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Perspective

# COVID-19 vaccine refusal among dentists: Worldwide trends and a call for action

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Dear Editors,

In early 2021, healthcare workers (HCWs) were designated as priority groups for COVID-19 vaccination.<sup>1,2</sup> Despite the prioritization, reports of COVID-19 vaccination hesitancy among HCWs started emerging shortly after the vaccine rollout.<sup>1–3</sup> For example, an April 2021 review of 76,471 HCWs estimated that more than a fifth (22.5%) of the HCWs worldwide were hesitant toward obtaining COVID-19 vaccination.<sup>2</sup> Similarly, a June 2021 review of more than 30,000 HCWs worldwide estimated that COVID-19 vaccine acceptance

rates among HCWs ranged from 27.7% to 77.3%.<sup>3</sup> One of the earliest reviews of 24,952 HCWs (data till February 2021) estimated that COVID-19 vaccination willingness of HCWs worldwide was a mere 51%.<sup>4</sup> The vast majority of these HCWs' studies have focused on physicians, nurses, or medical students leaving a knowledge gap on COVID-19 vaccination preferences of several other groups of HCWs.<sup>3–6</sup>

Dentistry is a unique field in the healthcare arena that has not been studied much regarding COVID-19 infections. For example, while major professional organizations suggest a risk to dental care professionals (DCPs) of contracting COVID-19 due to the nature of their work, the extent of transmission is not documented by such organizations.<sup>7,8</sup> In contrast, some investigators have reported that COVID-19 infection rates among DCPs have ranged from less than 1% to more than 15%.<sup>7–9</sup> Studies have also suggested that the majority of DCPs in many countries continued to provide care during the pandemic, but several key prevention practices (e.g., wearing N95 masks/eye protection devices

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**Table 1** COVID-19 vaccination refusal rates and reasons among dental health professionals Worldwide<sup>11–27</sup>.

Authors	Country	Sample size (N)	Refusal rate (%)	Vaccine refusal reasons and enablers
<i>Practicing dentists</i>				
Kaplan et al. <sup>11</sup>	Turkey	63 <sup>a</sup>	15.9	<i>Reasons:</i> Lack of scientific literature on vaccine and preference for medications instead of vaccines. <i>Enablers:</i> Male sex, older age, past vaccinations, COVID-19 infection history, having a chronic disease, working for primary health center; belief that no other treatment exists, living with a family/child.
Papagiannis et al. <sup>12</sup>	Greece	80 <sup>a</sup>	17.5	<i>Reasons:</i> Lack of trust in vaccine safety, effectiveness, and fear of side effects from the vaccines. <i>Enabler:</i> Older age, past flu vaccination, higher trust on vaccines/vaccination in general and in the COVID-19 related information received from the public health authorities or government sources.
Arora et al. <sup>13</sup>	India	99 <sup>a</sup>	25.3	<i>Reasons:</i> Concerns about vaccine side effects and the speedy development; and a belief it is not needed due to past COVID-19 exposure or perception of not being in one of the high-risk groups. <i>Enablers:</i> Older age, desire to protect others in the family/community, to stop pandemic preventive measures.
Abbas et al. <sup>14</sup>	Pakistan	300	50.0	<i>Reasons:</i> Lack of trust and confidence in vaccines and their safety profiles, preference for natural immunity. <i>Enabler:</i> Male sex, middle age, flu vaccine history, higher training/knowledge, hospital-based job.
Fares et al. <sup>15</sup>	Egypt	13 <sup>a</sup>	23.1	<i>Reasons:</i> Concerns of vaccine safety, side-effect, efficacy; low trust in pharma/vaccine information. <i>Enablers:</i> Male sex, older age, COVID-19 patient care work or past infection or higher perceived risk of infection.
Belingheri et al. <sup>16</sup>	Italy	421	17.8	<i>Reasons:</i> Concerns of vaccine safety, efficacy, side effects, pharma influence; COVID-19 infection history, low perceived severity/risk of COVID-19 infection, lack of information/trust on vaccines. <i>Enablers:</i> Older age, past flu vaccination, belief that vaccines protect others and help reduce sick days in infected.
El-Sokkary et al. <sup>17</sup>	Egypt	22 <sup>a</sup>	18.2	<i>Reasons:</i> Negative attitudes about vaccines in general, social media influence on decision making, lack of knowledge about the approval of COVID-19 vaccines, and lower trust in vaccine safety. <i>Enablers:</i> High income/work years/perceived severity of COVID-19, and history of scientific meeting attendance
AlKetbi et al. <sup>18</sup>	UAE	90 <sup>a</sup>	14.4	<i>Reasons:</i> Concerns of vaccine side-effects, lack of data/information on vaccines, belief the vaccines may not work. <i>Enablers:</i> Male sex, old age, ethnicity, trust in producer/distributor of vaccines, believe vaccines are effective
Nasr et al. <sup>19</sup>	Lebanon	529	14.0	<i>Reasons:</i> Concerns of vaccine safety, efficacy, side effects, speedy development, low knowledge or trust in pharma companies, belief that infection provides immunity/vaccine not helpful for variants. <i>Enablers:</i> To protect self/others; to end the pandemic; higher perceived risk of COVID-19 infection.

**Table 1** (continued)

Authors	Country	Sample size (N)	Refusal rate (%)	Vaccine refusal reasons and enablers
Woolf et al. <sup>20</sup>	UK	716 <sup>a</sup>	21.1	<i>Reasons:</i> Lower vaccine knowledge/trust in vaccine efficacy/safety; mistrust of health organizations <i>Enablers:</i> Male sex, older age, past flu vaccination, higher perceived risk of COVID-19 infections.
Al-Sanafi et al. <sup>21</sup>	Kuwait	170 <sup>a</sup>	2.9	<i>Reasons:</i> Vaccine side effects/negative attitudes, belief virus was man-made & conspiracy theories. <i>Enablers:</i> Male sex, higher knowledge/COVID-19 infection risk, public sector work, chronic disease history.
King et al. <sup>22</sup>	USA	480 <sup>a</sup>	17.0	<i>Reasons:</i> Concerns of vaccine side effects, efficacy, safety; belief that vaccines are not needed. <i>Enablers:</i> Positive attitude for vaccines in general, recommendation of others, trust in government.
<b>Dentists</b> = 12 studies from 11 Countries with 2983 practicing dentists. Overall COVID-19 vaccination refusal rates = 19.0% (95% CI = 12.8–25.2)				
<i>Dental college students</i>				
Kelekar et al. <sup>23</sup>	USA	245 <sup>a</sup>	44.1	<i>Reasons:</i> Concerns about vaccine side effects, safety, efficacy, speedy approvals, and politicization. <i>Enablers:</i> Past vaccination, belief vaccines are important, trust in health experts/information source.
Mascarenas et al. <sup>24</sup>	USA	248	44.2	<i>Reasons:</i> Concerns of vaccine safety, side effects; lower trust in experts & COVID-19 information. <i>Enablers:</i> Past flu vaccination, high vaccine knowledge/perceived value, past COVID-19 infection.
Saied et al. <sup>25</sup>	Egypt	256 <sup>a</sup>	18.8	<i>Reasons:</i> Concerns of vaccine safety, efficacy, side effects, production source; and lack of information on vaccines. <i>Enablers:</i> Male sex, past flu vaccination, higher perceived COVID-19 risk, knowing infected people.
Riad et al. <sup>26</sup>	22 nations <sup>β</sup>	6639	13.9	<i>Reasons:</i> Concerns of vaccine safety, side effects, speedy development; low trust in government or pharmaceutical companies, antivaccination beliefs, COVID-19 infection history, social media sites. <i>Enablers:</i> Male sex, influence of leaders/celebrities, higher knowledge and availability of vaccines.
Kateeb et al. <sup>27</sup>	Palestine	417	14.8	<i>Reasons:</i> Concerns of vaccine safety, efficacy, availability; natural immunity beliefs; religious or cultural influences, knowing someone who died of COVID-19, lack of vaccine-related information. <i>Enablers:</i> Male sex, past flu vaccination, higher trust in government or pharmaceutical companies.
<b>Dental students</b> = 5 studies from 23 Countries with 7805 dental students. Overall COVID-19 vaccination refusal rates = 24.9% (95% CI = 13.6–39.9)				

<sup>a</sup> Sign indicates that the dentists included in studies were part of a larger sample including others types of HCWs and the reasons/enablers listed are for the total sample of HCWs. Studies have been arranged in chronological order in the table based on when they were conducted (not published). The overall prevalence of vaccine refusal among dentists and dentistry college students was estimated from the included studies with 95% confidence intervals using random-effects modeling. USA = United States of America, UK = United Kingdom, UAE = United Arab Emirates.

or checking patient body temperature) were not followed by more than a quarter of the DCPs.<sup>7–10</sup> Similar to the lack of studies worldwide on DCPs' COVID-19 infection rates, in a comprehensive review of literature, we could not find the global trends of COVID-19 vaccination preferences among DCPs. Therefore, we assimilated all empirical evidence on COVID-19 vaccination refusal among practicing dentists and dentistry college students.

Using a scoping review methodology,<sup>1,2,6</sup> we queried Google Scholar, CINAHL, and PubMed databases to search for articles using the keywords 'Dental', 'Dentist', 'Dentistry', 'Healthcare', 'COVID-19', 'SARS-CoV-2', 'Vaccination', 'Vaccine', 'Intention', 'Acceptance', and 'Hesitancy'. The studies selected for this review were published in English, conducted with samples of practicing dentists or dentistry college students, published between March 2020–December 2021, and quantified COVID-19 vaccine refusal rates among study participants. Refusal rates from studies were extracted if the study participants' responses were 'no', 'not', 'refused', 'declined', or 'disagreed' with obtaining COVID-19 vaccines. Responses such as 'maybe', 'not sure', 'unsure' were not considered as COVID-19 vaccine refusal among participants across studies included in this review. Pooled prevalence rates (with 95% confidence intervals) for COVID-19 vaccine refusal were computed from the selected studies using random-effects modeling.

A total of 17 studies were included in this global review; the majority ( $n = 12/17$ ) of these studies surveyed practicing dentists ( $n = 2983$  participants from 11 countries) and the rest ( $n = 5/17$ ) surveyed dentistry college students ( $n = 7805$  participants from 23 countries) [Table 1, references included in the [Supplementary Materials](#)<sup>11–27</sup>]. The overall rate of COVID-19 vaccination refusal among practicing dentists worldwide was 19.0% (95% CI = 12.8–25.2%) while the rate of refusal for dentistry college students was 24.9% (95% CI = 13.6–39.9%). In the vast majority of the studies ( $15/17 = 88.3\%$ ), concerns about the safety, efficacy, side effects, or speedy development of vaccines were found to be the reasons for COVID-19 vaccination refusal among study participants. An additional key reason for COVID-19 vaccine refusal across studies was trust (i.e., lower trust in pharmaceutical companies, government, experts, healthcare organizations, COVID-19 vaccines/infection-related information, or vaccinations in general). In contrast, the major predictors for COVID-19 vaccination acceptance were: male sex (9 studies), older age (7 studies), past flu vaccination (7 studies), or being at a higher risk for COVID-19 infection (6 studies) [Table 1, references included in the [Supplementary Materials](#)<sup>11–27</sup>].

The findings of our review are disconcerting, but not surprising given the results from earlier studies on COVID-19 vaccination hesitancy among HCWs.<sup>1–5</sup> The rate of vaccine refusal among dentists (19%) in our review seems to be slightly lower than refusal rates among HCWs published in the early stages of COVID-19 vaccination campaigns (>20%).<sup>2–4</sup> The reasons for these differences need further research (e.g., timing of studies, greater availability of

vaccines or scientific information with time, direct patient care role or higher perceived risk in dentists, etc.). In contrast, dentistry students had a much higher rate of COVID-19 vaccination refusal (24.9%). A recent review of 19,991 medical students and 31,948 non-medical college students around the world found the rates of vaccine refusal among these students to be 18.9% and 22% respectively; lower than what we observed for dentistry college students in this review.<sup>6</sup> Again, these differences in rates need additional research (e.g., timing of studies, medical students being more likely to work on the frontlines and getting vaccinated to do so, or greater on-site vaccine access for non-dentistry college students, etc.). Interestingly, the predictors of COVID-19 vaccine acceptance/refusal among DCPs are very similar to the predictors observed in the general public and other HCWs.<sup>3–6</sup>

Our review has limitations that have major implications for research and prevention practice. First, we reviewed data only on practicing dentists and dentistry college students. Assuming that other DCPs (e.g., dental assistants) may have lower training/knowledge (predictors of vaccination) compared to dentists; the actual rates of vaccine refusal could be higher in the dental care workforce. Additional studies are warranted to understand the vaccination preferences of such groups (e.g., support staff and hygienists). Second, while there is a plethora of studies on HCWs (e.g. physicians and nurses), we did not find many studies for dentists. Especially, studies on DCPs from Asia and Africa are almost non-existent and these continents also have vaccine availability-related challenges. Therefore, the actual rate of refusal or non-vaccinated DCPs globally could be much higher than our estimates. Finally, our vaccine refusal rates did not include study participants' responses such as 'not sure' or 'maybe'; if a lot of these DCPs never get vaccinated, the rates of refusal would be much higher than our estimates.

Many DCPs have independent practices in communities where policies such as vaccine mandates cannot always be enforced, vaccination on-site may not be available, clients may not always be screened for COVID-19 infection or vaccination, and based on our review, it appears that many DCPs remain reluctant towards COVID-19 vaccination. These unique circumstances pose a high risk for COVID-19 infection among DCPs and their clients. Policymakers, professional organizations, and healthcare leaders need to act urgently and decisively to address these issues in the field of dental health care. We also call upon scholars to conduct research with DCPs or increase DCPs' participation in studies of HCWs to better understand COVID-19 vaccination preferences in a variety of DCPs across various geographic regions and practice settings worldwide.

## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2022.01.001>.

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