hesitancy were: insufficient knowledge about the vaccines, belief that COVID-19 does not exist or is not a serious disease, speedy development of vaccines, politics surrounding vaccine development process, misinformation from social media, previous COVID-19 infection or health conditions, and mistrust in authorities, health experts, and pharmaceutical companies.

Concerning factors associated with lower COVID-19 vaccination hesitancy and higher willingness for COVID-19 vaccines, the male gender was found to be an enabling factor in the majority of the studies (25/35 = 71.4%). Older age or having a doctorate or postgraduate education were associated with higher COVID-19 vaccine acceptance rates in more than half of the studies (23/35 = 65.7%). Compliance with vaccines, confidence in vaccines, or history of influenza vaccination was found to be a predictor of COVID-19 vaccine acceptance in a little more than half of the studies (18/35 = 51.4%). Similarly, direct patient contact/ caring for COVID patients or higher perceived risk and fear of being infected with COVID-19 were associated with lower COVID-19 vaccination hesitancy in more than half of the studies (20/35 = 57.1%). Other factors associated with higher COVID-19 vaccination acceptance were: White or Asian race, higher income/education, medical risk, and chronic disease history, not being infected with COVID-19 in the past, knowledge about COVID-19 infection and disease, working in non-rural areas, and beliefs that vaccines may protect friends, family, and community members.

Discussion

The findings of this review indicate that 22.51% out of 76,471 HCWs worldwide reported COVID-19 vaccination hesitancy. The public would assume that HCWs would have no hesitancy to take the COVID-19 vaccine, given the nature of the profession of HCWs. A recent survey from the general public in the United States (n = 1055) found that 32% of the participants would not or probably not get the COVID-19

Table 1 COVID-19 vaccination in healthcare workers: findings from review of studies worldwide

Author	Country/period	Sample size	Hesitancy rate (%)	Reasons for COVID-19 vaccination hesitancy	Enabling factors for COVID-19 vaccination
Papagiannis et al. [11]	Greece Feb 2020	461	31.4	Insufficient knowledge and awareness about the vaccines.	Male gender, older age, doctoral degree, higher knowledge about COVID-19 infection and disease.
Wang et al. [12]	Hong Kong Mar 2020	806	17	Concerns about efficacy, effectiveness, and safety, believing it as unnecessary, and no time to take COVID-19 vaccines.	Male gender, encountering COVID-19 patients, influenza vaccination compliance and chronic disease history.
Dror et al. [13]	Israel Mar 2020	549 ^a	28.5	Concerns about vaccine safety and efficacy, employment status, and belief that COVID-19 is a mild disease.	Male gender, doctoral degree, perceived risk of severe COVID-19 infection, and a history of influenza vaccination compliance.
Fu et al. [14]	China Mar 2020	352 ^a	4.3	Concerns regarding vaccine side effects, efficacy, costs, and disease trends or case fatality rates.	History of influenza vaccination, higher perceived risk of COVID-19 infection, and decisions of social contacts.
Kwok et al. [15]	Hong Kong Apr 2020	1205	37	Concerns regarding safety, efficacy, and duration of protection provided by COVID-19 vaccines.	Younger age, collective responsibility, and stronger overall confidence in vaccines to prevent diseases.
Nzaji et al. [16]	Congo Apr 2020	613	72	Misinformation from social networks and concerns about quality of the vaccines.	Male gender, doctoral degree, and a positive attitude towards vaccine
Detoc et al. [17]	France Apr 2020	1421 ^a	18.5	Concerns regarding safety and efficacy of the available vaccines.	Male gender, older age, fear of COVID-19 infection and disease, and higher individual perceived risk for infection.
Harapan et al. [18]	Indonesia April 2020	264 ^a	27	Concerns about effectiveness and cost of the available vaccines and being a retired healthcare worker.	Higher perceived risk of COVID-19 infection and if the vaccine was 95% effective instead of 50%.
Brunon et al. [19]	France Jul 2020	2047	23.1	Concerns about safety, efficacy, and effectiveness of COVID-19 vaccines.	Male gender, older age, doctoral degree, higher perceived risk, and history of influenza vaccination.
Schwarzinger et al. [20]	France Jul 2020	124 ^a	32.3	Concerns about side effects, safety, and the vaccine manufacturing country.	Male gender, older age, perceived risk and severity of COVID-19 disease, history of chronic diseases, past vaccine compliance.
Askaran et al. [21]	Iran Aug 2020	1219 ^a	41.9	Concerns about safety and cost. Higher perceived barriers to getting a COVID-19 vaccine.	Male gender, younger age, prosocial norms, higher perceived risks of COVID and perceived benefits of the vaccine.
Ditekemena et al. [22]	DR Congo Sept 2020	324 ^a	40	Low trust in the vaccine, and belief that vaccines are made to kill people in Africa or sterilize them.	Middle or higher income, being tested for COVID-19, or believing that COVID-19 existed as a serious disease.
Grech et al. [23]	Malta Sep 2020	123	8.3	Concerns about vaccine efficacy, short and long-term side effects, and insufficient knowledge about vaccines.	Male gender, older age, doctoral degree, and influenza vaccination history in the past.
Grech et al. [24]	Malta Sept 2020	1002	26	Concerns of vaccine safety, lack of knowledge, myths/falsehoods, fake news, and conspiracy theories.	Male gender, older age, doctoral degree, and higher acceptance of influenza vaccines in the past.
Kose et al. [25]	Turkey Sep 2020	1138	11.4	Concerns about side effects, efficacy, pharmaceutical companies, and lower trust in COVID-19 vaccine.	Male gender, younger age, history of taking influenza vaccinations.
Gadtho et al. [26]	USA Oct 2020	609	18	Insufficient knowledge, concerns regarding speed of vaccine development, and politics.	Male gender, older age, doctoral degree, White/Asian race, patient care roles or clinical work with interactions with COVID-19 patients.

Table 1 (continued)

Author	Country/period	Sample size	Hesitancy rate (%)	Reasons for COVID-19 vaccination hesitancy	Enabling factors for COVID-19 vaccination
Barry et al. [27]	S. Arabia Nov 2020	1512	11.8	Concerns about side effects and efficacy, speedy development & inadequate data on vaccine safety.	Male gender, higher perceived COVID-19 infection and disease risk, working in isolation or ICU, and past influenza vaccination history.
Shekhar et al. [28]	USA Nov 2020	3479	8	Concerns about safety, effectiveness, and the speed of development of the vaccine. Mistrust in government and regulatory authorities.	Male gender, older age, doctoral degree, higher income/education, White/Asian race, rural living and conservative ideology, influenza vaccination history, working in direct patient care.
Verger et al. [29]	Fr, Bg, Cn Nov 2020	2678	28.4	Concerns regarding vaccine safety and distrust in the ministry of health (France, Belgium, Canada).	Male gender, older age, influenza vaccination history, and recommending vaccines to others.
Eguia et al. [30]	Spain Nov 2020	464	22	Concerns about safety and effectiveness, belief that vaccines in general are harmful, & COVID-19 disease does not exist.	Male gender, older age, doctoral degree, and not infected with COVID-19 in the past.
Gennaro et al. [31]	Italy Nov 2020	1723	7	Concerns about safety and efficacy of vaccine, lower trust in pharmaceutical companies, using social media information.	Younger age, doctoral degree, history of influenza vaccination, and close contact with high-risk groups.
Temsah et al. [32]	S. Arabia Nov 2020	1512	18	Concerns about vaccine producing country, efficiency, and personal preferences.	Male gender, older age, and doctoral degree.
Kuter et al. [33]	USA Dec 2020	12,034	10	Concern about side effects, effectiveness, vaccines being too new, not knowing enough about the vaccine, and getting infected from the vaccines.	Male gender, older age, White/Asian race; higher education, vaccination history; direct patient care role, belief that vaccines protect self, family, and the community at large.
Jain et al. [34]	USA Dec 2020	2135	10	Concerns about side effects, efficacy, political involvement and distrust in pharma companies.	Perception of putting oneself or family and friends at risk of getting infected, living with individuals at risk of infection or infected.
Meyer et al. [35]	USA Dec 2020	16,158	16.4	Concerns about unknown risks, side effects, and lack of data on vaccines. Wait and watch others before taking vaccines.	Working in intensive care units, direct patient care and inpatient settings.
Shaw et al. [36]	USA Dec 2020	5287	15.9	Concerns about safety, side effect, efficacy, speedy vaccine development, politics, and research on the vaccines.	Male gender, older age, doctoral degree, White/Asian race, COVID-19 patient care and direct involvement with patients.
Qattan et al. [37]	S. Arabia Dec 2020	673	49.4	Concerns about safety, side effects, efficacy, speedy development, and belief that COVID disease does not exist.	Male gender, frontline worker, history of influenza vaccination, and high perceived risk of COVID-19 infection for self.
Papagiannis et al. [38]	Greece Dec 2020	340	21.5	Concerns about side effects, speedy development of the vaccines, and using mostly social media for information.	Male gender, older age, doctoral degree, history of influenza vaccination, and trust in government authorities.
Ledda et al. [39]	Italy Dec 2020	787	25	Concerns about safety, efficacy, little information on vaccines, belief that COVID is not a dangerous infection.	Male gender, older age, doctoral degree, direct patient care, a higher perceived risk for COVID-19 infection and chronic disease history.

Table 1 (continued)

Author	Country/period	Sample size	Hesitancy rate (%)	Reasons for COVID-19 vaccination hesitancy	Enabling factors for COVID-19 vaccination
Desveaux et al. [40]	Canada Jan 2021	8634	19.6	Concerns about side effects, speedy development, not part of job/responsibility, not needed for those in good health, lack of time and pay/sick benefits for getting COVID-19 vaccines.	Male gender, older age, higher education and income, European race, influenza vaccination history and compliance, higher perceived risk of COVID infection for self and family.
Hussein et al. [41]	Egypt Jan 2021	496	40.9	Concerns about safety, efficacy, newer techniques for vaccine development, and genetic mutations caused by vaccines.	Older age and history of chronic diseases.
Amin et al. [42]	USA Jan 2021	240	8	Vaccine being too new, concerns about side effects, and having had previous COVID infection.	Doctoral degree, and non-Black race.
Kociolek et al. [43]	USA Jan 2021	4277	8.4	Concerns about safety, long-term effects, m-RNA technology, and politics around the approval process for COVID-19 vaccines.	Male gender, White race, clinical worker, higher concerns about COVID-19 infection and disease but low medical risk.
Schradling et al [44]	USA Jan 2021	1398	14	Concerns about safety and efficacy of vaccines, pre-existing health conditions, and personal or religious reasons to not take vaccines.	Male gender, older age, doctoral degree, and White/Asian race.
Szmyd et al. [45]	Poland Jan 2021	387	17	Concerns about safety, short and long-term side effects, conspiracy theories, limitations of civil rights due to vaccine mandates.	Doctoral degree, past vaccine compliance, fear of COVID for self and family, and higher pandemic stress scores.

^aIndicates studies from the general population; data for healthcare workers were extracted from these studies. All studies listed in chronological order based on data collection dates

vaccine [46]. Their main concerns with the vaccine were potential side effects (60%), safety (48%), how well it works (30%), and not trusting the government (22%). These reasons for not getting vaccinated were very similar to the reasons found for HCWs in this review: concerns about safety, efficacy, and side effects of the COVID-19 vaccines. HCWs' willingness to be COVID-19 vaccinated serves an important role model function for the public. Studies have found that the public trusts physicians, hospitals, researchers, and health authorities to do the right thing regarding COVID-19. Also, studies from the general public on COVID-19 vaccination hesitancy have found that recommendations by healthcare providers are associated with lower odds for COVID-19 vaccination hesitancy [14, 29, 40, 47]. However, if HCWs continue to remain hesitant towards COVID-19 vaccines, it is unlikely that they would recommend these vaccines to the general public and ensure mass vaccinations with the available COVID-19 vaccines.

Several other sociodemographic characteristics that influence COVID-19 vaccination acceptance in the general public are also associated with COVID-19 vaccination acceptance or refusal in HCWs. For example, male HCWs were more likely to accept vaccines in this review. In the general public, it has been found that females are less likely to accept a COVID-19 vaccine and it has been postulated that this could be due to concerns about side effects such as infertility, serious side effects making them unable to take care of families, or greater susceptibility to myths and misinformation from media [3, 6, 13, 24, 40, 45]. A few studies on HCWs in this review also found higher vaccine acceptance in Whites and Asians. In the general public, COVID-19 vaccination hesitancy is well established among racial and ethnic minorities and the reasons could be similar irrespective of occupational groups (e.g., medical mistrust, history of discrimination and mistreatment in research, etc.) [3, 6, 9, 28]. Similar to findings in the general public, age was also a determinant for COVID-19 vaccination acceptance in HCWs; older HCWs were more willing to accept COVID-19 vaccines. This could be because older individuals may have higher education, greater experience in healthcare settings, greater perceived vulnerability to COVID-19 infection, or higher overall medical and health risk profiles [3, 5–8, 40]. Lower education is another factor associated with COVID-19 vaccination hesitancy in both HCWs and the general public. HCWs with lower education may not read the recent research, may have lower awareness or perceived risk of illness from COVID-19, lower past compliance with vaccinations, or may have a greater tendency to believe in community myths (e.g., conspiracy theories, injection of microchips, genetic mutation or infection from the vaccine, etc.) [6–12].

There is a lot of confluence for the aforementioned sociodemographic characteristics outlined in our review that associate with higher COVID-19 vaccination in HCWs.

A significant proportion of HCWs in the studies reviewed were females, with lower education and income, lower perceived risk of illness and younger, and belong to racial/minority populations. Frequently, these populations are overrepresented in the healthcare workforce as frontline, essential, or direct care workers [6–10]. Unfortunately, these are also the populations that have been most affected by the COVID-19 pandemic with a higher number of cases and deaths related to COVID-19 [3, 6, 9, 10]. Interdisciplinary and multipronged strategies must be utilized to increase COVID-19 vaccine uptake in these populations (e.g., incentives to be vaccinated, role models and community leaders encouraging vaccinations, educational interventions, hospital-based protocols and mandates, prioritizing vaccination for these groups and making vaccine access easy, giving time off or sick leave benefits to enable vaccination etc.) [6, 7, 9, 10, 47, 48].

Unlike the general public, HCWs have an obligation to “do no harm” to patients and a “duty to care” for patients who seek their help [48]. HCWs regularly work with vulnerable populations and cannot rely solely on wearing masks or personal protective equipment to fulfill their professional obligations to their patients. Also, healthcare facilities and their managers owe legal and ethical duties to their staff and patients for a safe healthcare environment. These facilities should consider a variety of protocols, educational interventions, and access options to increase COVID-19 vaccine uptake by their staff and patients. HCWs have an overwhelming need to become vaccinated and a moral obligation to serve as role models to encourage the public and their peers to engage in preventive health behaviors such as getting vaccinated with the available COVID-19 vaccines.

Several potential limitations should be considered regarding the results of this review. The search terms and methods used to identify relevant articles may have led to the omission of some relevant articles. Our criteria for selection (e.g., studies published in English during a certain time), may have introduced unknown biases. Uniformity in the primary outcome (declining to be vaccinated) differed significantly across studies (e.g., outright refusal, unlikely to take the vaccine, declined, disagreed with taking a vaccine, etc.) and may not be appropriately aggregated. Also, if a significant proportion of those who were unsure or undecided about COVID-19 vaccines end up declining the vaccine at a different period, the rates of hesitancy would be much higher than our estimates in this review. For the studies we included in this review, there were substantial differences in study participants based on age, gender, income, education, and professional roles (e.g., physicians versus nurses versus others). Aggregates presented in this review may not appropriately represent vaccine hesitancy for any particular group. Finally, this is a scoping review and not a quantitative

meta-analysis. We cannot, therefore, comment on quantitative estimates such as the weighted estimates of vaccination hesitancy accounting for sample sizes and study variations.

Conclusion

This scoping review of healthcare workers' hesitancy to be COVID-19 vaccinated found that, on average, 22.51% out of 76,417 HCWs worldwide were hesitant about the available vaccines. Their main concerns (safety, efficacy, and side effects) were very similar to the concerns identified by the general public. Being male, older, and having more advanced education were enabling factors for the uptake of COVID-19 vaccination. Healthcare workers have a moral imperative and duty to play an important role in the acceptance of COVID-19 vaccination by the public and their healthcare colleagues. Given the high rates of COVID-19 vaccination hesitancy in this population, education and policy-based interventions should be implemented to ensure that healthcare workers are vaccinated with the available COVID-19 vaccines. Without high compliance for COVID-19 vaccination among healthcare workers, there are enormous risks to the general public as well as healthcare workers.

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Declarations

Conflict of interest Authors have no conflicts of interest to declare.

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