

# A scoping review of COVID-19 vaccination hesitancy in dental health care workers

Alice He<sup>1</sup>, Eamon Yu<sup>1</sup>, Lisa Liu<sup>1</sup>, Woody Wu<sup>1</sup>, Rohan Rodricks<sup>1,2,\*</sup>, Constance Law<sup>1,2</sup>

<sup>1</sup> Faculty of Medicine and Health, Sydney Dental School, University of Sydney, Sydney 2010, Australia

<sup>2</sup> Oral Restorative Sciences, Division of Oral Health, Western Sydney Local Health District, Westmead 2145, Australia

\* Corresponding author: Rohan Rodricks, rohan.rodricks@health.nsw.gov.au

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**ABSTRACT:** Vaccine hesitancy amongst dental health care workers (DHCW) remains a concern due to the high risk of exposure to COVID-19 and the prolonged duration of aerosol-generating dental treatments. Ubiquitous acceptance of COVID-19 vaccines is critical for achieving herd immunity to combat this pandemic. This study aims to explore the individual, interpersonal and organizational factors contributing to vaccine hesitancy in dental professionals which may assist in the development of educational programs directed at enhancing vaccine acceptance. A total of 112 papers were identified of which 23 were deemed to be suitable. The socioeconomic model was employed as a framework to evaluate the contributing factors for vaccine hesitancy. Concerns over vaccine safety, lack of information, social media, socio-economic status and trust in governmental and pharmaceutical organizations were perpetuating reasons for vaccine hesitancy. The findings of this review highlight the importance of evidence-based vaccine education programs targeted at enhancing the knowledge surrounding COVID-19 vaccines which would assist in eradicating vaccine hesitancy within the dental community. This in turn has crucial implications in promoting vaccine acceptance within the general population.

**KEYWORDS:** COVID-19; vaccine; hesitancy; dental health care workers

## 1. Introduction

The emergence of the novel coronavirus identified in December 2019, Severe Acute Respiratory Syndrome-Coronavirus 2 (SARS-CoV-2), also known as COVID-19, has led to an unprecedented health crisis. Due to the unique nature of the dental work environment, dental health care workers (DHCW) have been identified as an at-risk group to virus exposure, resulting in an urgent need for an effective immunization strategy amongst other containment measures<sup>[1]</sup>. The prevalence of COVID-19 among DHCW varied greatly between 0.9% to 30%<sup>[2,3]</sup>.

Transmission of SARS-CoV-2 occurs through one of three ways: exposure to aerosols or respiratory droplets carrying infectious virus<sup>[4]</sup>, direct contact with infected bodily fluids<sup>[4]</sup>, or via touching mucous membranes after exposure to fomites contaminated with infectious virus particles<sup>[5]</sup>. Dentistry remains one of the most affected health professions in the current global pandemic, due to the potential exposure through these routes of transmission. DHCW are at a greater risk of contracting COVID-19 when compared to the general population<sup>[6]</sup> due to the close working proximity to the patient's airways, open-

bay settings within dental schools/hospitals, and the extended duration of aerosol-generating procedures<sup>[1,4]</sup>.

Vaccination is a highly effective strategy in reducing morbidity and mortality from infectious diseases, however, vaccine hesitancy remains one of the major global barriers to achieving herd immunity within a population<sup>[7]</sup>. Vaccine hesitancy has been defined as the “delay in acceptance or refusal of vaccination despite availability of vaccination services”<sup>[8]</sup>, and is influenced by factors such as “complacency, convenience and confidence”<sup>[8]</sup>. Significant factors contributing towards vaccine hesitancy include insufficient knowledge regarding the vaccine efficacy, and severe adverse reactions<sup>[9]</sup>. Vaccine hesitancy amongst DHCW is concerning due to their important roles as credible sources of health-related information and their increased risk of exposure to infections in a healthcare environment. Their opinions can markedly influence the public perception of vaccine acceptance, adherence, and hesitancy<sup>[9]</sup>. Therefore, vaccine hesitancy among DHCW could impact the implementation of vaccination programs within the community in the global efforts to combat COVID-19 infection<sup>[8]</sup>.

A multitude of personal, social and economic contextual indicators were found to be predictors of COVID-19 vaccine hesitancy amongst DHCW<sup>[7,9]</sup>. A socioeconomic model inclusive of individual, interpersonal and organization levels was used to categorize the common reasons affecting COVID-19 vaccine hesitancy among DHCW. Individual concerns of vaccine safety, efficacy and potential adverse reactions were primary reasons for COVID-19 vaccine hesitancy. Interpersonal factors were critical in shifting DHCW’ perceptions of vaccine acceptance in different socioeconomic environments. DHCW’ level of trust in organizational institutions and pharmaceutical companies were additional reasons for vaccine hesitancy levels. Government vaccine mandates for DHCW during a period of high vaccine hesitancy may have led to heightened unemployment rates and financial difficulties. As respected healthcare professionals, DHCW represent reliable sources of vaccine specific information to the general population. It is therefore important to understand the contributing factors for vaccine hesitancy within a specific field such as dentistry, to assess and address gaps in knowledge about vaccine development, production, efficacy, and safety as well as promote vaccine acceptance within the community. An enhanced understanding of the underlying factors of vaccine hesitancy among DHCW could facilitate the development of tailored vaccine education programs specific to the profession and improve public acceptance of COVID-19 vaccines.

## **2. Aim**

This study aims to explore factors influencing COVID-19 vaccine hesitancy among DHCW around the globe to facilitate the development of targeted education programs and initiatives to promote vaccine acceptance among DHCW and the general population.

## **3. Methods**

### **3.1. Search strategy for articles**

This scoping review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure the reproducibility of our findings. Published original papers from three main literature databases, (1) OVID-Medline, (2) Embase and (3) Scopus, that addressed vaccine hesitancy amongst the dental healthcare workforce were eligible for inclusion in this review. The search strategy was first performed in consultation with a qualified hospital librarian, followed consequently by a collective search by the authors.

The search strategy was based on the concept of COVID-19 vaccine hesitancy amongst dental healthcare workers. A search was done at the end of December 2022, using the following search terms: “hesitancy”, “compliance”, “acceptance”, “reluctance”, “vaccine”, “vaccination”, “immunization”, “dental”, “dentist”, “COVID-19” and “dental health care workers”. The subject and word search were entered individually into all the databases and then combined using Boolean operators “AND” and “OR”.

### **3.2. Screening of articles**

The reference lists of relevant publications from the search strategy were imported into EndNote X9 and shared with the authors. Only publications in English that were deemed relevant and suitable based on the title and abstract were reviewed for inclusion and duplicates were removed. Full text articles were assessed for suitability for inclusion after reviewing each article individually.

### **3.3. Inclusion and exclusion criteria**

Publications included in this review met the following inclusion criteria: (1) peer reviewed published articles from PubMed, (2) published from 2020 onwards, (3) concerned solely about dental healthcare workers/students, (4) the aims of the study were to investigate vaccine hesitancy.

The exclusion criteria were: (1) unpublished manuscripts (preprints), studies that assessed the general population, (2) studies that had a relatively small sample size, (3) published papers that have been withdrawn from the published source, (4) studies that did not investigate vaccine hesitancy, (5) publication language was not in English.

## **4. Results**

The results from the search strategy are shown in the PRISMA diagram (**Figure 1**). A total of 209 articles were identified, of which 112 were removed due to duplicates. A further 77 articles were excluded as they did not meet the inclusion criteria based on the titles and abstracts. The remaining 37 articles were evaluated with 16 excluded due to the following reasons detailed in **Figure 1**. The final 21 studies that fit the inclusion criteria were assessed to discuss the factors affecting vaccine hesitancy amongst DHCW (**Table 1**).

The study population of the included articles involved dental students, dental nurses as well as dentists and dental specialists. The surveys ranged from a single cross-sectional study to multiple follow-ups over a six-month period<sup>[10,11]</sup>. The definition of vaccine hesitancy varies among the studies included. Some articles specified a yes or no question to individuals receiving the vaccine<sup>[12]</sup> while others used a statement such as “COVID-19 is compulsory for all healthcare workers” and asked participants to mark agree, disagree or neutral<sup>[13]</sup>. As such, it was difficult to compare the true vaccine hesitancy in the selected papers. Bsoul and Loomer did not specifically discuss vaccine hesitancy but counted the percentage of individuals who had taken at least 1 dose of the vaccine as vaccine hesitancy<sup>[14]</sup>. Furthermore, there was a paucity of information available on whether individuals had changed their mind after receiving at least one dose of the vaccine.

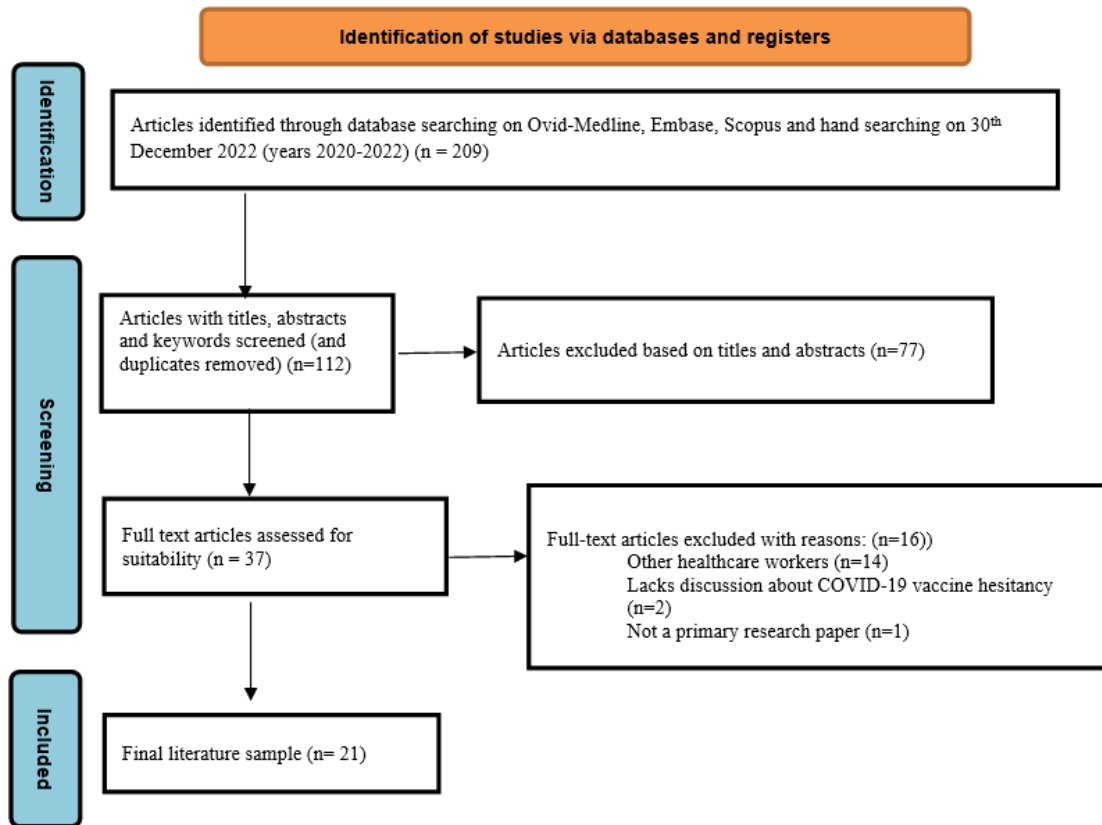


Figure 1. Prisma diagram.

Table 1. List of included studies.

Reference	Country	Type of study	Date range of study	Number of participants	Type of DHCWs	Hesitancy rate	Response recorded as vaccine hesitancy
10	South Africa	Cross sectional survey	September 2021–October 2021	205	Dental students	16.1%	-
11	United States	Longitudinal survey	4 January 2021–16 August 2021	3206	Dental hygienists	14%	Intending to be vaccinated and barriers to vaccination
12	Israel	Cross sectional study	March–April 2020	506	Dental professionals	15%	Results demonstrate correlation between an individual’s unemployment rate and their willingness to take the vaccine
13	Indonesia	Cross sectional study	June 2021	779	Dentists	NR	Discusses different factors as to why dentists might be hesitant about the vaccine without giving a flat hesitancy rate
14	United States	Observational survey study	29 January 2021–16 March 2021	379	Staff, students, faculty	-	94% took vaccine
16	multi-country	Online questionnaire	February–April 2021	1527	Dentists/dental students	27.5%	Disagreement to have the vaccine
17	Multi-country	Literature review	2007–2017	-	Healthcare staff	-	Unwillingness to receive vaccination
18	Palestine	Cross sectional study	February–March 2021	417	Dental students	27%	Not willing to take vaccine
19	Saudi Arabia	Saudi Arabia	December 2020–February 2021	247	Dental students	36%	Unsure and low acceptability
20	Portugal	Cross sectional questionnaire	14 April 2021–16 May 2021	890	Physicians, nurses, pharmacists, dentists	113/890	Did not want/No

Table 1. (Continued).

Reference	Country	Type of study	Date range of study	Number of participants	Type of DHCWs	Hesitancy rate	Response recorded as vaccine hesitancy
21	Jordan	Cross sectional survey	March–August 2021	409	Physicians, dentists, nurses	32.3%	Unwilling to take the vaccine
22	United States	Survey	September–December 2020	415	Medical and dental students	45% dental 23% medical	Not specified
23	Egypt	Cross sectional study	August–October 2021	171	Dentists	54.4%	Not willing to take the vaccine
25	Iran	Cross sectional survey	December 2020–January 2021	394	Dental students and dentists	62%	Delay vaccination until safety confirmed
26	Pakistan	Cross sectional study	Not recorded	164	Dentists, dental specialists, and assistants	7.32%	Refused to get vaccinated
28	Italy	Online survey	23 December 2020 to 2 January 2021	421	Dentists	17.8% (75/421)	“No” and “probably no” as hesitancy to receive vaccine
29	Lebanon	Cross sectional online survey	February 2021	529	Dentists	14%	Willing to get vaccinated
30	India	Lack of information	Lack of information	705	Dental students, dentists	15%	Vaccine acceptance or not
31	United States	Cross sectional survey	2020	248	Dental students	44%	Taken as unwilling/decline/hesitant
24,27	22 countries	Cross sectional study	February 2021	6639	Dental students	36.4%	Taken as unwilling to consent

## 5. Discussion

Vaccine hesitancy remains a crucial barrier hindering the uptake of COVID-19 vaccines in the general population. In Australia the percentage of vaccine hesitancy among the general population ranged between 6%–29%<sup>[15]</sup>. There is currently no data on vaccine hesitancy among DHCW in Australia. DHCW play an important role in the battle against COVID-19 through the safe provision of oral health care and the education and encouragement of the public to accept COVID-19 vaccines<sup>[16]</sup>. This scoping review uses the socio-economic model as a conceptual framework to provide a cohesive way of exploring the interplay of factors affecting COVID-19 vaccine hesitancy in DHCW on an individual, interpersonal, and organizational level<sup>[17]</sup>. This socio-economic model facilitates the notion that an individuals' behaviours and attitudes are shaped by a multidimensional layer of interpersonal and community factors. A thorough and collective approach in assessing these factors will aid in the development of future initiatives targeted at improving vaccine hesitancy amongst DHCW.

### 5.1. Individual

Individual beliefs and attitudes play a pivotal role in affecting DHCW willingness to accept COVID-19 vaccination. The lack of information on safety, efficacy and adverse reactions of the COVID-19 vaccine are listed as some of the contributing factors for vaccine hesitancy<sup>[10,18]</sup>. A study of South African dental students found that insufficient knowledge on the COVID-19 vaccine as one of the key factors contributing to a relatively high rate of vaccine hesitancy. Half of the students rated their knowledge of the COVID-19 vaccine as 'average', and reported a limited understanding of the herd immunity concept<sup>[10,19]</sup>. This lack of COVID-19 vaccine knowledge is also evident amongst DHCW in Portugal, where higher vaccine hesitancy among DHCW were reported compared to other healthcare worker colleagues<sup>[20]</sup>. Additionally, Portugal DHCW were found to be significantly more reluctant to test for

acquired immunity following COVID-19 vaccine or infection compared to the physicians and nurses<sup>[20]</sup>. This highlights the need for the development of vaccine education programs directed towards vaccine hesitant DHCW<sup>[20]</sup>.

Mistrust in the rapid development of the vaccine was a major concern for University of Western Cape South African dental students, highlighting the need for accurate and transparent information about the safety and efficacy of the vaccines<sup>[10]</sup>. More dentists felt the need to obtain sufficient information about the COVID-19 vaccination before receiving the vaccine compared with physicians, nurses, and pharmacists<sup>[20]</sup>. Saudi Arabian dental students expressed uncertainty about the unknown severe side effects and consequently reported a higher rate of vaccine hesitancy<sup>[19]</sup>. Another study involving Saudi Arabian dental students demonstrated that a lack of vaccine awareness was the main hindrance to achieving COVID-19 vaccine acceptance<sup>[21]</sup>. This is paralleled by concerns of potential side effects of COVID-19 vaccines reflected in the lower vaccine acceptance among DHCW in a multi-country survey<sup>[16]</sup>.

Dental students in the United States were hesitant to receive the COVID-19 vaccination due to their perception of COVID-19 being a trivial infection with a relatively quick recovery and lack of long-term side effects, along with their beliefs of having a lower risk of acquiring severe COVID-19 as part of the younger and healthier population<sup>[22]</sup>. Fear of allergic reactions, deterioration of current health status and complications resulting from the vaccine led to a declining rate of vaccine uptake and confidence in the vaccine among DHCW<sup>[23]</sup>. The lack of credible sources of information regarding the efficacy and safety of COVID-19 vaccine contributed towards heightened anxiety and vaccine hesitancy in DHCW<sup>[16,23]</sup>. Due to the scarcity of reliable information regarding COVID-19 vaccination, a significant proportion of Palestinian dental students believed that acquiring natural immunity from COVID-19 infection was the safer option compared to receiving the COVID-19 vaccine<sup>[10]</sup>. This highlights the necessity for educational interventions tailored to vaccine hesitant DHWC to increase COVID-19 vaccine acceptance levels.

Dental students were increasingly challenged by the discontinuation of clinical training, the unanticipated shift to online learning and the unprecedented increased risk of COVID-19 infection during aerosol-generating procedures<sup>[24]</sup>. These factors were pivotal in influencing dental students' willingness to get vaccinated to overcome the pandemic restrictions. It was shown that dental professionals that had attended COVID-19 training courses were more inclined to receive the vaccine<sup>[25,26]</sup>. Thus, the implementation of assurance strategies and education programs targeted at motivating hesitant DHCW to accept the COVID-19 vaccine may lead to increased COVID-19 vaccine acceptance amongst the general population globally. DHCW expressed greater need to receive more information about the vaccine post-vaccination than other healthcare workers, indicating the importance of strengthening communication and access to educational resources for DHCW even after vaccination<sup>[20]</sup>. Conclusively, a targeted approach towards educating DHCW about the necessity of COVID-19 vaccines will facilitate heightened vaccine acceptance across the population.

## **5.2. Interpersonal**

The influence of social media, religious and political stances, and the beliefs of friends and family are some of the interpersonal factors affecting DHCW's decision to accept the COVID-19 vaccine<sup>[20]</sup>. Social media platforms have been a considerable source of COVID-19 misinformation and speculation amidst the height of the pandemic, subjecting DHCW to the rapid spread of non-conclusive pro- and anti-vaccination beliefs, contributing to COVID-19 vaccine hesitancy<sup>[24,27]</sup>. A study by Riad et al. revealed that 33.4% of dental students' decision to acquire the COVID-19 vaccination was influenced by media

or social media, whilst 16.2% of the cohort based their decision on information from celebrities and/or religious/political leaders<sup>[27]</sup>. Similar findings were reported in South African dental students, with more than 50% of the students naming “social media” as one of the main sources for knowledge about the vaccine, followed by ‘healthcare workers’ and “health officials”<sup>[10]</sup>. Further studies demonstrated that social media is cited as one of the main information sources for individuals between 26–39 years when deciding if they would be vaccinated against COVID-19<sup>[24]</sup>. However, the power of social media in disseminating misinformation on a global scale may instigate vaccine uncertainties amongst DHCW due to its underlying motives in increasing viewer engagement and generating publicity<sup>[10]</sup>.

A motivating incentive for vaccine acceptance amongst dentists was to protect family, friends and patients<sup>[28,29]</sup>. Potgieter et al. reported that although most students did not feel individual pressure to get vaccinated, the pressure to get vaccinated from family and friends was one of the main motivators for receiving the COVID-19 vaccine<sup>[10]</sup>. Similarly, Kateeb et al. showed DHCW were concerned over potential transmission to family and friends, reinforcing the idea that the protection of family and friends is a significant motivator for adoption of COVID-19 preventative measures including vaccine uptake<sup>[18]</sup>. In addition, DHCW were also primarily concerned about factors including population vaccination level and vaccine-mandated travel restrictions. There was a much higher percentage of dentists compared to other healthcare workers agreeing to getting the vaccine if most of the population had been vaccinated and if it was required to travel between countries<sup>[20]</sup>. Further factors encouraging vaccine acceptance include the ability to return to normal everyday life, to avoid the need to wear masks, and to avoid missing work for socioeconomic reasons<sup>[28]</sup>.

Socioeconomic contextual factors were a key indicator of COVID-19 vaccine hesitancy on a global scale. Significantly, lower vaccine acceptance rates and confidence in COVID-19 vaccines were seen in dental students in low and lower middle-income countries when compared to upper-middle and high-income countries<sup>[16]</sup>. This may be attributed to the inequality in the distribution of and access to COVID-19 vaccines, heightened by the uncertainty concerning infection rates and transmission of the disease. Extreme economical and financial crises were shown to be a contributor to decreased vaccine hesitancy, exemplified by the higher vaccine acceptance in Lebanon where multiple total lockdowns motivated surveyed individuals to return to their normal lives<sup>[29]</sup>. A study conducted in Israel found a correlation between unemployment and the willingness to be vaccinated, demonstrating the influence of financial circumstances on COVID-19 vaccine acceptance<sup>[12]</sup>. A consideration of the interpersonal factors influencing COVID-19 vaccine hesitancy amongst DHCW illustrates the importance of providing accurate and transparent information to obtain the trust of and reduce vaccine hesitancy within the general population.

### **5.3. Organizational**

The level of trust in institutions plays a significant factor affecting DHCW attitudes towards the COVID-19 vaccine. According to the socio-ecological model, DHCW willingness to receive the COVID-19 vaccination is statistically associated with trust in the government to make decisions about the choice of vaccine, as well as the level of trust in the pharmaceutical industry to provide verifiable data about vaccine efficacy<sup>[18]</sup>. However, Sharaf et al.<sup>[23]</sup> found that 64% of DHCW in academia who refused to vaccinate conversely stated that they trust the pharmaceutical companies. This suggests that there is a lack of targeted educational programs for DHCW or that vaccine acceptance was borne out of fear of transmitting the disease<sup>[23]</sup>. Estrela et al. showed that DHCW were significantly less likely to believe that the information released by authorities compared to other healthcare workers<sup>[20]</sup>. Despite the high level

of trust in pharmaceutical companies, vaccine hesitancy was linked with concerns about the speed of production, safety, efficacy of the drug and its ability to worsen the condition of those inoculated<sup>[23]</sup>. Trust in the public health experts facilitated lower rates of vaccine hesitancy among dental students in the United States, which aligned with the opinions and consensus of the general population<sup>[14,21]</sup>. DHCW in Indonesia also showed lower vaccine hesitancy rates, owing to greater trust in their public health experts, with most DHCW strongly agreeing that the vaccines should be mandatory for both citizens and health workers<sup>[30]</sup>.

Contrastingly, a study in the United States showed that only 23% of a group of medical students including dental students were against vaccine uptake, while 50% of non-medical students would not accept the vaccines<sup>[21]</sup>. This high variability between the two populations may be partially explained by the effects of political polarization, where trust in political parties supersedes the trust in public health experts. This shows the differences in vaccine uptake that may occur when political agendas conflict with healthcare policies. South African dental students expressed that they primarily trusted vaccine information given by fellow healthcare providers over government and public health authorities, emphasizing the need for greater involvement of healthcare providers in governmental educational programs on the COVID-19 vaccine<sup>[10]</sup>. While only 35.1% of dental students in a multicenter international study trusted the government to make the most appropriate decision regarding the brand of vaccine provided, 63.5% of survey participants were willing to be inoculated, supporting the fact that organizational trust factors make up only a part of the reason for vaccine hesitancy<sup>[24,27]</sup>. Comparatively, the high vaccine hesitancy rates in South Asia were mainly due to the lack of public confidence in locally manufactured vaccines and an insufficient effort to promote education of DHCW about vaccination<sup>[13]</sup>. Cultural and political factors may act as obstacles underpinning vaccine hesitancy. Additionally, a lack of confidence in the healthcare system to ensure the universal availability of the COVID-19 vaccines when required, plays an important role in the unwillingness of DHCW to receive the vaccine<sup>[18]</sup>. A DHCW recommendation, as a trusted professional health figure, has been shown to be a strong positive correlate of vaccine acceptance amongst patients<sup>[31]</sup>. This serves to highlight the critical role of educating DHCW about vaccine safety so that they may pass on information promoting vaccine acceptance to patients to help lower vaccine hesitancy.

## **6. Limitations**

While there is extensive evidence outlining the factors affecting vaccine hesitancy in DHCW, there are some limitations in this scoping review. Firstly, the restriction of the articles to only English limits studies included and could result in language bias. Furthermore, the search strategy was limited to three databases. The selected key terms and search strategy may have omitted relevant literature due to synonyms and equivalent definitions used in other countries. Additionally, a variety of studies used different questionnaires or surveys which may have resulted in response bias due to the inconsistency of the method used and the lack of standardization. Many of the studies included in this review also used the non-probability snowball sampling technique which may have produced selection bias, and used an online-surveying method, which is limited to computerized and internet-friendly users. Due to the constantly evolving and dynamic nature of COVID-19 and the introduction of new COVID-19 vaccines, individuals' perceptions towards COVID-19 vaccine acceptance may fluctuate daily. Further studies investigating COVID-19 vaccine hesitancy across countries not included in this review could offer a broader global perspective of social and economic circumstances influencing DHCW vaccine hesitancy.



## 7. Conclusion

A detailed analysis of the individual, interpersonal and organizational factors provide a holistic perspective of variables affecting COVID-19 vaccine hesitancy in DHCW. The collective results highlight the need for a profession-specific vaccine program targeted at enhancing knowledge about the COVID-19 vaccines. This in turn will facilitate positive experiences to be shared with patients encouraging vaccine uptake. This requires a streamlined, coherent and transparent communication on the safety and effectiveness of COVID-19 assessing DHCW perceptions towards willingness to receive the COVID-19 vaccine is crucial in shaping patients' attitudes towards advocating for vaccine acceptance. Future educational curriculum aimed at enhancing knowledge regarding COVID-19 vaccines for dental students could be an efficient, cost-effective way to enhance public health literacy and combat vaccine hesitancy. A revision of the dental program curriculum to better inform dental students on the most up-to-date knowledge and understanding about vaccination trends including the COVID-19 vaccine is critical in facilitating the promotion of recommended public health measures against COVID-19 by DHCW. This review provides some insights into the knowledge and perceptions of DHCW towards COVID-19 vaccination and encourages further discussion into measures to reduce vaccine hesitancy in the dental community. Future studies could explore the avenues of using effective interventions to promote vaccination rates as well as fundamentally altering the core attitudes contributing to COVID-19 vaccine hesitancy.

## Conflict of interest

The authors declare no conflict of interest.

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