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Mental health outcomes among osteopathic physicians during COVID-19

Esther Lee, Joshua Lo, Pengyi Zhu, Yadi Fernandez Sweeny, Sebastien Fuchs



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Article Title

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Author Lists

Esther Lee, BS; Joshua Lo, MPH; Pengyi Zhu, BS; Yadi Fernandez-Sweeny, PsyD, MS, CRNA;
Sebastien Fuchs, M.D., Ph.D

Author Affiliations

Esther Lee, BS, College of Osteopathic Medicine of the Pacific, Western University Health
Sciences, Pomona, California

Joshua Lo, MPH, College of Osteopathic Medicine of the Pacific, Western University Health
Sciences, Pomona, California

Pengyi Zhu, BS, College of Osteopathic Medicine of the Pacific, Western University Health
Sciences, Pomona, California

Dr. Yadi Fernandez-Sweeny, PsyD, MS, CRNA College of Osteopathic Medicine of the Pacific,
Western University Health Sciences, Pomona, California

Dr. Sebastien Fuchs, M.D., Ph.D., College of Osteopathic Medicine of the Pacific, Western
University Health Sciences, Pomona, California

Conflict of interest

None

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The study was approved by Western University Health Sciences Institutional Review Board (protocol #: 1646112-1).

Informed consent

The study was survey-based, choosing to participate in the survey implies informed consent.

Correspondence Address

Esther Lee

Western University of Health Sciences, 309 E 2nd St, Pomona, CA,

Email: esther.lee1@westernu.edu

Phone: 607-220-4029

Author Contribution

Esther Lee, Joshua Lo, Pengyi Zhu provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data.

Yadi Fernandez-Sweeny and Sebastien Fuchs mentored to project, review the manuscript and gave final approval of the version of the article to be published.

All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Abstract

Background: SARS-CoV-2 infection responsible for the COVID-19 pandemic has demonstrated a significant burden on the mental health of health care providers. The purpose of the study is to evaluate the mental health symptoms among osteopathic physicians from a single academic institution during the COVID-19 pandemic.

Methods: This was a cross-sectional, survey-based study conducted during the COVID-19 pandemic from January 2021 to March 2021. The survey was emailed to 4239 alumni physicians from the single medical school in California, USA. Burnout, anxiety, and depression were assessed by the single-item Mini-Z Burnout Assessment, 7-item Generalized Anxiety Disorder Scale, and 2-item Patient Health Questionnaire, respectively.

Results: A total of 104 survey responses were analyzed. Of them, 53 (51.0%) were attending physicians and 51 (49.0%) were residents or fellow physicians. Anxiety, burnout, and depression were reported in 29 (29.9%), 31 (32%), and 11 (11.3%), respectively. Females had increased anxiety (OR 1.66, CI 1.21-2.27; $P=0.002$). Resident had higher burnout symptoms (OR 1.28, CI 1.06-1.53; $p=0.009$) and depression symptoms (OR 1.15, CI 1.01-1.30; $p=0.032$) compared to attending physicians. Physicians who encountered >50 COVID-19 patients had higher depression symptoms (OR 1.17, CI 1.02-1.35; $p=0.027$).

Conclusion: Our survey study demonstrated that osteopathic physicians graduated from a single academic institution experienced symptoms of anxiety, burnout, and depression during the COVID-19 pandemic based on the validated questionnaires. A higher prevalence was shown in the lesser experienced group of residents and fellow physicians compared to more experienced attending physicians. In addition, adjustments to the pandemic have caused a financial burden

24 among osteopathic physicians. Future studies are warranted to assess the long-term effects of the
25 pandemic on mental health among osteopathic physicians.

26 **Key words**

27

28 COVID-19, depression, anxiety, burn out, osteopathic physicians

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30 INTRODUCTION

31 Since the World Health Organization (WHO) declared the COVID-19 a global pandemic
32 on March 11, 2020, health care workers have faced unique challenges.¹ As frontline workers
33 caring for patients, physicians are particularly at an increased risk of infection. While the risk of
34 infection has partly been reduced with adequate personal protective equipment (PPE) and the
35 recent emergence of vaccinations, physicians continue to face a surge in COVID-19 cases,
36 workload strain, and concern about contracting the disease.² Additionally, there has also been
37 anecdotal evidence of financial difficulty from decreased patient volume and increased
38 investment in telehealth, adding additional burden to already strained health care workers.

39 Studies from previous pandemics have demonstrated a significant effect on the mental
40 health of health care providers. A study showed that frontline health professionals during
41 pandemics developed increased symptoms of posttraumatic stress disorder (PTSD), depression,
42 anxiety, burnout, and mental health issues.³ The prevalence of PTSD following recent pandemics
43 was reported to be 22.6% among the general population, with the highest prevalence among
44 health care workers at 26.9%.⁴ With such significant implications on physicians who are the
45 backbone of the healthcare system, there is a need for early intervention to prevent lasting effects
46 on healthcare providers' mental well-being.

47 Despite numerous studies exploring the impact of COVID-19 studies on various
48 healthcare providers, there has not yet been a study investigating the effect of COVID-19
49 specifically on osteopathic physicians in the United States. Osteopathic physicians are in a
50 unique position as the majority practice in primary care settings, which exposes them to high
51 volumes of COVID-19 patients. Additionally, some osteopathic physicians who perform the
52 osteopathic manipulative treatment (OMT) may have to adjust their practice during the COVID-

53 19, given the hands-on nature of the treatment. Thus, our study aims to evaluate the mental
54 health symptoms among osteopathic physicians graduated from a single medical school by
55 assessing the symptoms of anxiety, burnout, and depression, and identify factors that are at
56 increased risk for poor mental health outcomes.

57

58 **METHODS**

59 *Survey design and distribution*

60 We performed a cross-sectional, survey-based study during the COVID-19 pandemic
61 from January 26, 2021, to March 5, 2021. We contacted 4239 alumni from 2000 to 2019 at a
62 single medical school in California, USA inviting them to participate in the 57-question online
63 survey. Qualtrics database was developed for the project and was used to capture survey data.
64 Two healthcare physicians internally validated the survey and resolved any discrepancies.
65 Informed consent was presented to the participants at the beginning of the survey. Participation
66 was voluntary, and participants were allowed to terminate the survey at any time. Inclusion
67 criteria include licensed osteopathic physicians who practiced medicine during the COVID-19
68 pandemic. Exclusion criteria include physicians who did not practice medicine during the
69 COVID-19 pandemic. The project was approved by the Institutional Review Board (IRB
70 number: 1646112-1).

71 Demographic data were collected, including gender, race, age, geographic location,
72 practice years, position, specialty, type of practice, type of community, and vaccine status. Race
73 was assessed in the study as the previous literature has reported a disproportionate burden of
74 COVID-19-related outcomes among different racial groups.⁵ The race was categorized based on

75 US Census Bureau classification into “White or Caucasian,” “Asian,” “Hispanic,” “African
76 American or black,” “American Indian or Alaska Native,” “Native Hawaiian or Other Pacific
77 Islander,” “Multiracial,” or “Other.”⁶ COVID-19 exposure factors were obtained including the
78 number of COVID-19 patients encountered and the various COVID-19 related encounters or
79 experiences.

80 Symptoms of anxiety, burnout, and depression during the COVID-19 pandemic were
81 measured using validated measurement tools.⁷⁻⁹ The 7-item Generalized Anxiety Disorder
82 (GAD-7) Scale (range, 0-21) was used to assess symptoms of anxiety over the past two weeks,
83 with a scale of normal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety. A score
84 of 10 has been reported to be a cutoff point for identifying cases of GAD. The GAD-7 included a
85 final question assessing the “difficulty (these problems) made it for you to do your work, take
86 care of things at home, or get along with other people” (range, 0-3).⁷ The single-item Mini-Z
87 Burnout Assessment (range, 1-5) was used to assess burnout, with burnout defined as ≥ 3 .⁸ The 2-
88 item Patient Health Questionnaire (PHQ-2; range, 0-6) was used to evaluate symptoms of
89 depression over the previous two weeks, with a score of 3 as the cutoff for a positive depression
90 screening requiring further evaluation with the more in-depth PHQ-9.⁹

91 Various adjustments related to personal life and medical practice during COVID-19 and
92 their relation to the participants’ current mental health were collected. Adjustments related to
93 personal life included changing hobbies (ex. change from outdoor to indoor activities), changing
94 habits (ex. showering more frequently, eating separately, wearing certain clothes only for work,
95 doing more laundry, etc), living situation (ex. living in a separate room, hotel, or basement, using
96 a different bathroom, etc), and limiting exposure (ex. avoiding to meet friends/family, going to
97 public places, etc). The impact of COVID-19 in medical practice was obtained, including

98 adjustment to practice, financial burden, career change, and early retirement. Causes of financial
99 burden were explored, including telemedicine, a decline in the elective procedure, decline in the
100 inpatient visit, and reduced work time. Adjustments to medical practice were further categorized
101 into no adjustment needed, telemedicine, reduced staff, reduced work time, reduced elective
102 procedure, and decreased inpatient visit. Impact of mental health from new adjustments and the
103 type of adjustments or impact that has the most mental health difficulty were also asked.

104

105 *Statistical analysis*

106 Data analysis was performed using SPSS, version 27. The different distribution of
107 symptoms across subgroups is tested by the chi-square independence test and fisher's exact test.
108 This is summarized in **Table 2**. Multiple logistic regression models were used to determine risk
109 factors for the severity of anxiety, burnout, and depression. The binary outcomes were developed
110 for anxiety (no symptoms of anxiety vs. symptoms of anxiety). Variables were considered for
111 inclusion in multiple logistic regression when $p < 0.05$ in univariate analysis. Details of multiple
112 logistic regression are summarized in **Table 3**. All tests were two-sided, and the significance was
113 determined at $p < 0.05$.

114 **RESULTS**

115 *Baseline characteristics*

116 A total of 139 physicians completed the survey with a response rate of 2.5%. After
117 excluding 35 incomplete responses, 104 responses were analyzed. Most responses came from
118 white (62 [59.6%]), male (53 [51.0%]), age between 31-35 years old (37 [35.6%]) with 0-5
119 practice years (76 [73.1%]). Of them, 53 (51.0%) were attending physicians, and 51 (49.0%)

120 were resident or fellow physicians. The majority of the participants specialized in family
121 medicine (30 [28.8%]), followed by internal medicine (20 [19.2%]). Twenty-four (23.1%)
122 participants reported using the osteopathic manipulative treatment in practice. Most responses
123 came from participants from the West coast (68 [65.4%]) and practiced in hospital-affiliated
124 inpatient (53 [51.0%]) in the suburban community (47 [45.2%]). The majority of the participants
125 were vaccinated for COVID-19 (97 [93.3%]) and reported a reduction of anxiety (57 [58.8%])
126 after vaccination. For those patients who were not vaccinated (7 [6.7%]), they refused
127 vaccination due to personal choice (2 [1.9%]) or history of adverse reaction from the vaccine (1
128 [1.0%]).

129 Most participants had at least 50 encounters with COVID-19 patients (42 [40.4%]) and
130 worked with active COVID-19 patients (76 [73.1%]). The majority of the participants did not
131 test positive for COVID-19 or quarantined for possible unprotected COVID-19 exposure. Of
132 those who reportedly tested positive for COVID-19 (17 [16.3%]), the majority reported having
133 severe symptoms of COVID-19 (14 [82.4%]). Most of them had friends/close relatives that have
134 contracted COVID-19 (75 [72.1%]). Of them, 25 (24.0%) had a severe form of COVID-19 or
135 died from COVID-19. A number of 75 participants (72.1%) were afraid they might pass COVID-
136 19 on to others, and most of them reported that their family and friends are worried about cross-
137 infection from them (44 [52.9%]). The majority reported having adequate personal protective
138 equipment (PPE) to protect from COVID-19 at the time of the survey from January to March,
139 2021 (94 [90.4%]). However, this was not the case in the earlier phase of the COVID-19
140 pandemic. **Table 1** lists the demographic characteristics for the study population.

141 *GAD-7 Anxiety Scale Scores*

142 Symptoms of anxiety were reported from 29 participants (29.9%), with 13.4% in the mild
143 range, 13.4% in the moderate range, and 3.1% in the severe range. The last question assessed for
144 the difficulty functioning due to anxiety asking, “How difficult have these symptoms made it for
145 you to do your work, take care of things at home, or get along with other people.” 31.9% of
146 participants reported “somewhat difficult,” 5.3% reported “very difficult,” and 1.1% reported
147 “extremely difficult.” Females reported increased symptoms of anxiety ($p=0.031$) and increased
148 difficulty with getting work done, tasks at home, or getting along with other people ($p=0.014$)
149 (**Table 2**). Participants who had 25-50 COVID-19 patient encounters reported increased
150 symptoms of anxiety ($p=0.001$). The multivariable logistic regression analysis has also
151 confirmed these findings. (Gender “anxiety symptoms”: OR 1.66, CI [1.21-2.27]; $p=0.002$;
152 “difficulty functioning”: 1.33, [1.09-1.61]; 0.004) (25-50 COVID-19 patient encounters: 2.01,
153 [1.34-3.02]; 0.001)(**Table 3**).

154

155 *Mini-Z Burnout Scale Scores*

156 Burnout was reported in 31 (32.0%) of participants. Residents and fellow physicians
157 reported a two-fold higher incidence of burnout symptoms (20 out of 51 [39.2%]) compared to
158 attending physicians (11 out of 53 [20.8%]) (**Table 2**). Similarly, multivariable logistic
159 regression analysis showed that compared to attending physicians, residents or fellow physicians
160 were more likely to experience burnout symptoms (1.28 [1.06-1.53]; 0.009) (**Table 3**).

161

162 *PHQ-2 Depression Scale Scores*

163 Eleven (11.3%) participants were positive on depression screen questions (**Table 2**).
164 Patients who screen positive for this questionnaire would require a more detailed screening to

165 assess depression. Multivariable logistic regression analysis showed that residents or fellow
166 physicians were more likely to experience depression symptoms compared to attending
167 physicians (1.15 [1.01-1.30]; 0.032). Moreover, participants who had >50 COVID-19 patient
168 encounters were more likely to experience depression symptoms compared to participants who
169 had <25 COVID-19 patient encounters (1.17 [1.02-1.35]; 0.027) (**Table 3**).

170

171 *Lifestyle Adjustments and its impact on mental health during the COVID-19 pandemic*

172 The majority of the patients reported developing a new mental health difficulty during the
173 COVID-19 pandemic (66 [64.7%]). Of them, the majority reported not seek treatment for mental
174 health (41 [78.5%]) mainly due to not considering current mental health difficulty to need
175 treatment (39 [78.0%]). When asked about adjustments made to personal life, the majority
176 reported having to limit exposure (70 [67.3%]) and change habits (65 [62.5%]), with limit
177 exposure being the type of adjustments to a personal life that has the most impact on their mental
178 health difficulty. When asked about the impact of COVID-19 in medical practice, the majority
179 reported having to make adjustments to their practice (88 [84.6%]) followed by financial burden
180 (16 [15.4%]). Type of adjustments made to medical practice included implementing telemedicine
181 (58 [55.8%]), reduced elective procedures (33 [31.7%]), decreased patient visit (26 [25.0%]),
182 reduced work time (16 [15.4%]), and reduced staff (7 [6.7%]). When asked about the cause of
183 financial burden, seven participants (6.7%) reported a decline in the elective procedure to be the
184 most common cause. A number of 57 participants (58.8%) think that the adjustments to their
185 current medical practice will continue post-COVID-19 pandemic. Mental health and adjustments
186 during the COVID-19 were summarized in **Table 4**.

187

188 DISCUSSION

189 The COVID-19 pandemic has undoubtedly strained mental health among physicians. In
190 May 2020, the surge of COVID-19 cases resulted in a global total of 152,888 infections and
191 1413 deaths among health care workers, with the highest risk among general practitioners.¹⁰
192 Physicians who already have a higher risk of burnout, depression, and suicide prior to the
193 pandemic faced additional frustration and fear from lack of adequate PPE, traumatic patient
194 outcomes, and exhaustion.¹¹ These experiences resulted in a high prevalence of anxiety,
195 depression, and stress among those caring for COVID-19 patients.^{12,13} Thus, putting a spotlight
196 on physician mental well-being during the pandemic is critical for protecting our healthcare
197 providers at the frontline fighting against COVID-19.

198 Our survey-based study demonstrated high proportions of osteopathic physicians
199 experiencing symptoms of anxiety, burnout, and depression during the COVID-19 pandemic. We
200 identified demographic risk factors for the presence of symptoms associated with mental health,
201 including position, gender, and the number of COVID-19 patient encounters. To our knowledge,
202 this is the first study to assess the impact of the COVID-19 pandemic on mental health among
203 osteopathic physicians.

204 Our study demonstrated that 29.9% of participants had symptoms of anxiety, 32.0%
205 reported burnout, and 11.1% screened positive for depression symptoms. A high prevalence of
206 psychological symptoms has been reported in frontline healthcare workers during the COVID-19
207 pandemic. A meta-analysis on the psychological impact of COVID-19 on healthcare workers
208 from 13 Asian studies reported a comparable prevalence of 23.2% in anxiety and a higher
209 prevalence of 22.8% in depression compared to our study.¹⁴ Such discrepancy in the prevalence
210 of depression can be explained by development of coping mechanisms in our cohort as the

211 survey was distributed later in the pandemic. Furthermore, a cross-sectional study evaluating
212 mental health among otolaryngologists who are at increased infection risk from frequent
213 aerosolizing procedures showed comparable burnout of 21.8% and depression symptoms of
214 10.6%.¹⁵ Our findings are concerning for the future mental wellbeing of osteopathic physicians,
215 particularly regarding anxiety and burnout. Additionally, our study identified factors that are
216 associated with increased risk of anxiety, burnout, and depression, which can help provide early
217 support and interventions to prevent long-lasting implications.

218 In our study, female physicians reported three folds higher anxiety symptoms compared
219 to male physicians. This is consistent with current literature on the female healthcare workers
220 have higher rates of depression and anxiety, independent of COVID-19 exposure.^{2,16} Female
221 physicians often have to make sacrifices in their personal/familial and professional lives during
222 the COVID-19 pandemic, adding a further burden to their existing stress and exhaustion.¹⁰
223 However, this gender difference may be due to risks of response and measurement bias in these
224 screening tools in which male respondents are less likely to report symptoms.¹⁷ Thus, we may
225 not accurately capture the mental health among males using these tools, and focus should be
226 given to improve mental wellness in all physicians regardless of their gender.¹⁵

227 Furthermore, our study showed that physicians who encountered more than 25 COVID-
228 19 patients reported higher symptoms of anxiety, and physicians who encountered more than 50
229 COVID-19 patients reported higher symptoms of depression. Gainer et al. showed a similar
230 finding in that the physicians who spend more time treating COVID-19 patients, thus having
231 more frequent encounters with COVID-19 patients, had worse mental health outcomes, including
232 depression, anxiety, and PTSD.¹¹ Thus, special attention should be given to physicians who have

233 a frequent encounter with COVID-19 patients as they are not only at high risk for infection but is
234 also at risk for mental health difficulties.

235 Residents and fellow osteopathic physicians reported increased symptoms of burnout
236 compared to attending osteopathic physicians as assessed by Mini-Z Burnout Assessment. Our
237 study showed that 39% of residents reported symptoms of burnout which was similar to
238 previously reported burnout rates among residents during the COVID-19 pandemic (41%).¹¹
239 Resident burnout is well-known in the literature, given the long work hours and heavy clinical
240 duties coupled with education responsibilities. COVID-19 pandemic has created a new stressor
241 exacerbating the challenges experienced by residents.¹¹ Gainer et al. observed that residents
242 across the country had worse average mental health scores than attendings. Similarly,
243 Kannampallil et al. showed higher stress levels and burnout among resident trainees who treated
244 COVID-19 patients.¹⁸ To address potential mental symptoms experienced by residents, the
245 residency programs should consider placing more emphasis upon the mental health of the
246 residents through providing mental health support and resources. Additionally, residents may
247 benefit from shift breaks or time off to address mental fatigue.¹⁹

248 While 65% of osteopathic physicians reported new mental health difficulty, 79% of them
249 did not seek treatment, primarily due to not considering their problem required treatment. Sadly,
250 this is not surprising as seeking help may be perceived as a personality weakness among
251 physicians.²⁰ With current trends of mental health awareness, there has been a slow shift to a
252 more accepting mental health culture among physicians.

253 Our study also identified various adjustments to osteopathic physicians' personal life and
254 medical practice during the COVID-19 pandemic and its impact on their mental health. Among
255 personal adjustment, the physicians identified limiting exposure to have the most impact on their

256 mental health. Additionally, physicians reported adjustment to medical practice to be the most
257 important adjustment to medical practice that impacted their mental health. Physicians also
258 reported facing the financial burden with decreased in-patient visits, telemedicine visits, reduced
259 staff, and reduced elective procedures. However, as the country opens back up with increased
260 vaccinations, these adjustments may slowly revert back to prior pandemic settings that will offset
261 the financial burden.

262 Our study has several limitations. The cross-sectional survey-based study only captures
263 the symptoms of mental health at one point in time. The respondents' symptoms may change
264 with changing trends during the COVID-19 pandemic. Thus, it is not possible to determine
265 whether the respondents developed or experienced the mental health outcomes as a direct result
266 of COVID-19 or whether they had these symptoms prior to COVID-19. Next, the prevalence of
267 anxiety, burnout, and depression symptoms among physicians varies greatly in the literature due
268 to the use of different screening assessment tools and the timing of the survey distribution during
269 the COVID-19 pandemic. For this reason, it is difficult to directly compare our prevalence to that
270 reported in the current literature. Furthermore, while associations between risk factors and
271 outcomes can be considered, they should not be interpreted as causal. Additionally, we
272 distributed the survey to alumni from a single academic osteopathic medical school, thus limiting
273 the generalizability of the study results. Our low response rate leads to non-response bias.
274 Individuals who did not respond to surveys may have different responses. The low response rate
275 also means that the data may not be representative of the wider osteopathic physician population,
276 thus, it is difficult to draw a generalized conclusion from our results. Although our research team
277 has attempted to increase the response rate through multiple reminder emails, our study only
278 achieved a 2.5% response rate. Our study used institution emails to reach alumni, and it is

279 possible that the alumni no longer use institution email as their primary email. Lastly, there is a
280 paucity of literature examining mental health among osteopathic physicians prior to the COVID-
281 19 pandemic, making it difficult to deduce the role of the COVID-10 pandemic on mental health
282 difficulty. Thus, further studies on osteopathic physicians from diverse institutions with higher
283 response rates are recommended to improve the generalizability of the study.

284

285 **Conclusion**

286 The new era of the COVID-19 pandemic has brought a unique challenge for physicians in
287 the United States. We provided a cross-sectional study on mental well-being, specifically among
288 osteopathic physicians. We have found that osteopathic physicians have developed symptoms of
289 anxiety, burnout, and depression, and higher prevalence in the lesser experienced group of
290 residents and fellow physicians compared to more seasoned physicians. In addition, adjustments
291 to the pandemic have caused a financial burden for physicians. Future studies should assess the
292 long-term effects of the pandemic on mental health. We hope our study will provide the
293 foundation for actionable changes to improve the mental health of osteopathic physicians.

294

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Table 1. Demographic characteristics of the study population (N=104)

Category		N	%
Gender	Male	53	51.0
	Female	51	49.0
Race	White	62	59.6
	Asian	30	28.8
	Hispanic	6	5.8
	African American	2	1.9
	Multiracial	3	2.9
Age	25-30	22	21.2
	31-35	37	35.6
	36-40	20	19.2
	>41	24	23.1
Region	West	68	65.4
	Midwest	14	13.5
	South	11	10.6
	Northeast	10	9.6
Practice years	0-5	76	73.1
	6-10	15	14.4
	>11	12	11.5
Position	Attending physician	53	51.0
	Resident or fellow physician	51	49.0
OMM	No OMM	80	76.9
	Up to 25%	22	21.2
	26-50%	2	1.9
Type of practice	Hospital affiliated inpatient	53	51
	Hospital affiliated outpatient	34	32.7
	Private outpatient	16	15.4
Type of community	Suburban	47	45.2
	Urban	39	37.5
	Rural	18	17.3
Vaccine status	Vaccinated	97	93.3
	Not vaccinated	7	6.7
Impact of vaccine on anxiety	No impact	34	35.1
	Reduced anxiety	57	58.8
	Caused anxiety	6	6.2
Reason for not vaccinated	Waiting to get vaccine	4	3.8
	Personal choice	2	1.9
	Adverse reaction to Previous vaccine	1	1

Table 2. COVID-19 exposure factors (N=104)

		N	%
Number of COVID-19 patient encounters	<25	37	35.6
	25-50	21	20.2
	>50	42	40.4
Tested positive for COVID-19	No	87	83.7
	Yes	17	16.3
Developed severe symptoms of COVID-19	No	90	86.5
	Yes	14	13.5
Quarantined for COVID-19 exposure	No	77	74
	Yes	27	26
Work with active COVID-19 patients	No	28	26.9
	Yes	76	73.1
Have friends/close relatives that have contracted COVID-19	No	29	27.9
	Yes	75	72.1
Have close friends or families who had severe form of COVID-19 or died from COVID-19	No	79	76
	Yes	25	24
Afraid of passing COVID-19 on to others	No	29	27.9
	Yes	75	72.1
People avoid me because of medical profession	No	70	67.3
	Yes	34	32.7
Family and friends are worried that they might get infected through me	No	49	47.1
	Yes	55	52.9
Have adequate PPE to protect myself from COVID-19	No	10	9.6
	Yes	94	90.4

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Table 3. Distribution of anxiety, depression, and burnout in total and subgroups (position, gender, and number of COVID-19 patients)

	Position				Gender				Number of COVID-19 patients									
	Total	Resident or fellow physician	Attending physician		Male	Female		<25	25-50	>50								
GAD-7 Anxiety symptoms	N	%	N	%	N	%	P value	N	%	N	%	N	%	P value				
Normal	68	70.1	30	66.7	38	73.1		41	83.7	27	56.3	30	83.3	8	38.1	28	70.2	
Mild	13	13.4	7	15.6	6	11.5		3	6.1	10	20.8	2	5.6	6	28.6	5	13.8	
Moderate	13	13.4	5	11.1	9	15.4		4	8.2	9	18.8	4	11.1	7	33.3	1	12.8	
Severe	3	3.1	3	6.7	0	0	0.238	1	2	2	4.2	0.031	0	0	0	3	3.2	
Total	97	100	45	100	52	100		49	100	48	100		36	100	21	100	37	100
GAD-7: Difficulty functioning																		
Not difficult	58	61.7	25	56.8	33	66		35	74.5	23	48.9	24	68.6	9	47.4	24	64.9	
Somewhat difficult	30	31.9	15	34.1	15	30		11	23.4	19	40.4	10	28.6	7	36.8	11	29.7	
Very difficult	5	5.3	2	6.8	2	4		0	0	5	10.6	1	2.9	3	15.8	1	2.7	
Extremely difficult	1	1.1	0	2.3	0	0	0.587	1	2.1	0	0	0.014	0	0	0	1	2.7	
Total	94	100	50	100	50	100		47	100	47	100		35	100	19	100	37	100
Mini-Z: Burnout symptoms																		
Negative	66	68	25	55.6	41	78.8		34	69.4	32	66.7	28	77.8	11	52.4	25	67.6	
Positive	31	32	20	44.4	11	21.2	0.017	15	30.6	16	33.3	8	22.2	10	47.6	12	32.4	
Total	97	100	45	100	52	100		49	100	48	100		36	100	21	100	37	100
PHQ-2 Depression symptoms																		
Negative	86	88.7	37	82.2	49	94.2		45	91.8	41	85.4	35	97.2	18	85.7	30	81.1	
Positive	11	11.3	8	17.8	3	5.8	0.061	4	8.2	7	14.6	1	2.8	3	14.3	7	18.9	
Total	97	100	45	100	52	100		49	100	48	100		36	100	21	100	37	100

Note: All statistically significant values are marked in bold

Abbreviations: GAD-7= 7 item Generalized Anxiety Disorder Scale; PHQ-2= two-item Patient Health Questionnaire

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Table 4. Factors associated with symptoms of anxiety, burnout, and depression following multivariable logistic regression

		Adjusted OR (95% CI)	P value	
			Category	Overall
GAD-7: Anxiety symptoms				
Position	Attending physician	1 (Reference)	NA	0.152
	Resident or fellow physician	1.26 (0.92-1.72)	0.152	
Gender	Male	1 (Reference)	NA	0.002
	Female	1.66 (1.21-2.27)	0.002	
Number of COVID-19 patient encounters	<25	1 (Reference)	NA	0.002
	25-50	2.01 (1.34-3.02)	0.001	
	>50	1.12 (0.79-1.59)	0.514	
GAD-7: Difficulty functioning				
Position	Attending physician	1 (Reference)	NA	0.113
	Resident or fellow physician	1.17 (0.96-1.42)	0.113	
Gender	Male	1 (Reference)		0.004
	Female	1.33 (1.09-1.61)	0.004	
Number of COVID-19 patient encounters	<25	1 (Reference)	NA	0.176
	25-50	1.26 (0.98-1.63)	0.076	
	>50	1.02 (0.83-1.26)	0.836	
Mini-Z: Burnout symptoms				
Position	Attending physician	1 (Reference)	NA	0.009
	Resident or fellow physician	1.28 (1.06-1.53)	0.009	
Gender	Male	1 (Reference)		0.418
	Female	1.08 (0.90-1.30)	0.418	
Number of COVID-19 patient encounters	<25	1 (Reference)	NA	0.146
	25-50	1.27 (0.99-1.61)	0.05	
	>50	1.11 (0.91-1.36)	0.312	
PHQ-2 Depression symptoms				
Position	Attending physician	1 (Reference)	NA	0.032
	Resident or fellow physician	1.15 (1.01-1.30)	0.032	
Gender	Male	1 (Reference)		0.167
	Female	1.09 (0.96-1.24)	0.167	
Number of COVID-19 patient encounters	<25	1 (Reference)	NA	0.079
	25-50	1.12 (0.95-1.32)	0.192	
	>50	1.17 (1.02-1.35)	0.027	

Note: All statistically significant values are marked in bold

Abbreviations: GAD-7= 7 item Generalized Anxiety Disorder Scale; PHQ-2= two-item Patient Health Questionnaire

Table 5. Mental health and adjustments during COVID-19

		N	%
New mental health during COVID-19			
Worsening of or developed mental health	No	36	35.3
	Yes	66	64.7
	Total	102	100
Seek treatment for mental health	No	51	78.5
	Yes	14	21.5
	Total	65	100
Reason for not seeking treatment	Not consider needed	39	78
	Lack of time	9	18
	Stigma	2	4
	Total	50	100
Adjustment to personal life			
Type of adjustments	Change hobby	40	38.5
	Change habits	65	62.5
	Change in living situation	10	9.6
	Limit exposure	70	67.3
Impact mental health	No	42	43.3
	Yes	55	56.7
	Total	97	100
Type of adjustments that has the MOST impact on mental health difficulty	Change hobby	8	14.5
	Change habits	7	12.7
	Change in living situation	2	3.6
	Limit exposure	38	69.1
Impact of COVID-19 in practice			
Type of impact	Adjustment to practice	88	84.6
	Financial burden	16	15.4
	Career change	2	1.9
	Retirement	2	1.9
Type of impact that has the MOST impact on mental health difficulty	Adjustment to practice	15	55.6
	Financial burden	4	14.8
	Career change	1	3.7
	Other	7	25.9
	Total	27	100
Causes of financial burden	Telemedicine	4	3.8
	Decline elective procedure	7	6.7
	Decline inpatient visit	2	1.9

	Reduce work time	1	1
Adjustment to practice			
Type of adjustment	No adjustment	13	12.5
	Telemedicine	58	55.8
	Reduce staff	7	6.7
	Reduce work time	16	15.4
	Reduce elective procedure	33	31.7
	Decrease in patient visit	26	25
Impact mental health	No	70	72.2
	Yes	27	27.8
	Total	97	100
Continue post-COVID19	No	40	41.2
	Yes	57	58.8

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Conflict of Interest Statement

The project was approved by the Western University of Health Sciences Institutional Review Board (IRB number: 1646112-1).

We do not have any conflict of interest.

Journal Pre-proof

Implications for practice

- Our national survey-based study showed high proportions of osteopathic physicians experiencing mental health symptoms with 29.9% of participants having symptoms of anxiety, 32.0% having burnout, and 11.1% having been screened positive for depression. Our findings are concerning for the future mental wellbeing of osteopathic physicians, particularly regarding anxiety and burnout.
- In our study, female physicians reported three folds higher anxiety symptoms compared to male physicians. This is consistent with current literature on the female healthcare workers have higher rates of depression and anxiety, independent of COVID-19 exposure.
- Osteopathic physicians who encountered more than 25 COVID-19 patients reported higher symptoms of anxiety, and physicians who encountered more than 50 COVID-19 patients reported higher symptoms of depression. Thus, special attention should be given to physicians who have a frequent encounter with COVID-19 patients as they are not only at high risk for infection but is also at risk for mental health difficulties.
- Residents and fellow osteopathic physicians reported increased symptoms of burnout compared to attending osteopathic physicians. To address potential mental symptoms experienced by residents, the residency programs should consider placing more emphasis upon the mental health of the residents through providing mental health support and resources. Additionally, residents may benefit from shift breaks or time off to address mental fatigue