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Caregiver acceptance of an anticipated COVID-19 vaccination

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ABSTRACT

Background. The world is hopeful a vaccine will help mitigate the COVID-19 pandemic. The authors conducted a hospital-based study using a questionnaire to examine parental acceptance of an anticipated COVID-19 vaccination.

Methods. A 41-item questionnaire using the Health Belief Model was administered to caregivers of children receiving oral health care in a dental clinic in an urban pediatric teaching hospital. Demographic, health-seeking, and health-behavior questions were assessed.

Results. A total of 39.2% of caregivers would not allow their child to receive a COVID-19 vaccination. Whereas 27.8% of caregivers agreed that if their physician recommends a COVID-19 vaccination, they will allow their child to receive it, 52.2% said that a health care professional could influence this decision.

Conclusions. Dentists, intimately aware of the suggested risks of aerosol-generating procedures, can play a critical role in educating the public about the importance of accepting a COVID-19 vaccine.

Practical Implications. Dentists are in a unique position to discuss and advocate for vaccine acceptance. If a COVID-19 vaccine is not widely accepted, risks associated with performing aerosol-generating procedures will remain.

Key Words. COVID-19; vaccinations; pediatric dentistry; vaccine acceptance.

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An outbreak of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, has affected health care throughout the United States and worldwide. Concerns for the spread of the disease while keeping patients and providers safe have dominated discussions in all domains of health care. Historically, health care workers have proved to be at increased risk of contracting a virus during virulent outbreaks, as shown during the 2003 severe acute respiratory syndrome (SARS) epidemic and the 2009 H1N1 influenza pandemic.¹ Given that the primary route for transmission of SARS-CoV-2 is through droplets and aerosols, dental health care providers (DHCP) are at a particularly high risk of becoming infected and further spreading the virus.² Although symptomatic patients are likely the primary source of transmission, available data indicate that asymptomatic patients and those still in the incubation period are also carriers and potential spreaders of SARS-CoV-2.³ It is believed that children with COVID-19 frequently remain asymptomatic, and although they may have a lower transmission rate, there is concern that they still can be responsible for infecting others.⁴ This is of particular concern to DHCPs who complete aerosol-generating procedures on children and may be exposed to droplets and aerosols of asymptomatic carriers.

Vaccination is frequently cited as 1 of the most effective ways to prevent and control infectious disease,⁵ and, therefore, it is understood that vaccination may be the most reliable way to prevent and contain COVID-19.³ However, the literature reports complex beliefs and influences that cause populations to be hesitant, and even resistant, to vaccination.^{1,5-10} Personal experience, perceived effectiveness, and concerns regarding safety and adverse effects are the most influential factors in predicting parents' decision to vaccinate their child and themselves.⁶

Although there are common themes in regard to vaccine hesitancy, there are variations in the justification, both geographically and to specific vaccines.⁷ The Health Belief Model (HBM) is a

widely used framework for understanding health behaviors,⁸ including patient perceptions of disease and vaccination.⁹ There are 6 major parts of the original HBM: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and individual characteristics or self-efficacy.¹⁰

Pediatric dentists are in a unique position to support public health—accepted positions on vaccinations to patients and caregivers of patients, including a potential COVID-19 vaccine. The goal of our study was to investigate how receptive caregivers of pediatric dental patients would be to a potential COVID-19 vaccination. A secondary goal of our study was to investigate what influences the caregivers' decisions to vaccinate children, using the HBM framework. Information gathered from this study will allow for a greater understanding of the potential barriers to receiving a COVID-19 vaccination. This information can facilitate developing strategies to address vaccine hesitancy and anticipatory guidance regarding COVID-19 vaccinations and the potential effects for patients who opt in or out.

METHODS

This research was determined to be exempt from oversight by the Cincinnati Children's Hospital Medical Center Institutional Review Board (2020-0574). Caregivers (legal guardians or people authorized to consent in congruence with hospital policy) whose children were being treated in the pediatric dental clinic at 2 Cincinnati Children's Hospital Medical Center locations were asked to complete a questionnaire voluntarily to investigate their willingness to vaccinate their child with the potential COVID-19 vaccination.

We developed a 41-item questionnaire using the HBM theoretical framework. We collected survey data from September 28, 2020, through November 10, 2020. Fifteen survey questions were modeled from the HBM, 10 questions were related to demographic questions, 14 questions were designed to discover factors that could potentially influence the caregivers' decision to vaccinate, and, finally, 2 questions asked about caregivers' intentions to receive the vaccine and vaccinate their child. The HBM portion of the questionnaire was scored using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The demographic variables collected included age, sex, race and ethnicity, religious beliefs, highest education level completed, ZIP Code, number of children the caregiver cares for, and if any of the caregiver's children have any medical conditions. Multiple answers could be selected for certain demographic questions.

We piloted the questionnaire with a convenience sample of 10 caregivers for readability, clarity, and comprehension of instructions. On the basis of these findings, we made minor modifications regarding readability and clarity to the questionnaire. We did not include data from the pretested questionnaire in data analysis.

We administered the survey on an iPad using a SurveyMonkey application or we administered the survey on paper. One study investigator (R.R.M.) entered information from paper surveys obtained into SurveyMonkey. Study investigators (R.R.M., E.S.G., J.L.C.) approached English language-speaking caregivers in dental treatment rooms to invite them to complete the optional survey. Caregivers were informed that the survey would not affect their child's care. As study investigators were also clinicians, surveys were collected in between patient care responsibilities. Study investigators were immediately available for any questions or concerns but did not distribute surveys or ask for participation from caregivers of patients who were being treated by the study investigators the day the survey was distributed. All participants completed the survey while they were in the dental clinic. Caregivers were entered into a raffle for a gift card for their participation.

We completed and analyzed descriptive statistics for statistical significance. We reported frequencies as well as means and standard deviations. We analyzed categorical variables using a χ^2 test with Yates correction using SAS 14.2 (SAS Institute). We set significance level at *P* value below .05.

RESULTS

Demographics

Ninety-nine caregivers completed a questionnaire. Not all questions were completed by all 99 participants. Caregivers largely identified as female (81 of 97, 83.5%) (Table 1). Nearly 97% (95 of 98) identified as being not of Hispanic, Latino, or Spanish origin; however, we included

ABBREVIATION KEY

DHCP:	Dental health care providers.
HBM:	Health Belief Model.
MIS-C:	Multisystem inflammatory syndrome in children.
SARS-CoV-2:	Severe acute respiratory syndrome coronavirus 2.

Table 1. Caregiver demographics.

CATEGORY	DATA
Average (Standard Deviation) Age, y (Range)	38.8 (9.1), (24-63)
Average (Standard Deviation) No. of Children (Range)	2.8 (1.6), (1-11)
Sex, No., n/N (%)	
Female	81/97 (83.5)
Male	16/97 (16.5)
Are You Hispanic, Latino, or Spanish Origin?, No., n/N (%)	
Yes	3/98 (3.1)
No	95/98 (96.9)
How Would You Describe Yourself? (Select All That Apply), No., n/N (%)	
American Indian or Alaska Native	2/96 (2.1)
Asian	2/96 (2.1)
Black	20/96 (20.8)
Native Hawaiian	0/96 (0)
White	70/96 (72.9)
Other	4/96 (4.2)
What Is Your Present Religion, if Any? (Select All That Apply), No., n/N (%)	
Christian (all denominations)	59/98 (60.2)
Muslim (Islam)	4/98 (4.1)
Jewish	2/98 (2.0)
Agnostic (not sure if there is a God)	2/98 (2.0)
Jehovah's Witness	1/98 (1.0)
Mormon (Church of Jesus Chris of Latter-day Saints/LDS)	1/98 (1.0)
Orthodox (Greek, Russian, other)	0/98 (0)
Buddhist	0/98 (0)
Hindu	0/98 (0)
Atheist (do not believe in God)	0/98 (0)
Unitarian (Universalist)	0/98 (0)
Other	3/98 (3.1)
None	19/98 (19.4)
Don't know	1/98 (1.0)
Wish not to say	7/98 (7.1)
What Is the Highest Degree or Level of School You Have Completed?, No., n/N (%)	
< High school	4/97 (4.1)
High school diploma or General Educational Development credential equivalent	24/97 (24.7)
Some college, no degree	31/97 (32.0)
College degree	26/97 (26.8)
Master's degree	10/97 (10.3)
Doctorate degree	0/97 (0)
Professional degree	2/97 (2.1)
Do Any of Your Children Have Any of the Following Medical Conditions? (Select All That Apply), No., n/N (%)	
Heart conditions	1/96 (1.0)
Breathing problems	8/96 (8.3)
Behavior issues	11/96 (11.5)
Obesity	4/96 (4.2)

Table 1. Continued

CATEGORY	DATA
Diabetes	0/96 (0)
Cancer	0/96 (0)
None	73/96 (76.0)
Other, please specify	6/96 (6.3)

only English language–speaking participants in our study. Most caregivers identified as White (70 of 96, 72.9%), with 20 of 96 (20.8%) identifying as Black, 2 of 96 (2.1%) as Asian, 2 of 96 (2.1%) as American Indian or Alaska Native, and 4 of 96 (4.2%) as other. This is representative of the known demographics for the clinic population. In terms of religious identification, most caregivers (59 of 98, 60.2%) identified as Christian (all denominations). Nineteen of 98 (19.4%) caregivers selected no religion. Education levels varied among caregivers. Thirty-one of 97 (32.0%) had some college education, 26 (26.8%) had a college degree (for example, bachelor of science, bachelor of arts), 24 (24.7%) had completed high school or a General Educational Development credential equivalent, 10 (10.3%) had a master's degree, 4 (4.1%) had less than a high school degree, and 2 (2.1%) had a professional degree such as a doctor of medicine or juris doctor. The average (standard deviation) age of caregivers was 38.8 (9.1) years. Full demographic responses are reported in Table 1. Most caregivers in our study (73 of 96, 76.0%) reported that their children did not have any medical issues. Few caregivers declined to participate in the study, and among this group, no additional information was collected.

Preventive dental practice and vaccinations

Most caregivers (90 of 97, 92.8%) always allowed their children to have fluoride placed when recommended by the dentist (Table 2). Only 6 (6.2%) sometimes allowed fluoride, and 1 caregiver (1.0%) reported that they never allow fluoride. The results were similar for radiographs: 96 of 97 caregivers (99.0%) always allowed radiographs when recommended by the dentist. Only 1 caregiver (1.0%) said sometimes, and no caregivers chose never.

Many caregivers (91 of 97, 93.8%) themselves received childhood vaccinations (Table 2). However, only 43 of 97 caregivers (44.3%) receive the yearly influenza vaccine, and only 21 of 97 (21.6%) are required to receive it (for example, for work). Vaccination data for children were similar to caregiver data. Most caregivers (91 of 97, 93.8%) reported that their child was up to date on vaccinations, but only 45 of 96 (46.9%) reported their child received a yearly influenza vaccine. Thirty-six of 96 caregivers (37.5%) reported that their child did not receive the yearly influenza vaccine, and 15 of 36 (41.7%) reported their child sometimes received it. Seventy-seven of 94 caregivers (81.9%) reported that their child was not required to have a yearly influenza vaccine (for example, for school or day care).

Despite caregivers' high acceptance of fluoride, it was not predictive of yearly influenza vaccine for their child (odds ratio [OR], 0.01; 95% CI, 0.002 to 0.097; $P < .0001$) or their willingness to accept a COVID-19 vaccine if available (OR, 0.006; 95% CI, 0.001 to 0.05; $P < .0001$). Similarly, history of childhood vaccinations for the caregiver was not predictive of acceptance of a COVID-19 vaccination for themselves or their child (OR, 1; 95% CI, 0.197 to 5.1; $P < .0001$).

COVID-19

Most caregivers (80 of 96, 83.3%) reported they never had COVID-19, although 8 (8.3%) were unsure if they had COVID-19. Similarly, for children, 85 of 96 caregivers (88.5%) reported their child never had COVID-19, with 6 (6.3%) reporting they were not sure. Forty-six of 96 caregivers (47.9%) knew someone who had COVID-19, and 22 (22.9%) knew someone who was hospitalized with COVID-19 (Table 3).

There was much uncertainty surrounding whether caregivers would receive or allow their child to receive an available COVID-19 vaccine. Thirty-seven of 97 caregivers (38.1%) were not sure if they would receive an available COVID-19 vaccine, and 38 (39.2%) were not sure if they would allow their child to receive an available COVID-19 vaccine (Table 3). Only 21 caregivers (21.6%) would

Table 2. Caregiver dental and vaccination experience.

STATEMENT OR QUESTION	RESPONSE	NO., n/N (%)
When My Child Goes to the Dentist, I Allow Them to Have Fluoride Placed as Recommended by the Dentist.	Always	90/97 (92.8)
	Sometimes	6/97 (6.2)
	Never	1/97 (1.0)
When My Child Goes to the Dentist, I Allow Them to Take X-rays as Recommended by the Dentist.	Always	96/97 (99.0)
	Sometimes	1/97 (1.0)
	Never	0/97 (0)
Did You Receive Childhood Vaccinations (for Example, Measles, Mumps, Rubella, Tetanus)?	Yes	91/97 (93.8)
	No	3/97 (3.1)
	Don't remember	3/97 (3.1)
Do You Receive the Yearly Flu Vaccination?*	Yes	43/97 (44.3)
	No	37/97 (38.1)
	Sometimes	17/97 (17.5)
Are You Required to Receive the Yearly Flu Vaccine (for Example, for Work)?	Yes	21/97 (21.6)
	No	76/97 (78.4)
Is Your Child Up to Date on Vaccinations?	Yes	91/97 (93.8)
	No	3/97 (3.1)
	Not sure	3/97 (3.1)
Does Your Child Receive the Yearly Flu Vaccine?	Yes	45/96 (46.9)
	No	36/96 (37.5)
	Not sure	15/96 (15.6)
Is Your Child Required to Receive the Yearly Flu Vaccine (for Example, for School or Day Care)?	Yes	11/94 (11.7)
	No	77/94 (81.9)
	Not sure	6/94 (6.4)

* Owing to rounding the values do not sum to 100%.

accept a vaccine for their child, and 38 (39.2%) would not. This was similar for the caregivers themselves, with 19 of 97 (19.6%) accepting a vaccine, whereas 41 (42.3%) would not. Caregivers who knew someone with COVID-19 were more likely to accept a COVID-19 vaccination (OR, 0.473; 95% CI, 0.24 to 0.934; $P = .038$), but caregivers who knew someone who was hospitalized because of COVID-19 were not ($P = .241$). Age of child was not a strong factor in caregivers' deciding whether they would allow their child to have a COVID-19 vaccine, with 76 of 98 caregivers (77.6%) saying that age would not influence their decision. However, of the 45 caregivers (46.9%) who said their child received a yearly influenza vaccine, only 18 (40%) also said they would allow their child to receive a COVID-19 vaccine. This association was not statistically significant ($P = .633$).

Lastly, we asked questions regarding health-seeking and acceptance to determine parental perceptions of COVID-19 and preventive measures. We collapsed the 5-point Likert scale into 3 categories (agree, neutral, disagree) because of low categorical counts. We asked questions to determine caregivers' perceptions about severity of and susceptibility to the virus, barriers and benefits to vaccination, and cues to action (Table 4). Of particular interest, 30 of 97 caregivers (30.9%) agreed their child was at risk of getting COVID-19. Also, most caregivers (63 of 97, 64.9%) agreed that wearing a facial covering helped prevent the spread of COVID-19. The responses were similar when asked about social distancing; 73 of 97 caregivers (75.3%) believed it

Table 3. Caregiver COVID-19 experience.

QUESTION	RESPONSE	NO, n/N (%)
Would YOU Receive the COVID-19 Vaccine if Available?	Yes	19/97 (19.6)
	No	41/97 (42.3)
	Not sure	37/97 (38.1)
Would You Allow YOUR CHILD to Receive the COVID-19 Vaccine if Available?	Yes	21/97 (21.6)
	No	38/97 (39.2)
	Not sure	38/97 (39.2)
Have YOU Had COVID-19?*	Yes	8/96 (8.3)
	No	80/96 (83.3)
	Not sure	8/96 (8.3)
Has YOUR CHILD Had COVID-19?	Yes	5/96 (5.2)
	No	85/96 (88.5)
	Not sure	6/96 (6.3)
Do YOU Know Someone Who Has COVID-19?	Yes	46/96 (47.9)
	No	47/96 (49.0)
	Not sure	3/96 (3.1)
Do YOU Know Someone Who Has Been Hospitalized with COVID-19?*	Yes	22/96 (22.9)
	No	73/96 (76.0)
	Not sure	1/96 (1.0)
Does the Age of Your Children Influence Your Decision to Allow Them to Receive a COVID-19 Vaccine if Available?	Yes	22/98 (22.4)
	No	76/98 (77.6)

* Owing to rounding the values do not sum to 100%.

prevents the spread of COVID-19. Significantly, more caregivers who felt their child was at risk of getting COVID-19 also felt that masks (OR, 4.9; 95% CI, 2.1 to 11.0; $P < .0001$) and social distancing ($P < .0001$) prevent the spread of COVID-19. There was an association between knowing someone who had COVID-19 and wearing a facial covering to prevent spread of COVID-19 (OR, 17.3; 95% CI, 5.6 to 53.5; $P < .0001$). However, there was no association between knowing someone who has COVID-19 and the belief that their child may be at risk of getting COVID-19 ($P = .903$).

We asked 1 question about individual characteristics and self-efficacy, specifically, possible influences on decision making for acceptance of a COVID-19 vaccine for a child (Table 3). Most caregivers (48 of 92, 52.2%) said that recommendations from a health care professional would influence their decisions. Other options given were a family member or friend (6 of 92, 6.5%), government (5 of 92, 5.4%), media (2 of 92, 2.2%), all of the above (including health care professionals, 4 of 92, 4.3%), or none (39 of 92, 42.4%). When a response of none was given, caregivers were able to provide their own answers as to what would influence their decisions. Some of these response themes included previous reactions to vaccinations, extensive testing and data on adverse effects, medical literature, and personal beliefs or a person's own research on the vaccine.

DISCUSSION

Vaccinating the population against COVID-19 likely will be the most effective way to control the pandemic.¹¹ However, the speed at which these vaccines have been formulated, tested, manufactured, and distributed is unprecedented and has created widespread doubt concerning the safety and efficacy of vaccination against COVID-19. Factors such as adverse effects, allergic reactions, and the novelty of using messenger RNA contribute to widespread skepticism. In our study, less than 20% of

Table 4. Caregiver responses to questions on health-seeking and health-acceptance behaviors.

STATEMENT	RESPONSE	NO., n/N (%)	HEALTH BELIEFS MODEL DOMAIN
If My Child Gets COVID-19, They Will Get Sick.	Disagree	11/96 (11.5)	Perceived severity of virus
	Neutral	42/96 (43.8)	
	Agree	43/96 (44.7)	
If My Child Gets COVID-19, They Will Have to Go to the Hospital.	Disagree	23/98 (23.5)	Perceived severity of virus
	Neutral	44/98 (44.9)	
	Agree	31/98 (31.6)	
If My Child Gets COVID-19, They May Never Show Symptoms.*	Disagree	12/95 (12.6)	Perceived severity of virus
	Neutral	35/95 (36.8)	
	Agree	48/95 (50.5)	
My Child Is at Risk for Getting COVID-19.	Disagree	28/97 (28.9)	Perceived susceptibility to virus
	Neutral	39/97 (40.2)	
	Agree	30/97 (30.9)	
If My Child Gets COVID-19, Other Members of Our Family Will Get Sick.	Disagree	14/96 (14.6)	Perceived susceptibility to virus
	Neutral	34/96 (35.4)	
	Agree	48/96 (50.0)	
Wearing a Mask or Facial Covering Helps Prevent the Spread of COVID-19.	Disagree	12/97 (12.4)	Perceived susceptibility to virus
	Neutral	22/97 (22.7)	
	Agree	63/97 (64.9)	
Social Distancing (for Example, Keeping 6 Feet Apart from Others) Helps Prevent the Spread of COVID-19.	Disagree	4/97 (4.1)	Perceived susceptibility to virus
	Neutral	20/97 (20.6)	
	Agree	73/97 (75.3)	
Dentists and Dental Health Care Providers Are at High Risk for Getting COVID-19.	Disagree	8/98 (8.2)	Perceived susceptibility to virus
	Neutral	17/98 (17.3)	
	Agree	73/98 (74.5)	
I Am Worried My Child Will Get Sick or Have Side Effects from a COVID-19 Vaccine.	Disagree	14/96 (14.6)	Perceived clinical barrier to vaccination
	Neutral	29/96 (30.2)	
	Agree	53/96 (55.2)	
I Am Worried About How I Would Pay for the COVID-19 Vaccine for My Child.	Disagree	55/96 (57.3)	Perceived clinical barrier to vaccination
	Neutral	19/96 (19.8)	
	Agree	22/96 (22.9)	
It Would Be Difficult to Take Off From Work or School to Take My Child for the COVID-19 Vaccine.*	Disagree	59/97 (60.8)	Perceived clinical barrier to vaccination
	Neutral	17/97 (17.5)	
	Agree	21/97 (21.6)	
The COVID-19 Vaccine May Prevent My Child from Getting Sick.	Disagree	21/95 (22.1)	Perceived benefits of vaccination
	Neutral	49/95 (51.6)	

* Owing to rounding the values do not sum to 100%.

Table 4. Continued

STATEMENT	RESPONSE	NO., n/N (%)	HEALTH BELIEFS MODEL DOMAIN
	Agree	25/95 (26.3)	
My Child Getting the COVID-19 Vaccine May Stop Other Children from Getting Sick with the Virus.	Disagree	23/96 (24.0)	Perceived benefits of vaccination
	Neutral	42/96 (43.8)	
	Agree	31/96 (32.2)	
The COVID-19 Vaccination May Prevent Dentists and Dental Health Care Providers from Getting Sick with the Virus.	Disagree	17/98 (17.3)	Perceived benefits of vaccination
	Neutral	37/98 (37.8)	
	Agree	44/98 (44.9)	
If My Doctor Recommends That My Child Receive the COVID-19 Vaccine, Then I Will Vaccinate My Child.	Disagree	41/97 (42.3)	Cue to action
	Neutral	29/97 (29.9)	
	Agree	27/97 (27.8)	

caregivers were willing to receive a COVID-19 vaccine immediately, and less than 22% would allow their children to receive it immediately.

Available data suggest that children are susceptible to infection of the SARS-CoV-2 virus, but they are less likely than adults to become severely ill.¹² In April 2020, a novel syndrome in children and adolescents, termed multisystem inflammatory syndrome in children (MIS-C) was first described, and it is believed to be related to COVID-19. The clinical presentation and diagnosis of MIS-C include fever, severe illness, and involvement of 2 or more organ systems, along with laboratory evidence of inflammation and of COVID-19.¹³ The reports of this novel syndrome caused widespread uncertainty among caregivers and health care providers, who were once hopeful that healthy children would not fall ill if infected. MIS-C has also caused some to doubt the safety of a COVID-19 vaccine for children, because this syndrome involves postinfectious immune dysregulation. A COVID-19 vaccine theoretically could predispose children and adolescents to MIS-C given that this is believed to be an immune-mediated syndrome.¹³ As health care professionals, we must continue to evaluate the data and closely monitor the safety and efficacy of all COVID-19 vaccinations to make accurate recommendations to the public. During data collection of our study, there were no vaccines approved by the US Food and Drug Administration for emergency use authorization, and, as of the writing this article, there are still no COVID-19 vaccines approved for use in children younger than 16 years, all which likely influenced results.

Hesitancy to receive a COVID-19 vaccination leaves the population at greater risk of developing infection and experiencing mortality. As health care providers and, to a greater extent, as dentists, we are depending on widespread vaccination to limit the risk of developing infection and to safely deliver treatment. Disinformation and generalized distrust regarding the safety and efficacy of the vaccine are rampant, with news outlets and politicians reporting mixed messaging regarding the COVID-19 vaccine. In our study, most participants (52.2%) said that recommendations from health care professionals would influence their decisions in receiving a COVID-19 vaccine. This finding is consistent with other studies, such as 1 that evaluated acceptance of the novel H1N1 vaccine. Researchers found that participants were more likely to intend to receive the novel H1N1 vaccine if a physician had recommended it.⁹ Therefore, health care professionals are encouraged to incorporate vaccine recommendations and education in their daily patient-associated activities during a pandemic.⁹

Identifying barriers to vaccine acceptance, as described by the HBM, is important for successful anticipatory guidance counseling to help promote vaccine acceptance and to effectively communicate to the population. In our study, only 44.7% of caregivers agreed with the statement that they worried that their child would get sick from the virus, and even fewer (31.6%) agreed that their child could be hospitalized as result of a COVID-19 infection. This lack of perceived severity of the virus is a barrier that some dentists may encounter. Similarly, only 26.3% of caregivers agreed that a

vaccine may prevent their child from getting sick with COVID-19, and 32.2% of caregivers agreed that their child's getting a COVID-19 vaccination could stop other children from getting sick. This barrier of perceived benefits of vaccination represents another hurdle that dentists will have to surmount when discussing vaccinations with caregivers.

Despite this, DHCPs must include the COVID-19 vaccine in their discussions about vaccination, just like the influenza and human papillomavirus vaccines. Dentists play a critical role in educating the public about the importance of accepting a vaccine at a time when skepticism may be high, and, in regions where the state dental board allows, dentists should also be ready and willing to help administer the vaccine to the public.

One of the limitations of our study is the small number of participants (n = 99). Regional (Greater Cincinnati, Ohio area), cultural (72.9% White, 100% English-language speaking), and sex (83.5% female) diversity within the population sample were limited, compromising generalizability. In addition, at the time that survey collections were completed, the 2020 US presidential election had not been decided. Although the data suggest that this population does not consider the government (5.4%) or media (2.2%) as an influence to accept a COVID-19 vaccine, there is widespread belief that politics and media coverage has a substantial influence on public opinion and understanding regarding COVID-19. The data could change if the same survey were administered in 2021, considering the fluidity of the pandemic. On December 11, 2020, the US Food and Drug Administration issued the first emergency use authorization for a COVID-19 vaccine in people 16 years and older.¹⁴ As of February 2021, 2 additional vaccines have been approved for emergency use authorization. This will likely have a profound effect on how the population feels about vaccine acceptance. As the HBM predicts that there may be low vaccine acceptance for children, more research is needed to determine the perceived barriers to and acceptance of a COVID-19 vaccine and to better understand the implications of regional and cultural diversity. However, dentists and oral health care providers can play a critical role in promoting vaccine acceptance.

CONCLUSIONS

Although caregivers are accepting of certain dental procedures for their child (for example, fluoride treatment and radiographs), they may not be accepting of a COVID-19 vaccination for themselves or their child. Dentists, as health care providers, play a critical role in making recommendations about the COVID-19 vaccination. As uncertainty exists among caregivers about whether their child will get sick with COVID-19, dentists should discuss the importance of vaccination to prevent the negative sequelae of the disease. Identifying barriers to vaccine acceptance, such as limited availability, is important for successful anticipatory guidance counseling to help promote vaccine acceptance and to effectively communicate to the population. ■

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1. Seale H, Kaur R, Wang Q, et al. Acceptance of a vaccine against pandemic influenza A (H1N1) virus amongst healthcare workers in Beijing, China. *Vaccine*. 2011;29(8):1605-1610.

2. Ahmed MA, Jouhar R, Ahmed N, et al. Fear and practice modifications among dentists to combat novel coronavirus disease (COVID-19) outbreak. *Int J Environ Res Public Health*. 2020;17(8):2821.

3. Baghizadeh Fini M. What dentists need to know about COVID-19. *Oral Oncol*. 2020;105:104741.

4. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta Paediatr*. 2020;109(6):1088-1095.

5. Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy and healthcare providers. *Expert Rev Vaccines*. 2015; 14(1):99-117.

6. Goss MD, Temte JL, Barlow S, et al. An assessment of parental knowledge, attitudes, and beliefs regarding influenza vaccination. *Vaccine*. 2020;38(6): 1565-1571.

7. Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine*. 2016;34(52): 6700-6706.

8. Reiter PL, Brewer NT, Gottlieb SL, McRee AL, Smith JS. Parents' health beliefs and HPV vaccination of their adolescent daughters. *Soc Sci Med*. 2009;69(3):475-480.
9. Coe AB, Gatewood SB, Moczygmba LR, Goode JV, Beckner JO. The use of the health belief model to assess predictors of intent to receive the novel (2009) H1N1 influenza vaccine. *Innov Pharm*. 2012;3(2):1-11.
10. Chen IH, Hsu SM, Wu JJ, et al. Determinants of nurses' willingness to receive vaccines: application of the health belief model. *J Clin Nurs*. 2019;28(19-20):3430-3440.
11. Wang J, Peng Y, Xu H, Cui Z, Williams RO 3rd. The COVID-19 vaccine race: challenges and opportunities in vaccine formulation. *AAPS PharmSciTech*. 2020;21(6):225.
12. Ahmed S, Mvalo T, Akech S, et al. Protecting children in low-income and middle-income countries from COVID-19. *BMJ Glob Health*. 2020;5(5):e002844.
13. Nakra NA, Blumberg DA, Herrera-Guerra A, Lakshminrusimha S. Multi-system inflammatory syndrome in children (MIS-C) following SARS-CoV-2 infection; review of clinical presentation, hypothetical pathogenesis, and proposed management. *Children (Basel)*. 2020;7(7):69.
14. FDA News Release: FDA takes key action in fight against COVID-19 by issuing emergency use authorization for first COVID-19 vaccine. Accessed December 14, 2020. <https://www.fda.gov/news-events/press-announcements/fda-takes-key-action-fight-against-covid-19-issuing-emergency-use-authorization-first-covid-19>