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Mental health among otolaryngology resident and attending physicians during the COVID-19 pandemic: National study

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Abstract

Background: Otolaryngologists are among the highest risk for COVID-19 exposure.

Methods: This is a cross-sectional, survey-based, national study evaluating academic otolaryngologists. Burnout, anxiety, distress, and depression were assessed by the single-item Mini-Z Burnout Assessment, 7-item Generalized Anxiety Disorder Scale, 15-item Impact of Event Scale, and 2-item Patient Health Questionnaire, respectively.

Results: A total of 349 physicians completed the survey. Of them, 165 (47.3%) were residents and 212 (60.7%) were males. Anxiety, distress, burnout, and depression were reported in 167 (47.9%), 210 (60.2%), 76 (21.8%), and 37 (10.6%) physicians, respectively. Attendings had decreased burnout relative

to residents (odds ratio [OR] 0.28, confidence interval [CI] [0.11-0.68]; $P = .005$). Females had increased burnout (OR 1.93, CI [1.12.-3.32]; $P = .018$), anxiety (OR 2.53, CI [1.59-4.02]; $P < .005$), and distress (OR 2.68, CI [1.64-4.37]; $P < .005$). Physicians in states with greater than 20 000 positive cases had increased distress (OR 2.01, CI [1.22-3.31]; $P = .006$).

Conclusion: During the COVID-19 pandemic, the prevalence of burnout, anxiety, and distress is high among academic otolaryngologists.

KEYWORDS

COVID-19, mental health, mental wellness, otolaryngologists, psychiatric distress

1 | INTRODUCTION

The COVID-19 pandemic has presented health care providers with a unique set of challenges. While all health care providers have some exposure risk, it is particularly pronounced in those caring for patients undergoing mucosal or aerosol-generating procedures.[1-3] At baseline, there are increased risks of acute respiratory infections among health care workers during procedures such as tracheal intubation, tracheotomy, noninvasive ventilation, and manual ventilation.[4] Anecdotal reports from Wuhan, China report higher rates of COVID-19 infection specifically among otolaryngologists, likely due to the frequent use of those high-risk procedures in their typical, often nonelective, practice.[5-9] This risk of exposure can be mitigated through the use of personal protective equipment (PPE); however, this essential resource is already becoming scarce.[10] In addition, they are being faced with increasing numbers of positive cases, unfamiliar hospital roles, and concern for safety of themselves, their loved ones, and their patients. Thus, beyond the risk to their physical health, there is also great risk to their mental well-being.

A review of prior outbreaks demonstrates a history of a mental burden on health care providers during similar times. A number of studies conducted during the 2003 severe acute respiratory syndrome (SARS) and 2014 Ebola crises used surveys and in-depth interviews to demonstrate increased symptoms of stress, anxiety, depression, insomnia, and distress among health care workers.[11-17] In certain situations, investigators still found increased psychiatric morbidity 1 to 2 years after the 2003 SARS outbreak, though it is unclear whether these can be directly attributable to SARS.[18-20] There are now similar concerns for the health care workers during the COVID-19 pandemic. Studies from COVID-19 in Wuhan, China, where it was first detected, as well as in Singapore and India have already shown an increased mental strain on health care workers, reflected through validated surveys on anxiety, depression, insomnia, and distress.[21-23] This collection of prior evidence suggests a need to provide early support and intervention in the hopes of preventing any immediate or long-lasting implications.

Despite the history of increased psychiatric symptoms in health care workers during outbreaks and the increased infection risk among providers exposed to aerosolization, to the best of our knowledge, no study has characterized the impact on the mental health of this specific population. This study aims to assess mental health symptoms among otolaryngology physicians during the COVID-19 pandemic by measuring symptoms of burnout, anxiety, depression, and distress.

2 | PATIENTS AND METHODS

This is a cross-sectional, survey-based, national study conducted during the COVID-19 pandemic from April 14, 2020 to April 25, 2020. The self-administered, anonymous online survey collected demographic data and mental health measurements from otolaryngology physicians from academic institutions throughout the United States. Participation was voluntary, and participants were allowed to terminate the survey at any time. A Research Electronic Data Capture database was developed specifically for this project and used to capture survey data. It was accessible only to study personnel. This project was reviewed and determined to qualify as quality improvement by the University of Pennsylvania's Institutional Review Board.

We contacted otolaryngology program directors via e-mail from all 109 allopathic academic programs in the United States to disperse the survey to their residents, fellows, and attendings. Demographic data were self-reported by the participants, including sex (male or female), age, occupation (attending physicians, fellows, resident physicians), and geographic location. Date of

projected peak resource utilization for each state was obtained from the Institute for Health Metrics and Evaluation's *COVID-19 Projections* in order to categorize participants based on the "Surge status" of their state.[24] States reaching their date of projected peak resource use during our study period were in the "Surge," while states that had not reached that date were "Pre Surge," and states that were already past that date were "Post Surge." Numbers of positive COVID-19 cases and numbers of COVID-19 deaths per state were obtained from the *COVID Tracking Project* from date April 19, 2020, the midpoint of our study period.[25]

We focused on symptoms of burnout, anxiety, distress, and depression for all participants, using validated measurement tools.[26-30] The single-item Mini-Z Burnout Assessment (range, 1-5) was used to assess burnout, with burnout defined as ≥3.[27,28] The 7-item Generalized Anxiety Disorder (GAD-7) Scale (range, 0-21) was used to assess symptoms of anxiety over the past 2 weeks, with a scale of normal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety.[26] A score of 10 has been reported to be a cutoff point for identifying cases of GAD. The GAD-7 included a final question assessing the "difficulty (these problems) made it for you to do your work, take care of things at home, or get along with other people" (range, 0-3). The 15-item Impact of Event Scale (IES; range, 0-75) was used to assess symptoms of distress over the past 7 days, with a scale of subclinical (0-8), mild (9-25), moderate (26-43), and severe (44-75) distress.[29] A score of 27 has been reported as a cutoff for risk of posttraumatic stress disorder (PTSD).[31] The IES total score was also divided into two subscores: intrusion (range, 0-35) and avoidance (range, 0-40). Per Horowitz et al, the intrusion subscores assessed symptoms of "unbidden thoughts and images, troubled dreams, strong pangs or waves of feelings, and repetitive behavior."[29] The avoidance subscore measured "ideational constriction, behavioral inhibition and counterphobic activity, and awareness of emotional numbness."[29] The 2-item Patient Health Questionnaire (PHQ-2; range, 0-6) was used to assess symptoms of depression over the past 2 weeks, with a score of 3 as the cutoff for a positive depression screening requiring further evaluation with the more in-depth PHQ-9.[30] These categories were based on values established in the literature.[26-30]

Data analysis was performed using R software version 3.6.3. The difference in distribution of symptoms across multiple groups is tested by the chi-square independence test (Tables 2 and 3) and by the nonparametric Wilcoxon rank sum test and Kruskal-Wallis test (Tables 4 and 5). To determine risk factors for severity of burnout, anxiety, distress, and depression, multiple logistic regression models were used (Table 6). The binary outcome variables were created for anxiety (normal vs other categories) and for distress (subclinical vs other categories). Type of physician, sex, age, surge status, and number of positive cases were included in the model, while location and number of deaths were found to be highly correlated with the number of positive cases and therefore excluded to alleviate the issue of collinearity. All tests were two-sided and the significance level $\alpha = .05$ was applied. 95% Confidence intervals (CIs) were constructed, where applicable.

3 | RESULTS

3.1 | Baseline characteristics

A total of 349 physicians completed the survey. Of these, 165 (47.3%) were residents, and 184 (52.7%) were attending physicians, of which 12 were fellows. A number of 1614 otolaryngology residents and 2849 otolaryngology fellows and attendings work at the academic institutions contacted based on review of each institution's website. Thus, our response rate is 10.22% for residents and 6.46% for attendings, though these may be underestimates as we do not know whether all programs ultimately dispersed the survey to their physicians. Table 1 lists the demographic variables for the entire population. Most participants were men (212 [60.7%]), and the most common age range was 31-35 years (114 [32.7%]). Our male to female breakdown is consistent with that of the otolaryngology population, where 63.9% of residents and 85% of attendings are estimated to be males.[32,33] A number of 126 (36.1%) participants worked in the Midwest, 107 (30.7%) worked in the Northeast, 75 (21.5%) in the South, and 41 (11.7%) in the West. The majority came from states projected to reach their peak resource use during the study period (205 [58.7%]). Following, 54.2% of participants came from states estimated to have greater than 20 000 confirmed positive COVID-19 cases, and 54.2% came from states estimated to have greater than 1000 COVID-19 deaths.

3.2 | Mini-Z Burnout Scale scores

Burnout was reported in 76 (21.8%) of participants. A greater distribution of resident physicians were experiencing burnout compared to attending physicians (49 [29.7%] vs 27 [14.7%]; $P = .001$). A significantly greater proportion of female physicians also reported burnout compared to male physicians (40 [29.2%] vs 36 [17.0%]; $P = .010$) (Table 2). The median (interquartile range, IQR) scores on the Mini-Z Burnout measurement for all participants was 2.0 (2.0-2.0). As with the results

TABLE 1 Demographic characteristics of the study population

		Role, N (%)		Location, N (%)				Surge, N (%)		Cases, N (%)		Deaths, N (%)	
	Total, N (%)	Resident	Attending	Midwest	Northeast	South	West	Pre	Surge	Post	<20 000	>20 000	<1000	>1000
Overall	349 (100)	165 (47.3)	184 (52.7)	126 (36.1)	107 (30.7)	75 (21.5)	41 (11.7)	28 (8.0)	205 (58.7)	116 (33.2)	189 (54.2)	160 (45.8)	189 (54.2)	160 (45.8)
Sex														
Men	212 (60.7)	89 (53.9)	123 (66.8)	75 (59.5)	64 (59.8)	47 (62.7)	26 (63.4)	19 (67.9)	126 (61.5)	67 (57.8)	116 (61.4)	96 (60.0)	116 (61.4)	96 (60.0)
Women	137 (39.3)	76 (46.1)	61 (33.2)	51 (40.5)	43 (40.2)	28 (37.3)	15 (36.6)	9 (32.1)	79 (38.5)	49 (42.2)	73 (38.6)	64 (40.0)	73 (38.6)	64 (40.0)
Age														
26-30	94 (26.9)	93 (56.4)	1 (0.5)	35 (27.8)	32 (29.9)	20 (26.7)	7 (17.1)	4 (14.3)	53 (25.9)	37 (31.9)	40 (21.2)	54 (33.8)	45 (23.8)	49 (30.6)
31-35	114 (32.7)	66 (40.0)	48 (26.1)	42 (33.3)	31 (29.0)	25 (33.3)	16 (39.0)	15 (53.6)	62 (30.2)	37 (31.9)	69 (36.5)	45 (28.1)	65 (34.4)	49 (30.6)
36-40	44 (12.6)	3 (1.8)	41 (22.3)	18 (14.3)	12 (11.2)	8 (10.7)	6 (14.6)	2 (7.1)	32 (15.6)	10 (8.6)	25 (13.2)	19 (11.9)	24 (12.7)	20 (12.5)
>40	97 (27.8)	3 (1.8)	94 (51.1)	31 (24.6)	32 (29.9)	22 (29.3)	12 (29.3)	7 (25.0)	58 (28.3)	32 (27.6)	55 (29.1)	42 (26.2)	55 (29.1)	42 (26.2)

grouped by the cutoff point, analysis of the median scores found residents to have a significantly increased score for burnout compared to attendings (2.0 [2.0-3.0] vs 2.0 [2.0-2.0]; $P < .0005$), and females to have a significantly increased scores for burnout compared to males (2.0 [2.0-3.0] vs 2.0 [2.0-2.0]; $P = .004$) (Table 4). Multivariable logistic regression analysis, which controlled for confounders, also showed that attendings were less likely to have positive screening for burnout compared to residents (odds ratio [OR] 0.28, CI [0.11-0.68]; $P = .005$). In addition, compared to male physicians, females physicians were more likely have a positive screening for burnout (OR 1.93, CI [1.12.-3.32]; $P = .018$) (Table 6).

3.3 | GAD-7 Anxiety Scale scores

A large portion of participants had symptoms of anxiety (167 [47.9%]), with 28.9% of all participants in the mild range, 11.5% in the moderate range, and 7.4% in the severe range. For the question at the end of the GAD-7 asking "How difficult have these (symptoms) made it for you to do your work, take care of things at home, or get along with other people?" 48.1% of participants reported "somewhat difficult," 4.3% reported "very difficult," and 0.9% reported "extremely difficult." Females reported increased symptoms of anxiety ($P = .001$) and increased difficulty with the getting work done, tasks at home, or getting along with other people ($P = .011$) (Table 2). The median (IQR) score on the GAD-7 was 4.0 (2.0-8.0). Similar to findings in severity of symptoms, female participants had higher scores compared to males (6.0 [3.0-9.0] vs 3.0 [1.8-7.0]; $P < .0005$) (Table 4). Multivariable logistic regression analysis also showed that females were more likely to report anxiety (OR 2.53, CI [1.59-4.02]; $P < .005$) (Table 6).

3.4 | IES Distress Scale scores

A large portion of participants had symptoms of distress (210 [60.2%]), with 32.7% of all participants in the mild range, 20.9% in the moderate range, and 6.6% in the severe range. Females reported experiencing higher symptoms of distress compared to males ($P = .001$, Table 2). Compared with those working in states with less than 20 000 positive cases, participants working in states with greater than 20 000 positive cases were significantly more likely to experience symptoms of distress on the IES ($P = .027$). Compared to those working in states with less than 1000 deaths reported, participants working in states with greater than 1000 reported deaths were also

TABLE 2 Symptom severity of burnout, anxiety, distress, and depression measurements in total cohort and subgroups (role, sex, and age)

		Role, N (%)			Sex, N (%)			Age, N (%)				
Severity category	Total, N (%)	Resident	Attending	*P* value	Men	Women	*P* value	26-30	31-35	36-40	>40	*P* value
Mini-Z: burnout symptoms												
Negative	273 (78.2)	116 (70.3)	157 (85.3)	**.001**	176 (83.0)	97 (70.8)	**.010**	67 (71.3)	89 (78.1)	34 (77.3)	83 (85.6)	.124
Positive	76 (21.8)	49 (29.7)	27 (14.7)		36 (17.0)	40 (29.2)		27 (28.7)	25 (21.9)	10 (22.7)	14 (14.4)	
GAD-7: anxiety symptoms												
Normal	182 (52.1)	82 (49.7)	100 (54.3)	.280	129 (60.8)	53 (38.7)	**.001**	42 (44.7)	63 (55.3)	23 (52.3)	54 (55.7)	.190
Mild	101 (28.9)	49 (29.7)	52 (28.3)		49 (23.1)	52 (38.0)		32 (34.0)	30 (26.3)	13 (29.5)	26 (26.8)	
Moderate	40 (11.5)	24 (14.5)	16 (8.7)		21 (9.9)	19 (13.9)		14 (14.9)	15 (13.2)	1 (2.3)	10 (10.3)	
Severe	26 (7.4)	10 (6.1)	16 (8.7)		13 (6.1)	13 (9.5)		6 (6.4)	6 (5.3)	7 (15.9)	7 (7.2)	
GAD-7: difficulty functioning												
Not difficult	163 (46.7)	79 (47.9)	84 (45.7)	.293	113 (53.3)	50 (36.5)	**.011**	42 (44.7)	57 (50.0)	17 (38.6)	47 (48.5)	.190
Somewhat difficult	168 (48.1)	76 (46.1)	92 (50.0)		88 (41.5)	80 (58.4)		45 (47.9)	54 (47.4)	23 (52.3)	46 (47.4)	
Very difficult	15 (4.3)	7 (4.2)	8 (4.3)		10 (4.7)	5 (3.6)		4 (4.3)	3 (2.6)	4 (9.1)	4 (4.1)	
Extremely difficult	3 (0.9)	3 (1.8)	0 (0.0)		1 (0.5)	2 (1.5)		3 (3.2)	0 (0.0)	0 (0.0)	0 (0.0)	
IES: distress symptoms												
Subclinical	139 (39.8)	69 (41.8)	70 (38.0)	.358	100 (47.2)	39 (28.5)	**.001**	38 (40.4)	49 (43.0)	19 (43.2)	33 (34.0)	.433
Mild	114 (32.7)	47 (28.5)	67 (36.4)		67 (31.6)	47 (34.3)		26 (27.7)	36 (31.6)	13 (29.5)	39 (40.2)	
Moderate	73 (20.9)	39 (23.6)	34 (18.5)		32 (15.1)	41 (29.9)		22 (23.4)	26 (22.8)	8 (18.2)	17 (17.5)	
Severe	23 (6.6)	10 (6.1)	13 (7.1)		13 (6.1)	10 (7.3)		8 (8.5)	3 (2.6)	4 (9.1)	8 (8.2)	
PHQ-2: depression symptoms												
Negative	312 (89.4)	148 (89.7)	164 (89.1)	1.000	189 (89.2)	123 (89.8)	.993	83 (88.3)	107 (93.9)	37 (84.1)	85 (87.6)	.247
Positive	37 (10.6)	17 (10.3)	20 (10.9)		23 (10.8)	14 (10.2)		11 (11.7)	7 (6.1)	7 (15.9)	12 (12.4)	

Note: All statistically significant values are marked in bold.

Abbreviations: GAD-7, 7-item Generalized Anxiety Disorder Scale; IES, Impact of Event Scale; PHQ-2, two-item Patient Health Questionnaire.

TABLE 3 Symptom severity of burnout, anxiety, distress, and depression measurements in total cohort and subgroups (location, surge status, state COVID-19-positive case numbers, and state COVID-19 deaths)

		Location, N (%)					Surge, N (%)				Cases, N (%)			Deaths, N (%)		
Severity category	Total, N (%)	Midwest	Northeast	South	West	*P* value	Pre	Surge	Post	*P* value	<20 000	>20 000	*P* value	<1000	>1000	*P* value
Mini-Z: burnout symptoms																
Negative	273 (78.2)	95 (75.4)	84 (78.5)	63 (84.0)	31 (75.6)	.526	22 (78.6)	161 (78.5)	90 (77.6)	.979	153 (81.0)	120 (75.0)	.225	153 (81.0)	120 (75.0)	.225
Positive	76 (21.8)	31 (24.6)	23 (21.5)	12 (16.0)	10 (24.4)		6 (21.4)	44 (21.5)	26 (22.4)		36 (19.0)	40 (25.0)		36 (19.0)	40 (25.0)	
GAD-7: anxiety symptoms																
Normal	182 (52.1)	69 (54.8)	55 (51.4)	38 (50.7)	20 (48.8)	.867	12 (42.9)	113 (55.1)	57 (49.1)	.202	105 (55.6)	77 (48.1)	.427	102 (54.0)	80 (50.0)	.705
Mild	101 (28.9)	31 (24.6)	32 (29.9)	23 (30.7)	15 (36.6)		6 (21.4)	55 (26.8)	40 (34.5)		53 (28.0)	48 (30.0)		52 (27.5)	49 (30.6)	
Moderate	40 (11.5)	17 (13.5)	13 (12.1)	8 (10.7)	2 (4.9)		7 (25.0)	22 (10.7)	11 (9.5)		20 (10.6)	20 (12.5)		23 (12.2)	17 (10.6)	
Severe	26 (7.4)	9 (7.1)	7 (6.5)	6 (8.0)	4 (9.8)		3 (10.7)	15 (7.3)	8 (6.9)		11 (5.8)	15 (9.4)		12 (6.3)	14 (8.8)	
GAD-7: difficulty functioning																
Not difficult	163 (46.7)	61 (48.4)	48 (44.9)	37 (49.3)	17 (41.5)	.562	10 (35.7)	100 (48.8)	53 (45.7)	.269	94 (49.7)	69 (43.1)	.161	92 (48.7)	71 (44.4)	.230
Somewhat difficult	168 (48.1)	57 (45.2)	55 (51.4)	36 (48.0)	20 (48.8)		14 (50.0)	96 (46.8)	58 (50.0)		86 (45.5)	82 (51.2)		88 (46.6)	80 (50.0)	
Very difficult	15 (4.3)	6 (4.8)	4 (3.7)	1 (1.3)	4 (9.8)		3 (10.7)	7 (3.4)	5 (4.3)		6 (3.2)	9 (5.6)		6 (3.2)	9 (5.6)	
Extremely difficult	3 (0.9)	2 (1.6)	0 (0.0)	1 (1.3)	0 (0.0)		1 (3.6)	2 (1.0)	0 (0.0)		3 (1.6)	0 (0.0)		3 (1.6)	0 (0.0)	
IES: distress symptoms																
Subclinical	139 (39.8)	52 (41.3)	33 (30.8)	39 (52.0)	15 (36.6)	.223	10 (35.7)	90 (43.9)	39 (33.6)	.228	88 (46.6)	51 (31.9)	**.027**	89 (47.1)	50 (31.2)	**.013**
Mild	114 (32.7)	40 (31.7)	41 (38.3)	16 (21.3)	17 (41.5)		9 (32.1)	56 (27.3)	49 (42.2)		51 (27.0)	63 (39.4)		50 (26.5)	64 (40.0)	
Moderate	73 (20.9)	25 (19.8)	26 (24.3)	16 (21.3)	6 (14.6)		7 (25.0)	44 (21.5)	22 (19.0)		37 (19.6)	36 (22.5)		37 (19.6)	36 (22.5)	
Severe	23 (6.6)	9 (7.1)	7 (6.5)	4 (5.3)	3 (7.3)		2 (7.1)	15 (7.3)	6 (5.2)		13 (6.9)	10 (6.2)		13 (6.9)	10 (6.2)	
PHQ-2: depression symptoms																
Negative	312 (89.4)	115 (91.3)	97 (90.7)	63 (84.0)	37 (90.2)	.395	22 (78.6)	187 (91.2)	103 (88.8)	.121	171 (90.5)	141 (88.1)	.592	168 (88.9)	144 (90.0)	.872
Positive	37 (10.6)	11 (8.7)	10 (9.3)	12 (16.0)	4 (9.8)		6 (21.4)	18 (8.8)	13 (11.2)		18 (9.5)	19 (11.9)		21 (11.1)	16 (10.0)	

Note: All statistically significant values are marked in bold.

Abbreviations: GAD-7, 7-item Generalized Anxiety Disorder Scale; IES, Impact of Event Scale; PHQ-2, two-item Patient Health Questionnaire.

TABLE 4 Median scores of burnout, anxiety, distress, and depression measurements in total cohort and subgroups (role, sex, and age subgroups)

		Role, median (IQR)			Sex, median (IQR)			Age, median (IQR)				
Scale	**Total, median (IQR)**	**Resident**	**Attending**	***P* value**	**Men**	**Women**	***P* value**	**26-30**	**31-35**	**36-40**	**>40**	***P* value**
Mini-Z: burnout symptoms	2.0 (2.0-2.0)	2.0 (2.0-3.0)	2.0 (2.0-2.0)	**<.0005**	2.0 (2.0-2.0)	2.0 (2.0-3.0)	**.004**	2.0 (2.0-3.0)	2.0 (2.0-2.0)	2.0 (2.0-2.0)	2.0 (1.0-2.0)	**.047**
GAD-7: anxiety symptoms	4.0 (2.0-8.0)	5.0 (2.0-9.0)	4.0 (2.0-7.0)	.461	3.0 (1.8-7.0)	6.0 (3.0-9.0)	**<.0005**	5.0 (2.0-8.0)	4.0 (2.0-8.0)	4.0 (3.0-7.2)	4.0 (2.0-7.0)	.543
IES: intrusion symptoms	6.0 (2.0-13.0)	6.0 (2.0-13.0)	6.0 (1.8-13.0)	.939	4.0 (1.0-9.0)	9.0 (3.0-17.0)	**<.0005**	6.0 (2.0-15.0)	6.0 (2.0-11.8)	6.0 (2.0-15.0)	6.0 (1.0-12.0)	.796
IES: avoidance symptoms	6.0 (1.0-14.0)	7.0 (2.0-15.0)	6.0 (1.0-12.0)	.203	5.0 (0.8-13.0)	9.0 (3.0-15.0)	**.001**	8.0 (2.0-16.8)	6.0 (1.0-14.0)	5.0 (0.0-10.0)	7.0 (1.0-13.0)	.442
IES: distress symptoms	13.0 (3.0-27.0)	14.0 (4.0-29.0)	12.0 (2.8-26.0)	.486	10.0 (2.0-22.2)	19.0 (8.0-31.0)	**<.0005**	14.0 (4.0-32.2)	12.5 (3.0-25.8)	10.0 (2.8-27.0)	13.0 (3.0-27.0)	.711
PHQ-2: depression symptoms	0.0 (0.0-2.0)	0.0 (0.0-2.0)	0.0 (0.0-2.0)	.895	0.0 (0.0-1.0)	1.0 (0.0-2.0)	.098	0.0 (0.0-2.0)	0.0 (0.0-1.8)	1.0 (0.0-2.0)	0.0 (0.0-2.0)	.993

Note: All statistically significant values are marked in bold.
Abbreviations: GAD-7, 7-item Generalized Anxiety Disorder Scale; IES, Impact of Event Scale; PHQ-2, two-item Patient Health Questionnaire.

TABLE 5 Median scores of burnout, anxiety, distress, and depression measurements in total cohort and subgroups (location, surge status, state COVID-19-positive case numbers, and state COVID-19 deaths)

		Location, median (IQR)					Surge Status, median (IQR)				Cases, median (IQR)			Deaths, median (IQR)		
Scale	**Total, median (IQR)**	**Mid-west**	**Northeast**	**South**	**West**	***P* value**	**Pre**	**Surge**	**Post**	***P* value**	**<20 000**	**>20 000**	***P* value**	**<1000**	**>1000**	***P* value**
Mini-Z: burnout symptoms	2.0 (2.0-2.0)	2.0 (2.0-2.0)	2.0 (2.0-2.0)	2.0 (2.0-2.0)	2.0 (2.0-2.0)	.775	2.0 (2.0-2.0)	2.0 (2.0-2.0)	2.0 (2.0-2.0)	.893	2.0 (2.0-2.0)	2.0 (2.0-2.2)	.427	2.0 (2.0-2.0)	2.0 (2.0-2.2)	.529
GAD-7: anxiety symptoms	4.0 (2.0-8.0)	4.0 (2.0-8.8)	4.0 (2.0-8.0)	4.0 (2.0-7.0)	5.0 (2.0-9.0)	.932	5.0 (2.8-12.2)	4.0 (2.0-8.0)	5.0 (2.0-7.0)	.425	4.0 (2.0-7.0)	5.0 (2.0-9.0)	.253	4.0 (2.0-7.0)	4.5 (2.0-8.0)	.634
IES: intrusion symptoms	6.0 (2.0-13.0)	5.0 (1.0-13.0)	8.0 (3.0-15.0)	3.0 (1.0-11.0)	6.0 (1.0-13.0)	**.021**	6.5 (1.8-14.8)	6.0 (1.0-14.0)	7.0 (2.0-12.0)	.851	5.0 (1.0-11.0)	7.0 (2.0-14.3)	**.023**	4.0 (1.0-11.0)	7.0 (3.0-15.0)	**.009**
IES: avoidance symptoms	6.0 (1.0-14.0)	6.0 (2.0-13.8)	9.0 (1.0-15.0)	5.0 (0.5-12.5)	6.0 (1.0-13.0)	.290	7.5 (1.8-18.0)	6.0 (1.0-13.0)	6.5 (2.0-13.3)	.468	5.0 (1.0-12.0)	9.0 (1.0-15.0)	**.032**	5.0 (1.0-11.0)	9.0 (1.0-15.0)	**.019**
IES: distress symptoms	13.0 (3.0-27.0)	11.0 (3.2-27.8)	18.0 (6.0-29.0)	8.0 (2.0-26.5)	14.0 (2.0-25.0)	.082	15.5 (4.5-29.5)	11.0 (3.0-28.0)	13.5 (4.0-25.0)	.678	10.0 (3.0-27.0)	17.0 (5.0-29.0)	**.021**	10.0 (2.0-27.0)	17.0 (5.0-29.0)	**.014**
PHQ-2: depression symptoms	0.0 (0.0-2.0)	0.0 (0.0-2.0)	0.0 (0.0-2.0)	0.0 (0.0-2.0)	1.0 (0.0-1.0)	.993	1.0 (0.0-2.0)	0.0 (0.0-1.0)	1.0 (0.0-2.0)	.200	0.0 (0.0-1.0)	1.0 (0.0-2.0)	.188	0.0 (0.0-2.0)	1.0 (0.0-2.0)	.472

Note: All statistically significant values are marked in bold.
Abbreviations: GAD-7, 7-item Generalized Anxiety Disorder Scale; IES, Impact of Event Scale; PHQ-2, two-item Patient Health Questionnaire.

TABLE 6 Factors associated with symptoms of burnout, anxiety, distress, and depression following multivariable logistic regression

	Participants with symptoms/ Total (%)	Adjusted OR (95%CI)	*P* value	
			Category	Overall
Mini-Z: burnout symptoms				
Role				
Resident	49/165 (29.7)	1 (Reference)	NA	**.005**
Attending	27/184 (14.7)	0.28 (0.11-0.68)	**.005**	
Sex				
Men	36/212 (17.0)	1 (Reference)	NA	**.018**
Women	40/137 (29.2)	1.93 (1.12-3.32)	**.018**	
Age				
26-30	27/94 (28.7)	1 (Reference)	NA	.481
31-35	25/114 (21.9)	1.14 (0.57-2.28)	.709	
36-40	10/44 (22.7)	2.46 (0.76-7.96)	.131	
>40	14/97 (14.4)	1.78 (0.57-5.55)	.317	
Surge status				
Pre	6/28 (21.4)	1 (Reference)	NA	.738
Surge	44/205 (21.5)	0.80 (0.29-2.25)	.678	
Post	26/116 (22.4)	0.67 (0.22-2.06)	.482	
Cases				
<20 000	36/189 (19.0)	1 (Reference)	NA	.219
>20 000	40/160 (25.0)	1.44 (0.80-2.58)	.219	
GAD-7: anxiety symptoms				
Role				
Resident	83/165 (50.3)	1 (Reference)	NA	.872
Attending	84/184 (45.7)	1.06 (0.53-2.13)	.872	
Sex				
Men	83/212 (39.2)	1 (Reference)	NA	**<.0005**
Women	84/137 (61.3)	2.53 (1.59-4.02)	**<.0005**	
Age				
26-30	52/94 (55.3)	1 (Reference)	NA	.608
31-35	51/114 (44.7)	0.66 (0.35-1.26)	.213	
36-40	21/44 (47.7)	0.77 (0.29-2.06)	.605	
>40	43/97 (44.3)	0.83 (0.34-2.04)	.681	
Surge status				
Pre	16/28 (57.1)	1 (Reference)	NA	.188
Surge	92/205 (44.9)	0.46 (0.20-1.07)	.071	
Post	59/116 (50.9)	0.50 (0.20-1.27)	.146	
Cases				
<20 000	84/189 (44.4)	1 (Reference)	NA	.155
>20 000	83/160 (51.9)	1.42 (0.88-2.30)	.155	
IES: distress symptoms				
Role				
Resident	96/165 (58.2)	1 (Reference)	NA	.827
Attending	114/184 (62.0)	1.08 (0.53-2.21)	.827	

TABLE 6 (Continued)

	Participants with symptoms/ Total (%)	Adjusted OR (95%CI)	*P* value	
			Category	Overall
Sex				
Men	112/212 (52.8)	1 (Reference)	NA	**<.0005**
Women	98/137 (71.5)	2.68 (1.64-4.37)	**<.0005**	
Age				
26-30	56/94 (59.6)	1 (Reference)	NA	.288
31-35	65/114 (57.0)	1.01 (0.52-1.95)	.983	
36-40	25/44 (56.8)	0.99 (0.36-2.72)	.990	
>40	64/97 (66.0)	1.84 (0.72-4.68)	.204	
Surge status				
Pre	18/28 (64.3)	1 (Reference)	NA	.240
Surge	115/205 (56.1)	0.50 (0.21-1.19)	.115	
Post	77/116 (66.4)	0.60 (0.23-1.57)	.298	
Cases				
<20 000	101/189 (53.4)	1 (Reference)	NA	**.006**
>20 000	109/160 (68.1)	2.01 (1.22-3.31)	**.006**	
PHQ-2: depression symptoms				
Role				
Resident	17/165 (10.3)	1 (Reference)	NA	.496
Attending	20/184 (10.9)	0.65 (0.18-2.27)	.496	
Sex				
Men	23/212 (10.8)	1 (Reference)	NA	.945
Women	14/137 (10.2)	1.03 (0.49-2.17)	.945	
Age				
26-30	11/94 (11.7)	1 (Reference)	NA	.110
31-35	7/114 (6.1)	0.52 (0.17-1.58)	.251	
36-40	7/44 (15.9)	2.33 (0.50-10.87)	.280	
>40	12/97 (12.4)	1.64 (0.37-7.40)	.517	
Surge status				
Pre	6/28 (21.4)	1 (Reference)	NA	.055
Surge	18/205 (8.8)	0.23 (0.07-0.71)	**.011**	
Post	13/116 (11.2)	0.27 (0.08-0.96)	**.044**	
Cases				
<20 000	18/189 (9.5)	1 (Reference)	NA	.272
>20 000	19/160 (11.9)	1.57 (0.70-3.49)	.272	

Note: The multivariable logistic regression results are found in the "overall" *P* value. The "category" *P* value corresponds to the *P* value for each category compared to the reference. All statistically significant values are marked in bold.

Abbreviations: GAD-7, 7-item Generalized Anxiety Disorder Scale; IES, Impact of Event Scale; PHQ-2, two-item Patient Health Questionnaire.

significantly more likely to experience symptoms of distress on the IES ($P = .013$) (Table 3).

The median (IQR) score on the IES for distress was 13.0 (3.0-27.0). The median (IQR) scores for the two subscores that comprise the distress score were 6.0 (2.0-13.0) for intrusive symptoms and 6.0 (1.0-14.0) for avoidance symptoms. Similar to findings in severity of symptoms, female participants had higher scores

compared to males (19.0 [8.0-31.0] for females vs 10.0 [2.0-22.2] for males; $P < .0005$; Table 4). Those who worked in a state with greater than 20 000 cumulative positive cases had significantly increased scores of distress compared to those who worked in a state with fewer than 20 000 positive cases (17.0 [5.0-29.0] vs 10.0 [3.0-27.0]; $P = .021$), and this was also reflected in the two distress subscores (intrusive and avoidance). Working in a state with greater than 1000 deaths had significantly increased scores of distress compared to working in a state with fewer than 1000 deaths (17.0 [5.0-29.0] vs 10.0 [2.0-27.0]; $P = .014$), and this was also reflected in the two distress subscores. Lastly, geographic region was associated with significant differences in the intrusive subscore of distress (Midwest 5.0 [1.0-13.0], Northwest 8.0 [3.0-15.0], South 3.0 [1.0-11.0], West 6.0 [1.0-13.0]; $P = .021$) (Table 5).

Multivariable logistic regression analysis also showed that females and physicians working in a state with greater than 20 000 positive cases were associated with increased presence of symptoms of distress (Table 6). Compared to males, females were more likely to report symptoms of distress (OR 2.68, CI [1.64-4.37]; $P < .0005$). Compared to physicians working in a state where the number of positive COVID-19 cases was less than 20 000, those working in a state where the positive case number exceeded 20 000 were more likely to have symptoms of distress (OR 2.01, CI [1.22-3.31]; $P = 0.006$).

3.5 | PHQ-2 Depression Scale scores

Thirty-seven (10.6%) participants were positive on our depression screener. In a clinical setting, patients who screen positive on this depression instrument would then require a more detailed screening to assess depression. The median (IQR) score on the PHQ-2 for depression for all participants was 0.0 (0.0-2.0). There were no significant differences in responses to the PHQ-2 between our subgroups.

4 | DISCUSSION

In this national survey-based study, we found large proportions of participants to be experiencing symptoms of burnout, anxiety, and distress. Furthermore, we identified demographic risk factors for presence of symptoms, including type of physician, sex, geographic region, and incidence of COVID-19. Turning attention to physician mental health is of great importance, as these problems have high prevalence in the physician population even prior to this pandemic. Studies conducted prior to the COVID-19 pandemic have reported prevalence of burnout in all physicians as greater than 50%,[34] and prevalence of depressive symptoms in surgeons as around 30%.[35] Though studies conflict regarding the exact prevalence of suicide in the U.S. physician population,[36] the suicide rate is widely cited as being higher than the general population.[37] The increased pressures during the current pandemic have raised concerns for worsening mental health from this baseline.[38,39] Given the route of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), there is increased concern for otolaryngologists due to the multidisciplinary nature of the field and risk of aerosolization during procedures.[4,6] To our knowledge, this is the only study that has specifically surveyed academic otolaryngologists during a pandemic using standardized metrics of burnout, anxiety, distress, and depression.

Our findings show that 47.9% of participants had symptoms of anxiety, 60.2% had symptoms of distress, 21.8% reported burnout, and 10.6% screened positive for depression symptoms. Out of the four, distress was the most prevalent positive result among our participants. Increased IES scores have correlated with a risk of PTSD, with Coffey et al suggesting a cutoff of 27.[31,40] Also, 27.5% of our participants fall into the moderate and severe ranges, which start at a score of 26. A score of 10 or greater on the GAD-7 is thought to be a reasonable cutoff point for identifying cases of GAD,[26] and 18.9% of our participants scored above that. The PHQ-2 assesses the degree to which an individual has experienced depressed mood and anhedonia over the past 2 weeks, serving as a screener for depression. It should be emphasized that a positive screening on PHQ-2 requires further evaluation with the PHQ-9 to make any conclusions, with 10.6% of our participants warranting additional screening. Overall, the reported symptoms in our study are concerning for the future mental wellbeing of our physicians, particularly regarding distress and anxiety, though further study is needed.

Residents reported increased burnout compared to attendings. This is unsurprising given the nature of their role in the hospital and the increased work hours. Prior studies have revealed significantly elevated levels of burnout in U.S. otolaryngology residents compared to attendings at baseline.[41] Importantly, these studies have used the Maslach Burnout Inventory (MBI) as their measure of burnout, which our Mini-Z Burnout Assessment has been validated against with particularly good correlation for the MBI's emotional exhaustion subscale.[28] A study by Golub et al reported high emotional exhaustion in 33% of residents, moderate in 29%, and low in 38%, which was strongly associated with increased work hours.[42] In our study, 29.7% of residents reported at least

"I am definitely burning out and have one or more symptoms of burnout, for example, emotional exhaustion," and 70.3% of residents reported "I enjoy my work. I have no symptoms of burnout" or "I am under stress, and don't always have as much energy as I did, but I don't feel burned out." Taken together, it is possible that we are in fact seeing a decrease in burnout from baseline in our study. Though residents anecdotally report increased anxiety and stress in response to COVID-19, they also acknowledge that their work hours are much improved due to the cancellation of elective procedures and limitations on the number of in-hospital personnel. Thus, in the specific case of burnout, increased time off may have mitigated increased stressors in the workplace for our population.

Given the uneven spread of COVID-19 throughout the United States, we sought to identify an association between severity of COVID-19 and our mental health outcome measures. Our findings identified differences in distress based on these variables. Physicians working in states with greater than 20 000 positive cases or 1000 deaths reported increased symptoms of distress compared to those in states with less than 20,00 positive cases or 1000 deaths. When looking specifically at intrusive distress symptoms, separated out from the avoidant symptoms, there was a significant difference by region, with the Northeast having the highest median intrusive distress scores. As the Northeast had a substantially greater number of cases during our study period,[25] these participants are more likely to be treating positive patients or potentially being redeployed to other roles, and their stress may be compounded by diminishing PPE. Given the relationship between positive case numbers, death numbers, and region, only the positive case number variable was included in the multivariable analysis, and remained significant for distress.

Female respondents reported significantly higher amounts of burnout, anxiety, and distress. These findings are consistent with those identified in other studies during the current pandemic in China.[21,22] This is also supported by an abundance of literature on a higher prevalence of "internalizing" psychiatric disorders such as anxiety and depression in females compared to males, who have higher prevalence of substance abuse and "externalizing" disorders, including attention-deficit/hyperactivity disorder, conduct disorder, intermittent explosive disorder, and oppositional defiant disorder.[43,44] However, it is also important to consider the risks of response and measurement bias in these screening tools. These tools rely on symptom-based reporting, where males may be less likely to report symptoms.[45-47] Furthermore, their symptoms may not fit these standard measurement tools, and their "externalizing" disorders may be masking depression and anxiety.[46] For these reasons, it is possible that males may be underdiagnosed by these tools and clinically. Thus, our study may not be fully capturing the state of mental health among males, and therefore it is important to focus efforts on improving mental wellness in all physicians regardless of their gender.

This study has several limitations that are important to consider. Depending on the trajectory of the pandemic, the mental health symptoms of health care workers could intensify or diminish over time. Thus, long-term psychological implications of this population are worth future investigation. In addition, we did not include a control group and therefore are unable to definitely conclude that these symptoms in health care workers differ from those of the general population or of any other specialty. However, Zhang et al found health care workers mental health scores to be significantly increased compared to nonmedical health care workers during COVID-19 in China.[22] We are also unable to distinguish whether these symptoms are in the setting of preexisting mental health symptoms rather than new symptoms, though free responses to an optional question at the end of the survey suggest that many are experiencing a mental change that they attribute to COVID-19. In addition, because our survey was emailed to each program director to distribute to their department, we are unable to confirm whether they received this email and/or forwarded it to their department. Given our response rates, we cannot exclude the possibility of a non-response bias. Providers who received but did not respond to the survey may not have been experiencing any distress, anxiety, burnout, or depression and therefore were not interested in responding. Alternatively, those who received the survey but did not fill it out could have been too overwhelmed to respond.

5 | CONCLUSIONS

The COVID-19 pandemic presents a challenging position for otolaryngologists, where a calling to serve their communities may be at odds with concern for self and loved ones. Otolaryngologists are particularly at risk due to the aerosolizing nature of their procedures. We found that otolaryngologists are experiencing elevated anxiety and distress. However, the cancellation of elective procedures and measures to limit in-house personnel may also have provided an increase in time outside of work, mitigating some of the negative effects of the pandemic on mental health. We present here a cross-sectional analysis of a spectrum of mental health concerns among

otolaryngologists' during this pandemic. Though further studies are needed to capture a longitudinal picture, it is important that institutions start focusing efforts on the mental wellness of their physicians.

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