

Dental students' attitudes and hesitancy toward COVID-19 vaccine

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Abstract

Background: Dentists are a group of providers who have been identified by CDC at high risk of exposure to COVID-19 through their contact with patients. This would apply to dental students as well. Thus, it is important to achieve high COVID-19 vaccination rates in this group. Further, as healthcare providers, they are entrusted with providing health recommendations and advocating for their patients, community, and profession, including vaccinations.

Methods: Using ualtrics^{XM} an online platform, in 2020, a survey was administered anonymously to dental students at three dental schools to assess the attitudes of dental students to the novel COVID-19 vaccine. Factors and reasons associated with vaccine hesitancy and acceptance toward the COVID-19 vaccine and likelihood of recommending and giving the vaccination to patients were assessed.

Results: Nearly, all participants had positive attitudes toward vaccines in general, agreed they would likely be exposed to COVID-19, and personally knew someone who had COVID-19; however, only 56% are willing to take a COVID-19 vaccine as soon as an FDA-approved vaccine was available. Of those unwilling to take the vaccine, 63% reported they would take it if mandated by the health systems/dental school; however, 16.3% of the overall respondents would not take the COVID-19 vaccine even if mandated. Several factors are associated with vaccine acceptance and the likelihood of recommending the vaccination, such as trusting public health experts, concerns about side effects, and agreeing with vaccine mandates.

Conclusion: Our results highlight the need for an educational curriculum about the safety and effectiveness to promote the uptake of COVID-19 vaccine.

KEYWORDS

attitudes, COVID-19, dental students, vaccine acceptance, vaccine hesitancy

1 | INTRODUCTION

The ongoing COVID-19 pandemic has resulted in devastating consequences not only in terms of number of cases

and deaths, but has also impacted the workplace, including the practice of Dentistry. Dentists and dental students in training directly interact with patients and are, therefore, a group at high risk for acquiring the infection or

transmitting the disease.¹ The dental workforce is at an increased risk of exposure to SARS-CoV-2 because of the closeness of the dental team with the patient and the often-lengthy dental visits involving aerosol-producing dental procedures. Thus, the early vaccination of dental providers including dental students is important to ensure a protected dental workforce and an adequate workforce to vaccinate the general public if the need arises.

The purpose of this study is to assess the attitudes of dental students to the novel COVID-19 vaccine. Vaccine hesitancy and acceptance are assessed to identify potential concerns that need to be addressed not only to ensure adequate uptake of the vaccine among these essential health-care providers, but also to ensure that they provide vaccine recommendations and counsel vaccine-hesitant patients.

2 | MATERIALS AND METHODS

This study was conducted with all (1481) dental students at three geographically distributed dental schools in Florida ($N = 505$), Michigan ($N = 576$), and Utah ($N = 400$). The study was approved by Oakland University (Protocol #: IRB-FY2021-58) and Nova Southeastern University (Protocol #2020-591) Institutional Review Boards. A survey instrument developed from previously validated surveys²⁻⁴ on attitudes and behaviors about vaccination administered to medical students⁵ was adapted for use with dental students. The survey consisted of demographic information on gender, age, race/ethnicity, and year in school and 29 questions that assessed the following domains: (1) previous immunization behavior; (2) general attitudes and perception of vaccines; (3) current knowledge/interest about COVID-19 vaccine; (4) perceived likelihood of COVID-19 infection; and (5) personal experience with COVID-19. The questions were all close ended on a Likert scale (strongly disagree to strongly agree) or dichotomous (yes/no) items, with one open ended question asking the respondent for suggestions on improving the uptake of COVID-19 vaccine. The survey was administered anonymously online using qualtrics^{XM} and took approximately 5 min to answer.

From qualtrics^{XM}, a dataset was downloaded that was imported to EXCEL and cleaned. Those who did not consent or complete the survey were deleted. The 4-point Likert scale items were recategorized as strongly agree/agree and strongly disagree/disagree for ease of interpretation. The data analyses were performed in Epi InfoTM Version 7.2.4.0. Descriptive statistics included frequencies, percentages, and means to describe the distributions of responses to individual questions in the survey. The students were then categorized by their willingness to take the COVID-19 vaccine upon FDA approval (willing/acceptors/nonhesitant and unwilling/decline/hesitant).

Chi-square and odds ratios (ORs) with 95% confidence intervals (CI) were used to identify statistically significant differences between dental students who would agree to take or disagree to take the COVID-19 vaccine upon FDA approval. Multiple logistic regression was used to identify predictors of willingness to take the COVID-19 vaccine; willing to recommend COVID-19 vaccine to family and friends; willing to recommend COVID-19 vaccine to patients; and willing to give COVID-19 vaccine to their patients, after controlling for demographic variables.

3 | RESULTS

The survey was completed by 248 dental students (response rate 18%) across the three dental schools with a higher proportion of preclinical (D1–D2, 59.6%) than clinical (D3–D4, 40.4%) students. The sample was 58% female with a mean age of 26.3 ± 3.8 , and racially diverse with 16.3% Hispanic, 2.8% African American, 13.1% Asian, 10.3% Middle Eastern/North African, and 55.5% White.

The majority (94.7%) of students agreed they would likely be exposed to COVID-19 as a health care provider and personally knew someone who had COVID-19 (89.8%); however, fewer (78.8%) indicated that COVID-19 vaccination was important to them, and even fewer (32.9%) indicated they would participate in a COVID-19 vaccine trial. Only 55.8% of students were willing to take a COVID-19 vaccine immediately upon FDA approval. Of those unwilling to take the vaccine, 63% reported they would take it if mandated by the health systems/dental school. There were still 16.3% of the overall respondents who reported they would not take the COVID-19 vaccine even if mandated.

Only two-thirds (65.6%) reported trusting the information they received about the COVID-19 vaccine from the public health experts, 67.4% were willing to recommend the vaccine to their family and friends, and a similar proportion (68.6%) would recommend it to their patients. An even fewer number of students (55.5%) were willing to vaccinate their patients.

In the bivariate analyses as seen in Table 1, students willing to take the vaccine were statistically significantly ($p < 0.05$) different on all questions except three questions compared to those hesitant to take the vaccine. The three questions were: I am likely to be exposed to COVID-19 as a future a health care provider; I personally know someone who had COVID-19 infection; and I personally know someone who had died from COVID-19 infection. No differences were seen by demographic variables of age, gender, race/ethnicity, year in school (D1–D4), and University in willingness to take the vaccine.

In logistic regression analyses, experience with COVID-19 and personal vaccination behaviors were not predictive of COVID-19 vaccine uptake upon FDA approval.

TABLE 1 Survey responses among COVID-19 vaccine acceptance and hesitant groups

Survey item	Participants that responded affirmatively (agree/strongly agree)			p value
	All respondents (N = 245) %	COVID-19 vaccine acceptance group (N = 136) %	COVID-19 vaccine hesitant group (N = 109) %	
General attitudes to vaccine				
People get more vaccines than are good for them	18.0	11.0	26.1	0.0016
Vaccines are important for me to stay healthy as a future health care provider	97.6	100.0	94.5	0.0057
It is my role as a future a health care provider to learn about vaccines for myself and my patients	98.8	100.0	97.3	0.0520
It is my role as a future healthcare provider to advocate for the vaccine for myself and my patients	86.5	98.5	71.3	<0.0001
COVID-19 vaccine – general opinions				
The COVID-19 vaccination should be mandatory for the general public	40.0	65.9	8.3	<0.0001
The COVID-19 vaccination should be mandatory for all health care providers	53.5	92.1	64.9	<0.0001
Personal views – COVID-19 and vaccine				
I am likely to be exposed to COVID-19 as a future a health care provider	94.7	96.3	93.6	0.3233
COVID-19 vaccination is important for me as a health care provider	78.8	99.3	53.2	<0.0001
I would like to be involved in a COVID-19 vaccine trial	32.9	58.2	0.93	<0.0001
I am concerned that a COVID-19 vaccine may not be effective	54.1	42.2	68.8	<0.0001
I am concerned about serious side effects from a COVID-19 vaccine	43.5	40.7	92.7	<0.0001
I need more information about the COVID-19 vaccine	89.8	85.1	96.3	0.0037
I trust the information I am receiving about the COVID-19 vaccine from the public health experts	65.6	92.8	33.9	<0.0001
The only reason I will get a COVID-19 vaccine is if it is mandated by health systems/medical school	31.6	5.1	64.2	<0.0001
I would recommend the vaccine to my family and friends	67.4	98.5	33.0	<0.0001
I would recommend the vaccine to my patients	68.6	97.7	36.7	<0.0001
I would give the vaccine to my patients	55.5	75.7	34.0	<0.0001
Experience with COVID-19				
I am at a risk of getting severely ill from COVID-19 infection	34.7	44.1	22.9	0.0005
I had COVID-19 infection	10.6	5.4	16.8	0.0047

(Continues)

TABLE 1 (Continued)

Survey item	Participants that responded affirmatively (agree/strongly agree)			p value
	All respondents (N = 245) %	COVID-19 vaccine acceptance group (N = 136) %	COVID-19 vaccine hesitant group (N = 109) %	
I personally know someone who has had COVID-19 infection	89.8	87.6	92.5	0.2135
I personally know someone who has died from COVID-19 infection	24.6	24.8	24.3	0.9283
Personal Vaccination Behavior				
As an adult, have you ever delayed getting a vaccine for reasons other than illness or allergy?	21.6	14.7	29.9	0.0049
As an adult have you ever decided not to get a vaccine for reasons other than illness or allergy?	23.3	9.3	40.2	<0.0001
Did you get a flu vaccine during the 2019–2020 flu season?	60.5	73.6	44.8	<0.0001
Do you plan on getting a flu vaccine this flu season (2020–2021)?	72.5	88.3	53.2	<0.0001

However, those who trusted COVID-19 information received from public health experts and thought the COVID-19 vaccination should be mandatory for the general public were more likely to take the COVID-19 vaccine uptake upon FDA approval, and those concerned about serious vaccine side-effects, and reported willingness to get a COVID-19 vaccine if it is mandated by health systems/dental school were less likely to take the vaccine. Of the demographic variables, those younger were more likely to take the vaccine (Table 2).

Logistic regression analyses modeling for recommending the vaccine to family and friends, again demographic variables, experience with COVID-19, and personal vaccination behaviors were not predictive. Those willing to take the COVID-19 vaccine upon FDA approval, trusted public health experts, and thought the COVID-19 vaccination should be mandatory for the general public were more likely to recommend and those concerned that a COVID-19 vaccine may not be effective were statistically significantly less likely to recommend vaccine to family and friends.

In modeling for willingness to give the vaccine to their patients using logistic regression, again demographic variables and experience with COVID-19 were not predictive, but personal vaccination behaviors were predictive. Those who agreed that COVID-19 vaccination was important to them as health care providers got a flu vaccine during the 2019–2020 flu season, and would recommend the vaccine to family and friends were more likely to give the vaccine to patients, and those reporting they needed more information about the COVID-19 vaccine were statistically signif-

icantly less likely to give the vaccine to patients. Interestingly, their own willingness to take the COVID-19 vaccine upon FDA approval was not predictive.

Twenty-six dental students provided comments. Themes identified reflected concerns about vaccine safety/efficacy, rapid development/implementation of vaccine, trust in regulatory agencies, politicization, and resources and education for the public.

4 | DISCUSSION

This study is the first to evaluate attitudes toward COVID-19 vaccination and vaccine hesitancy among US dental students. As future healthcare providers, understanding dental students' perspectives is important not only because of the high-risk the COVID-19 virus poses to our profession, but also because of the potential enlistment of dentists to play additional roles during a pandemic. In the current circumstance, these roles range from advocating on behalf of our profession and patients, educating our patients, to assisting or vaccinating our patients and communities.

A surprising result is that only 56% were willing to take the COVID-19 vaccine once approved by the FDA, with a very large cohort of 44% unwilling to take it. These proportions are similar to those seen in the US general population. Our results suggest several possible reasons for this hesitancy: general attitudes toward vaccines with one out of five dental students agreeing that people get more vaccines than are good for them; one out of five have also

TABLE 2 Logistic regression analyses and models

Survey item	Participants who responded affirmatively (agree/strongly agree)			
	Willing to take COVID-19 vaccine when FDA approved	Willing to recommend COVID-19 vaccine to family and friends	Willing to recommend COVID-19 vaccine to patients	Willing to give COVID-19 vaccine
Demographics				
Age	0.30 (0.09, 0.99)	NS	NS	NS
Gender	NS	NS	NS	NS
Race/ethnicity	NS	NS	NS	NS
Clinical status (D3–D4 vs. D1–D2)	NS	NS	NS	NS
General attitudes to vaccine				
People get more vaccines than are good for them	NS	NS	NS	NS
It is my role as a future healthcare provider to advocate for the vaccine for myself and my patients	NS	NS	NS	NS
COVID-19 vaccine – general opinions				
The COVID-19 vaccination should be mandatory for the general public	5.46 (1.39, 21.37)	21.82 (1.40, 340.57)	10.38 (1.22, 87.97)	NS
Personal views – COVID-19 and vaccine				
COVID-19 vaccination is important for me as a health care provider	NS	NS	5.92 (1.58, 22.24)	5.74 (1.77, 18.61)
I will take the COVID-19 vaccine as soon as an FDA-approved vaccine is available	–	22.40 (3.01, 166.84)	23.22 (3.44, 156.67)	NS
I am concerned that a COVID-19 vaccine may not be effective	NS	0.25 (0.07, 0.97)	NS	NS
I am concerned about serious side effects from a COVID-19 vaccine	0.07 (0.02, 0.33)	NS	NS	NS
I need more information about the COVID-19 vaccine	NS	NS	55.47 (2.13, 1444.21)	0.12 (0.02, 0.97)
I trust the information I am receiving about the COVID-19 vaccine from the public health experts	4.13 (1.15, 14.91)	5.30 (1.54, 18.26)	5.47 (1.75, 17.11)	NS
The only reason I will get a COVID-19 vaccine is if it is mandated by health systems/medical school	0.02 (0.005, 0.11)	NS	NS	NS
Experience with COVID-19				
I am at a risk of getting severely ill from COVID-19 infection	NS	NS	NS	NS
I had COVID-19 infection	NS	NS	NS	NS
Personal Vaccination Behavior				
Did you get a flu vaccine during the 2019–2020 flu season	NS	NS	NS	2.69 (1.30, 5.51)

Note: African Americans with Asians as the reference group.

delayed getting or decided not to get a vaccine for reasons other than illness or allergy; and two out of five did not get a flu vaccine during the 2019–2020 flu season. The prevailing practice of the widespread use of personal protective equipment in Dentistry might have also allayed the students concerns of contracting or transmitting COVID-19. A recent study reported the prevalence of COVID-19 infection in dentists low at 0.9%, which could have also impacted vaccine hesitancy.⁶ Further, although the majority thought they were likely to be exposed to COVID-19 as a future dentist (95%) and personally knew someone who had COVID-19 (89.8%), 65% did not consider themselves at a risk of getting severely ill from COVID-19 infection. This was also reflected in their comments. There were also several concerns about the COVID-19 vaccination which included 54% being concerned that a COVID-19 vaccine may not be effective and 44% concerned about serious side effects from a COVID-19 vaccine. Lack of trust in the information received from public health experts was also a concern.

It is interesting to note that a respondent's previous experience with COVID-19 was not predictive of vaccine acceptance or hesitancy; willingness to recommend the vaccine to family and friends, and patients; and willingness to give the vaccine to patients. A surprising predictor across the models was agreeing with vaccine mandates, particularly mandates to vaccinate the general public.

As in the general public,^{7–9} trust of the information received from public health experts seemed to play a key role in vaccine acceptance by the dental students with those willing to take the vaccine four times more likely (OR 4.13, 95% CI 1.15, 14.91) to trust information from public health experts. It is not surprising that those willing to take the vaccine were less likely to be concerned about the serious side effects from a COVID-19 vaccine. Additionally, students providing comments mentioned politicization of the vaccine, need for transparency, and concerns about the speed of vaccine development potentially impacting vaccine safety. Minimization of the severity of COVID-19 infection with frequent comparison to common cold and influenza was also reported. To some extent, it is disappointing that dental students had similar opinions and lower COVID-19 acceptance to the general public¹⁰ in several domains with regard to the COVID-19 vaccine, particularly because an accreditation standard¹¹ is providing students with the tools to address these concerns as stated in Standard 2-10 “Graduates must be competent in the use of critical thinking and problem-solving, including their use in the comprehensive care of patients, scientific inquiry and research methodology.” It seems we might have failed to inculcate these concepts in our students.

Research has shown that a physician's recommendation is a strong correlate of vaccine acceptability among patients.^{9,12,13} There is an urgency for dentists to join other

Healthcare Providers (HCPs) as the world begins mass vaccination campaigns, to outrace the new more contagious SARS-CoV-2 variants and end the pandemic. Previous studies have shown that medical students who are vaccinated have positive attitudes toward vaccines and it is hoped that by sharing their vaccination experiences with their patients, they may be able to encourage vaccine uptake.^{3,4} All persons interacting with patients in the clinical setting should be confident about the safety and effectiveness of COVID-19 vaccines and should be taught how to make strong recommendations for COVID-19 vaccination.¹⁴ Early engagement with dental students through enhanced curriculum is thus necessary as evidenced by our results. This curriculum should include increasing dental students' knowledge and attitudes about vaccines, and teaching vaccine counseling skills using evidence-based interventions. Studies with medical students have shown that curriculum interventions are effective with flu vaccine acceptance.¹⁵

4.1 | Limitations of this study

The sample size of 248 and the resultant wide confidence intervals for some of the variables could be considered a limitation of this study. This was due to the fact that the vaccine was almost here and time was of the essence to get unbiased results. That the survey included students at three dental schools that are geographically distributed, and the racial diversity of the respondents, enhances generalizability. Further, no differences were seen by school in willingness to take the vaccine. When compared to dental students nationally, our sample of students were similar in gender distribution, but had a higher proportion of underrepresented minority students, which were mostly Hispanic students.¹⁶ Nonresponse bias is also a possibility as those who did not respond might have been more hesitant about the vaccine than respondents. This nonresponse would underestimate the true prevalence of vaccine hesitancy among dental students resulting in larger true differences between those willing to take the vaccine and those not willing to take the vaccine. Additionally, as this study assessed willingness to get the vaccine, it assessed the respondent's intentions, which may differ from behavior. Therefore, it is difficult to predict if those who indicated that they would take the vaccine will actually do so and vice-a-versa.

5 | CONCLUSIONS

This study in dental students demonstrated substantial vaccine hesitancy to the COVID-19 vaccine. The 2020 American Dental Association House of Delegates at its

recent meeting in October 2020 passed Resolution 91H-2020 that supports dentists' willingness to administer vaccines, including the COVID-19 vaccine.¹⁷ Further, as of March 2021, federal legislation has been passed allowing dentists to provide vaccinations.¹⁸ With these two developments, as the current dental curriculum is lacking in this area, there is an imperative need to include in the dental curriculum training designed to enhance student knowledge about vaccines, including the COVID-19 vaccine, and to teach vaccine counseling skills.

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COMPETING INTERESTS

The authors have no competing financial interests or personal relationships to declare.

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