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# A cross-sectional survey of anxiety levels of oral and maxillofacial surgery residents during the early COVID-19 pandemic

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**Purpose.** The coronavirus disease 2019 (COVID-19) pandemic has increased anxiety among the general population. The purpose of this project was to investigate attitudes and anxiety among oral and maxillofacial surgery (OMS) residents during the early COVID-19 pandemic.

**Materials and Methods.** This was a cross-sectional study. OMS residents were sent electronic invitations to answer a survey. The survey was sent in April and May 2020. Residents enrolled in OMS residency programs accredited by the Commission on Dental Accreditation were included. Predictor variable was attitudes of OMS residents toward the pandemic. The outcome variable was anxiety levels of OMS residents due to the pandemic according to the Hospital Anxiety and Depression Scale-A. Other variables were demographic characteristics, general knowledge regarding the pandemic, and attitudes of OMS residents toward the pandemic. Statistical analysis was performed using Fisher's exact test, Wilcoxon rank sum test, and univariate and multivariate logistic regression ( $P < .05$ ).

**Results.** We received 275 responses. The majority of respondents were males (74.5%) aged 26 to 30 (52.7%). Residents reported different levels of anxiety (i.e., mild 58.2%, severe 41.8%). Based on multivariate analysis, moderate or severe anxiety was associated with being female ( $P = .048$ ) and a senior resident ( $P = .049$ ). Factors such as potential deployment to other services, availability of personal protective equipment, and unclear disease status of patients contributed to anxiety.

**Conclusion.** Our study found that during the early COVID-19 pandemic, all residents experienced some anxiety. Senior OMS residents and female OMS residents experience higher anxiety levels than other residents. (Oral Surg Oral Med Oral Pathol Oral Radiol 2021;000:1–8)

In December 2019, city officials in Wuhan, China, recognized a cluster of patients with pneumonia caused by an unknown etiology and linked to Huanan Seafood Wholesale Market.<sup>1,2</sup> In February 2020, the World Health Organization (WHO) officially named the disease coronavirus disease 2019 (COVID-19).<sup>1</sup> The rapid virus transmission caused an international emergency associated with substantial morbidity and mortality worldwide.<sup>1,3,4</sup> COVID-19 is now considered a pandemic.<sup>3</sup> COVID-19 is unique because asymptomatic patients can act as carriers for weeks before they develop symptoms.<sup>5</sup> COVID-19 is transmitted mainly by the respiratory route or via contact with infected

secretions,<sup>6</sup> but other methods of transmission have been reported (e.g., fecal-oral route,<sup>6</sup> fomites<sup>7</sup>). COVID-19 concentrates in the upper airway mucosa<sup>5</sup>; procedures involving this location (i.e., a majority of procedures in oral and maxillofacial surgery, OMS) are considered high risk. When viral particles become aerosolized, they can stay in the air for at least 3 h.<sup>5,8</sup> COVID-19 infection can progress rapidly, has unknown definitive treatment, and may require intensive resuscitation and rehabilitation.

During this pandemic, emotional distress and anxiety are increasing in the general population. There is a fear of becoming ill, in addition to financial losses, shelter-in-place orders, inability to spend time with family and friends, and conflicting messages from authorities.<sup>9,10</sup> Health care workers (HCWs) are not immune to the psychological

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## Statement of Clinical Relevance

The coronavirus disease 2019 (COVID-19) pandemic has increased anxiety among health care workers. Prior to the COVID-19 pandemic, more than half of oral and maxillofacial surgery (OMS) residents reported moderate to severe anxiety during their residency. Our study found that during the early COVID-19 pandemic, all residents experienced some anxiety. Senior OMS residents and female OMS residents experience higher anxiety levels than other residents.

effect of the COVID-19 pandemic.<sup>11</sup> HCWs face unique circumstances with long working hours, an increased risk of infection, an increase in loss and suffering, and a shortage of personal protective equipment (PPE).<sup>11,12</sup> Asymptomatic COVID-19 carriers increase disease transmission.<sup>13</sup> HCWs can be asymptomatic carriers of the virus, resulting in virus transmission to their family and friends.

Prior to the COVID-19 pandemic, more than half of OMS residents reported moderate to severe anxiety during their residency.<sup>14</sup> The COVID-19 pandemic is hypothesized to further increase the level of anxiety among OMS residents.<sup>14,15</sup>

The purpose of this study was to investigate the attitudes and presence of anxiety among OMS residents during the early COVID-19 pandemic. The investigators hypothesize that anxiety levels are high due to the COVID-19 pandemic. The specific aims were to investigate (1) the attitudes of OMS residents toward the early COVID-19 pandemic and (2) OMS residents' anxiety levels during the early COVID-19 pandemic.

## MATERIALS AND METHODS

### Study Design

The study was approved by Emory University's institutional review board (approval no. 00000418). We designed and implemented a cross-sectional analytical study. A 27-question, closed-ended, anonymous survey (Figure 1) was sent electronically to OMS residents in the United States.

### Study Sample

The study population consisted of all US OMS residents enrolled in an OMS residency program approved by the Commission on Dental Accreditation. The study sample consisted of residents who responded to and submitted the survey. Exclusion criteria were (1) OMS residents in non-Commission on Dental Accreditation accredited programs, (2) incomplete surveys, (3) surveys returned after the closure of the study, and (4) residents with invalid emails. The study team contacted representatives of all OMS programs to obtain email addresses for all residents. The survey was sent to OMS residents in April and May 2020.

### Study Variables

The primary predictor variables were attitudes regarding effects of the pandemic on residents' own health, graduation requirements, and self-perceived competency. The primary outcome variable was anxiety level measured using the Hospital Anxiety and Depression Scale-A (HADS-A). The survey consisted of 3 sections. The first section included demographic data (age, sex, marital status, parental status, program type, postgraduate year [PGY], and location (by US region)). The second section investigated general knowledge and attitudes of OMS

#### Survey Questions

##### Section 1: Demographics

1. What is your age group?
2. What is your gender?
3. What is your marital status?
4. Do you have children?
5. What is your OMS program type?
6. What year are you in residency?
7. Where are you located?

##### Section 2: Knowledge and Attitudes Regarding COVID-19

8. Do you believe you will recover if you get infected by COVID-19 virus?
9. Do all infected patients with COVID-19 die?
10. Are you at occupational risk of getting COVID-19?
11. Are you hesitant about treating patients with COVID-19?
12. Are you worried about being deployed to critical care, medicine or anesthesia services?
13. Do you feel N95 mask provides enough personal protection during treatment of a COVID-19 POSITIVE patient?
14. Do you feel N95 mask provides enough personal protection during treatment of a COVID-19 NEGATIVE patient?
15. Do you feel N95 mask provides enough personal protection during treatment of a PERSON UNDER INVESTIGATION (PUI)?
16. Do you believe that your institution should test every patient for COVID-19 virus?
17. Do you feel that COVID-19 is getting unnecessary attention currently?
18. Do you feel the government has taken enough steps to eradicate the disease?

##### Section 3: HADS-A

19. Are you worried about meeting your graduation requirements because of COVID-19 pandemic?
20. Are you worried about not being surgically competent because of decrease in surgical experience secondary to COVID-19 pandemic?
21. I feel tense or "wound up"
22. I get a sort of frightened feeling as if something awful is about to happen
23. Worrying thoughts go through my mind
24. I can sit at ease and feel relaxed
25. I get a sort of frightened feeling like "butterflies" in my stomach
26. I feel restless as I have to be on the move
27. I get a sudden feeling of panic

Fig. 1. Survey questions.

residents toward the COVID-19 pandemic. Residents reported their beliefs and feelings toward (1) their own recovery from COVID-19; (2) patient mortality; (3) their own occupational risk; (4) hesitation to treat patients; (5) deployment to other services (critical care, medicine, anesthesia); (6) thoughts regarding PPE when treating patients who are COVID-19 positive, negative, or under investigation (PUI); (7) universal testing; (8) media coverage; and (9) government actions regarding management of COVID-19. The third section consisted of the HADS-A. The HADS covers 14 items, 7 of which relate to anxiety symptoms (HADS-A) and 7 that relate to depressive symptoms (HADS-B).<sup>16,17</sup> HADS-A has 88% sensitivity and 81% specificity for diagnosis of an anxiety

disorders.<sup>14,18</sup> Further discussion regarding the utility of HADS is beyond the scope of this article. The survey reliability and validity were previously tested to measure anxiety and depression in various patient populations.<sup>19-22</sup>

In our study, we used the anxiety scores (HADS-A) with subcategories of feelings (tension, fear, worry, relaxed, nervous, panic, and restlessness).<sup>14,18</sup> Each item has a Likert response scale (0 = *most of the time*, 3 = *from time to time or occasionally*).<sup>23</sup> Scores were summed (0 to 21), with higher scores indicating an increase in anxiety, from none/mild (0-7), moderate (8-10), or severe (11-21) anxiety. Previous studies demonstrated that these scores are reliable.<sup>16</sup>

### Data Collection and Analysis

The study data were collected and managed using the Research Electronic Data Capture platform (REDCap, Fort Lauderdale, FL, USA) hosted at the Emory University School of Medicine.<sup>24</sup>

All analyses were performed using R statistical software (Version 3.6.3; The R foundation; Vienna, Austria). For the purposes of this analysis, residents were dichotomized into 2 cohorts based on anxiety scores <8 (no/mild anxiety) and ≥8 (moderate/severe anxiety). For univariate analyses, Fisher's exact test was used to examine categorical variables. Wilcoxon's rank-sum test was used to examine differences in ordinal variables between cohorts. For multivariate analysis of predictors of moderate/severe anxiety, multivariate logistic regression was performed on predictors with  $P < .1$  on univariate analysis. In order to limit model overfitting, backwards elimination variable selection was performed based on minimizing the corrected Akaike information criterion. Statistical significance was defined as  $P < .05$ .

## RESULTS

All 101 OMS residency programs were contacted to request email addresses of OMS residents. Of them, 82 programs shared a complete list of resident emails, 8 programs provided an institutional email listserv, and 2 programs shared individual emails of residents who were interested in participating. Nine programs did not participate: 8 did not reply and 1 refused. The survey was sent to 1142 residents and 14 invalid email addresses from various programs were found. Overall, 275 (24.3%) residents completed the survey.

### General Background of OMS Residents

Of the 275 residents who responded, 205 were male (74.5%) and 70 were female (25.5%). Age ranges were as follows: 26 to 30 years ( $n = 145$ , 52.7%), 31 to 35 years ( $n = 110$ , 40%), 36 to 40 years ( $n = 16$ , 5.8%), younger than 25 ( $n = 2$ , 0.7%), or older than 40 ( $n = 2$ , 0.7%). The majority of respondents were married

( $n = 147$ , 53.5%). One hundred ninety-three had no children (70.2%), 72 had children (26.2%), and 10 were expecting (3.6%). Most of the residents surveyed were located in northeastern states ( $n = 104$ , 37.8%), followed by southeastern ( $n = 71$ , 25.8%), midwestern ( $n = 60$ , 21.8%), southwestern ( $n = 35$ , 2.7%), northwestern ( $n = 1$ , 0.04%) states or other (4, 1.5%). Most residents were enrolled in a 4-year ( $n = 148$ , 53.8%) or a 6-year ( $n = 120$ , 43.6%) OMS program. Respondents were in PGY 1 ( $n = 66$ , 23.7%), PGY 2 ( $n = 62$ , 22.3%), PGY 3 ( $n = 50$ , 18%), PGY 4 ( $n = 42$ , 15.1%), PGY 5 ( $n = 20$ , 7.2%), PGY 6 ( $n = 22$ , 7.9%) or were noncategorical ( $n = 13$ , 4.7%; [Table I](#)).

### Attitudes Toward the COVID-19 Pandemic

[Table II](#) presents the primary predictor variable, attitudes of OMS residents toward the COVID-19 pandemic. The majority of respondents reported that they believed that if they became infected with COVID-19 they would recover ( $n = 270$ , 98.2%). Almost all respondents reported that in their opinion an infected patient would survive COVID-19 ( $n = 274$ , 99.6%). The majority believed that they have a higher occupational risk of becoming infected ( $n = 271$ , 98.5%). More than half of the respondents reported some hesitancy to treat COVID-19–positive patients ( $n = 165$ , 60%). Approximately half of respondents ( $n = 119$ , 43.3%) reported concern about deployment to other services (e.g., critical care, medicine, anesthesia, etc.). OMS residents thought that an N95 mask would not provide sufficient personal protection during treatment of a COVID-19–positive patient ( $n = 168$ , 61.1%) but were appropriate when treating COVID-19–negative patients ( $n = 254$ , 92.4%). Approximately half felt that an N95 mask would provide sufficient protection when treating a PUI ( $n = 147$ , 53.5%).

The majority of residents believed that their institutions should test the COVID-19 status of every patient ( $n = 161$ , 58.5%). The majority believed that the pandemic was getting appropriate media attention ( $n = 221$ , 80.4%) but felt that government was not taking enough steps to control the pandemic ( $n = 183$ , 64.8%). Most felt that they would be able to meet program graduation requirements ( $n = 200$ , 72.7%) and reported being comfortable with their own surgical competency despite a significant decrease in surgical volume due to COVID-19 pandemic ( $n = 175$ , 63.6%).

### Anxiety Regarding the COVID-19 Pandemic

Of 275 responses, 160 residents reported normal/mild anxiety (58.2%) and 115 residents expressed moderate or severe anxiety levels (41.8%). Based on univariate testing, 11 variables met criteria to be introduced into the multivariate logistic regression model: sex, residency year, and COVID questions 4 to 6 and 8 to 13

**Table I.** Resident demographic characteristics and program information

	Entire cohort ( <i>N</i> = 274), <i>n</i> (%)	Normal anxiety level ( <i>n</i> = 160), <i>n</i> (%)	Abnormal/borderline anxiety level ( <i>n</i> = 115), <i>n</i> (%)	<i>P</i> value*
Sex, male	205 (74.5)	130 (81.3)	75 (65.2)	.003
Age, years				.471
20-25	2 (0.7)	2 (1.3)	0 (0)	
26-30	145 (52.7)	86 (53.8)	59 (51.3)	
31-35	110 (40.0)	62 (38.8)	48 (41.7)	
36-40	16 (5.8)	10 (6.3)	6 (5.2)	
>40	2 (0.7)	0 (0)	2 (1.7)	
Marital status				.445
Married	147 (53.5)	84 (52.5)	63 (54.8)	
Single	123 (44.7)	74 (46.3)	49 (42.6)	
Other	4 (1.5)	1 (0.6)	3 (2.6)	
Children				.615
Yes	72 (26.2)	45 (28.1)	27 (23.5)	
No	193 (70.2)	110 (68.8)	83 (72.2)	
Expecting	10 (3.6)	5 (3.1)	5 (4.3)	
Location				.660
Northeast	104 (37.8)	63 (39.4)	41 (35.7)	
Southeast	71 (25.8)	41 (25.6)	30 (26.1)	
Midwest	60 (21.8)	37 (23.1)	23 (20.0)	
Southwest	35 (2.7)	17 (10.6)	18 (15.7)	
Northwest	1 (0.4)	0 (0)	1 (0.9)	
Other	4 (1.5)	2 (1.3)	2 (1.7)	
Program				.813
4-Year OMS	148 (53.8)	87 (54.4)	61 (53.0)	
6-Year OMS	120 (43.6)	68 (42.5)	52 (45.2)	
Other	7 (2.5)	5 (3.1)	2 (1.7)	
Year				.067
Senior (≥PGY 3)	132 (48.0)	69 (43.1)	63 (54.7)	
Junior (<PGY 3)	143 (52.0)	91 (56.9)	52 (45.2)	

OMS, oral and maxillofacial surgery; PGY, postgraduate year.

\*Fisher's exact test or Wilcoxon rank sum test based on distribution of the data.

(Tables I and II). After multivariate model fitting, only sex, residency year, and COVID questions 6, 9, and 12 were statistically significant (Table III). Based on this analysis, moderate or severe anxiety was associated with being female ( $P = .048$ ) and a senior resident ( $P = .049$ ). Residents reported an increase in anxiety levels when they (1) believed that an N95 mask did not offer protection from a patient with COVID-19 ( $P < .001$ ), (2) thought that their institution should test all patients for COVID ( $P < .001$ ) but the institution was not testing, and (3) felt that a decrease in surgical volume because of the pandemic may result in not meeting graduation requirements ( $P = .001$ ; Table III).

## DISCUSSION

The purpose of this study was to investigate attitudes and anxiety among OMS residents during the early COVID-19 pandemic. The investigators hypothesized that residents would feel anxiety due to the COVID-19 pandemic. The specific aims were to investigate (1) the attitudes of OMS residents toward the early COVID-19 pandemic and (2) residents' anxiety levels during the early COVID-19 pandemic.

The majority of respondents were males aged 26 to 30 years, with no children and living in northeastern region of the United States. These demographic characteristics of OMS residents as a group are similar to previous reports.<sup>25-29</sup> Therefore, we felt comfortable comparing our findings to previous reports of anxiety among residents. The majority of residents who completed the survey were in PGY 1 or 2. This is likely because a reduction in clinical patient care<sup>4</sup> and related activities,<sup>25,30</sup> allowing younger residents who would typically be heavily involved in patient care additional time to complete survey. Additionally, in general, during the early COVID-19 pandemic, institutions suspended elective patient care<sup>25</sup> and decreased didactic schedules or rotations and residents spent less time at work.<sup>25,31</sup> These changes occurred because of discontinued elective procedures, resident deployment to other services, and/or limited access to PPE.<sup>25,30</sup> These overall changes decreased direct patient contact and allowed time for academic pursuits such as completion of the survey. A majority of respondents were from northeastern states. The difference in respondents by state could be due to the different rates of initial surge.

**Table II.** Attitudes of oral and maxillofacial surgery residents toward COVID-19

	<i>Entire cohort (N = 275)</i>	<i>Normal anxiety level (n = 160)</i>	<i>Abnormal/borderline anxiety level (n = 115)</i>	<i>P value*</i>
1. Do you believe you will recover if you are infected by COVID-19 virus?	Yes: 270 (98.2%) No: 5 (1.8%)	Yes: 158 (98.8%) No: 2 (1.2%)	Yes: 112 (97.4%) No: 3 (2.6%)	.653
2. Do all patients infected with COVID-19 die?	Yes: 1 (0.4%) No: 274 (99.6%)	Yes: 0 (0%) No: 160 (100%)	Yes: 1 (0.9%) No: 114 (99.1%)	.418
3. Are you at occupational risk of contracting COVID-19?	Yes: 271 (98.5%) No: 4 (1.5%)	Yes: 158 (98.8%) No: 2 (1.2%)	Yes: 113 (98.3%) No: 2 (1.7%)	>.99
4. Are you hesitant about treating patients with COVID-19?	Yes: 165 (60.0%) No: 109 (40.0%)	Yes: 80 (50.0%) No: 80 (50.0%)	Yes: 85 (73.9%) No: 30 (26.1%)	<.001
5. Are you worried about being deployed to critical care, medicine, or anesthesia services?	Yes: 119 (43.3%) No: 155 (56.7%)	Yes: 55 (34.4%) No: 105 (65.6%)	Yes: 65 (56.5%) No: 50 (43.5%)	<.001
6. Do you feel that an N95 mask provides enough personal protection during treatment of a COVID-19–positive patient?	Yes: 107 (38.9%) No: 168 (61.1%)	Yes: 80 (50.0%) No: 80 (50.0%)	Yes: 27 (23.5%) No: 88 (76.5%)	<.001
7. Do you feel that an N95 mask provides enough personal protection during treatment of a COVID-19–negative patient?	Yes: 254 (92.4%) No: 21 (7.6%)	Yes: 146 (91.3%) No: 14 (8.8%)	Yes: 108 (93.9%) No: 7 (6.1%)	.494
8. Do you feel that an N95 mask provides enough personal protection during treatment of a person under investigation?	Yes: 147 (53.5%) No: 128 (46.5%)	Yes: 99 (61.9%) No: 61 (38.1%)	Yes: 48 (41.7%) No: 67 (58.3%)	.001
9. Do you believe that your institution should test every patient for the COVID-19 virus?	Yes: 161 (58.5%) No: 114 (41.5%)	Yes: 78 (48.8%) No: 82 (51.2%)	Yes: 83 (72.2%) No: 32 (27.8%)	<.001
10. Do you feel that COVID-19 is getting unnecessary attention currently?	Yes: 54 (19.6%) No: 221 (80.4%)	Yes: 42 (26.3%) No: 118 (73.7%)	Yes: 12 (10.4%) No: 103 (89.6%)	.001
11. Do you feel that the government has taken enough steps to eradicate the disease?	Yes: 94 (34.2%) No: 181 (64.8%)	Yes: 69 (43.1%) No: 91 (56.9%)	Yes: 25 (21.7%) No: 90 (78.3%)	<.001
12. Are you worried about meeting your graduation requirements because of the COVID-19 pandemic?	Yes: 75 (27.3%) No: 200 (72.7%)	Yes: 30 (18.8%) No: 130 (81.2%)	Yes: 45 (39.1%) No: 70 (60.9%)	<.001
13. Are you worried about not being surgically competent because of a decrease in surgical experience secondary to the COVID-19 pandemic?	Yes: 100 (36.4%) No: 175 (63.6%)	Yes: 48 (30.0%) No: 112 (70.0%)	Yes: 52 (45.2%) No: 63 (54.8%)	.011

Data presented as count (percentage).

COVID-19, coronavirus disease 2019.

\*Fisher's exact test.

For example, northeastern states (e.g., New York or New Jersey) experienced an earlier surge in patients with COVID-19. This led to earlier aggressive responses implemented by the states and institutions than in states that experienced a later surge.<sup>32</sup>

### Attitudes Toward the COVID-19 Pandemic

Regarding residents' own attitudes toward the COVID-19 pandemic, it is possible that ongoing uncertainty regarding the pandemic introduced anxiety. Conflicting recommendations from WHO<sup>33</sup> and the Centers for Disease Control and Prevention<sup>34</sup> caused confusion during the early stage of the pandemic. At the time of the survey, WHO stated that surgical masks were adequate to care for patients with COVID-19,<sup>33</sup> but the Centers for Disease Control and Prevention indicated that the exact role of the airborne route in the transmission of COVID-19 was unknown.<sup>34,35</sup> Since then, institutional daily operations and recommendations have

continued to evolve. The ongoing tension between maintenance of health and safety of HCWs and patient care<sup>36-38</sup> has the potential to increase anxiety.<sup>39</sup> Therefore, it is not surprising that answers from our survey were mixed. Approximately half of the respondents in our survey believed that their institution should test every patient. However, this was not the protocol in many institutions. Patients undergoing surgical interventions and patients with signs and symptoms of COVID-19 received priority tests. It is possible that as tests become more available with a faster result all patients will be required to undergo preoperative COVID testing. Additional and faster testing would likely decrease uncertainty and thus decrease anxiety among HCWs, including OMS residents.

The majority of residents believed that they have an occupational risk for COVID-19 infection but that they would recover if infected. In addition, residents indicated they did not feel protected with an N95 mask when

**Table III.** Multivariable logistic regression analysis of factors associated with the presence of moderate/severe anxiety

Variable	Odds ratio	95% CI	P value*
Sex, male	0.55	0.30 to 0.98	.048
Year Senior ( $\geq$ PGY 3)	1.66	1.01 to 2.85	.049
Q6 (Yes)	0.38	0.21 to 0.67	<.001
Q9 (Yes)	2.59	1.49 to 4.59	<.001
Q12 (Yes)	2.60	1.44 to 4.77	.001

CI, confidence interval; PGY, postgraduate year; Q, question.

\*Based on a logistic regression model with the likelihood of moderate/severe anxiety (vs normal anxiety) as the response variable and predictors that had *P* values <.1 on univariate analysis initially placed in the model. This was followed by variable selection through backwards selection based on the corrected Akaike information criterion.

treating a COVID-19–positive patient but felt protected with an N95 mask when treating a COVID-19–negative patient. Half of respondents felt protected by an N95 mask when the patient was PUI. It is likely that the United States benefited from information from countries that experienced the pandemic first<sup>40,41</sup> and initiated early protocols to protect head and neck surgeons (including OMS).<sup>40,41</sup> This knowledge combined with guidance by OMS programs<sup>17</sup> likely provided assurance to OMS residents. Therefore, it is not surprising that in our survey all residents reported anxiety as a result of pandemic, albeit at different severity levels.

### Anxiety Regarding the COVID-19 Pandemic

Residents' stress, anxiety, and depression have been discussed in the literature.<sup>14,42,43</sup> Stress has a negative impact on mental and emotional health.<sup>43-45</sup> Studies conducted before the pandemic reported that OMS residents exhibit moderate to severe levels of anxiety,<sup>14</sup> low personal achievement, episodic cognitive disturbances, chronic anger, family disharmony, depression, drug abuse, suicidal ideation, and suicide.<sup>14,42,43</sup> In our project, all residents reported anxiety, albeit of different severities. We found that certain variables were associated with severe anxiety: female sex, late residency year, and having specific beliefs regarding the COVID-19 pandemic (i.e., feeling protected with an N95 mask during treatment of a COVID-19–positive patient, belief that the institution should test patients, and graduation requirements). Numerous factors might lead to an increase in anxiety among chief residents, such as the potential effect of the pandemic on their graduation requirements, inadequate time to obtain surgical competency and skills, and/or availability of jobs after graduation. We believe that female residents experienced more anxiety because

of additional responsibilities/concerns such as children being more at home (due to day care or school shut closure) or the possibility of being pregnant during the pandemic.

Our study found that most residents were not concerned about failing to complete graduation requirements because of the COVID-19 pandemic. This finding is surprising because determining surgical competency is challenging. The specific number of OMS procedures that need to be completed before a resident achieves competency is unclear.<sup>46</sup> Traditional methods of evaluating competency of OMS residents (e.g., number of cases, volume, duration of training, etc.)<sup>46</sup> may have to be modified because patient interactions decreased during the pandemic. In comparison to OMS surgeons, general surgery residents expressed a significant difficulty in achieving minimum case requirements.<sup>39</sup> It is possible that residents did not report concern regarding completion of requirements because residents trusted that residency programs would develop guidelines and modify graduation requirements during the pandemic.

This project has some limitations. First, only approximately one-quarter of all OMS residents in the United States participated. However, we believe that the respondents adequately represent the whole group because their overall demographic characteristics were similar to those of previous studies.<sup>25-29</sup> Second, as the COVID-19 pandemic evolved, our knowledge and understanding of transmission and treatment progressed. This undoubtedly affected reported anxiety levels of respondents between the beginning and end of survey collection. Our study is a cross-sectional analytical study; thus, we did not examine test-retest reliability or whether an increase in COVID-related knowledge decreased levels of anxiety over time. In addition, the survey was administered before it was discovered that people of different racial and ethnic groups have different outcomes.<sup>47</sup> Therefore, we did not obtain information on ethnicity or race.

In conclusion, the early COVID-19 pandemic produced overall anxiety and uncertainty among OMS residents in the United States. Our study showed that females and senior residents experience higher anxiety levels than other residents. Institutions should encourage support groups for female residents, promote work-life balance, and promote diverse mentorship programs. Inconsistent PPE, ever-changing institutional policy regarding patient testing, and COVID-19's effects on the case volume required for graduation all increased anxiety among OMS residents. Education and policies directed at these specific COVID-related matters may help to decrease anxiety levels in OMS residents.



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