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Cross-Sectional Survey Results on Mental Health Among Orthopedic Surgery Residents Across North America

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OBJECTIVE: With recent increasing rates of medical student and physician suicide, there has been a focus on examining depression in medical providers and trainees, particularly surgical residents. However, there is a paucity of data specific to orthopedic surgery. Our goal was to evaluate the mental health status of current trainees across North America in order to determine whether or not there were specific demographic or program characteristics correlated with improved mental health scores.

DESIGN: A cross-sectional survey was developed and administered to collect basic demographic information as well as residency program qualities. The Mental Health Inventory 5 (MHI-5) was used to assess depression and anxiety in study participants. We then evaluated the associations between various resident and program characteristics and depression scores with a p value set at <0.05 for significance.

SETTING: Orthopedic Surgery residency programs across the United States and Canada. Surveys were distributed to 44 programs and responses were received from 41 of those programs.

PARTICIPANTS: An anonymous survey was distributed to Orthopedic Surgery residents across the United States and Canada; participation in the survey was voluntary and free of coercion. We received a total of 279 responses from 41 institutions across North America.

RESULTS: The mean MHI-5 score of all respondents was 71.5 (range 8.0-100). Women, PGY2 and PGY3 residents and those working >80 hours per week were found to have significantly lower MHI-5 scores. Greater MHI-5 scores were seen in respondents who felt their program offered them an adequate level of surgical independence, case volume/variety, mentorship, and educational opportunities as well as adequate resources to deal with personal or work-related issues.

CONCLUSIONS: This study illustrates the prevalence of low-level depression in United States and Canadian orthopedic surgery residents. Additionally, we identified several characteristics that residency programs may focus on to help prevent burnout and depression in trainees. (J Surg Ed 000:1−8. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: mental health, resident education, depression, orthopedic surgery

COMPETENCIES: Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement

INTRODUCTION

In the face of increasing rates of medical student and physician suicide, there has been a recent focus on examining burnout and depression among medical providers and trainees, particularly residents. Surgical training has long had a reputation of being particularly demanding, yet its unique challenges and effects on mental health are rarely

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discussed or addressed. Depression has been shown to have detrimental psychological and physical effects on the individual, but more globally has been linked to poor-quality patient care and increased medical errors.[1-3] Estimates of the prevalence of depression or depressive symptoms in residency trainees ranges from 20.9% to 50.8% with up to 8% of residents noting feelings of suicidal ideation within the last year.[4-7] Despite the growing body of literature examining depression and burnout in the residency setting, there remains a paucity of literature specifically addressing orthopedic surgery residents in the United States and Canada.

There is an increased incidence in burnout and depression for those in the medical field compared to their peers in the general United States population, regardless of stage of training or practice.[5] These studies showed high risk of suffering from burnout and depression across all specialties studied.[1,4-6,8,9] Junior residents, women, smokers, those who consumed more than 5 drinks per week and those who were unmarried were most often found to have increased burnout or depression risk.[1,4,8,9] Only one such study has examined burnout and quality of life in orthopedic surgery; none have examined mental health specifically to date.[10]

With roughly 50% of orthopedic surgeons experiencing symptoms of burnout, it is critical to explore mental health in our field.[10,12] To our knowledge, no study has investigated the presence of depression or anxiety in orthopedic surgery residents or correlated program characteristics with overall resident mental health. We sought to evaluate the mental health status of current trainees across North America in order to determine whether or not there were specific demographic or program characteristics correlated with improved mental health scores. Our hypothesis was that a significant proportion of orthopedic surgery residents have a concerning depression score with women and junior residents having lower scores than other demographic groups. Our secondary hypotheses were that residents with a lower number of available resources in their residency program and unhappiness with their choice of programs had lower mental health scores.

METHODS

This was a cross-sectional pilot study designed to assess the mental health of orthopedic surgery residents in the United States and Canada using an anonymous survey. The survey was developed as part of the 2015 American Orthopaedic Association (AOA) North American Traveling Fellowship (NATF) and received Institutional Review Board (IRB) approval prior to administration. Basic demographic information including age, gender, race, ethnicity, as well as residency program qualities such as number of hours worked, call shifts per week, faculty reputation, and surgical case volume were collected. Additionally, a Likert scale (Excellent, Very Good, Good, Fair, Poor) was utilized to assess resident satisfaction with a variety of program characteristics and features such as mentorship and education opportunities, surgical independence, and resources available for residents.

The Mental Health Inventory 5 (MHI-5) was utilized to assess depression and anxiety among study participants. This 5-question survey is derived as a subset from the longer SF-36 questionnaire and has been extensively studied and shown to be a valid and reliable screening measure of mental health status; a copy is shown in Figure 1.[13,14] Three of the questions are aimed at depressive symptoms and psychological well-being, while the remaining 2 questions measure symptoms of anxiety. There are 6 possible responses to each of the 5 questions, scored between 1 and 6. The scores from each question are summed and then transformed into a number on a 100-point scale with a higher MHI-5 score being correlated with better mental health. The MHI-5 has been shown to be able to detect mood and anxiety disorders when compared with the use of DSM-IV criteria as the gold standard; however it is less accurate for somatoform disorders or substance abuse.[15] Various cut points have been investigated to suggest the presence of depression; we utilized a cut point of 60 based off of previous studies.[14-17]

The survey was distributed electronically to program directors at 44 orthopedic surgery residency programs across the United States and Canada with a cover letter explaining the purpose of the study and that completion of the questionnaire was completely voluntary. Fourteen of the programs were the sites visited as part of the AOA NATF; an additional 30 programs were chosen at random to yield roughly one-quarter of all orthopedic surgery training programs in North America. The surveys were anonymous: basic demographic data were collected but no personal identifying information was obtained. Study data were collected and managed using REDCap electronic data capture tools. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for importing data from external sources.[18]

Summary statistics were calculated for all continuous variables in terms of means and standard deviations and categorical variables in terms of frequencies and percentages. Group differences for categorical variables were compared using an analysis of variance (ANOVA) model

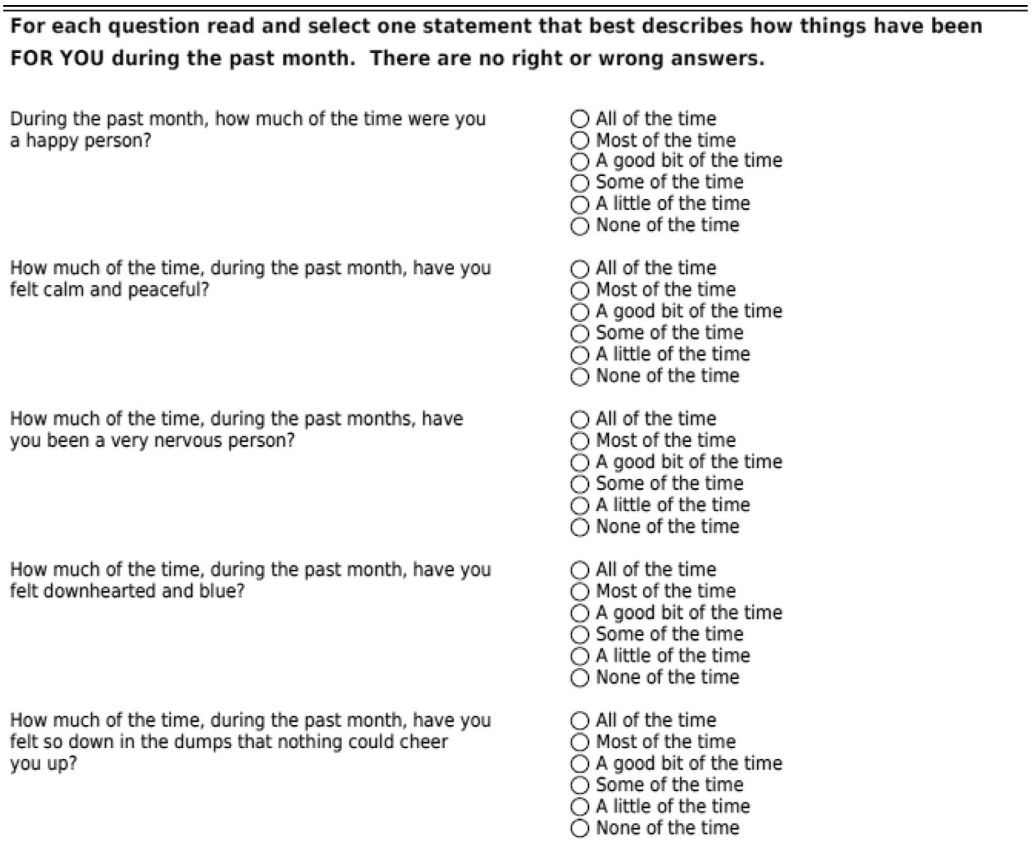

FIGURE 1. Example of the Mental Health Inventory 5 question survey administered as part of the NATF survey.

with significance set at 0.05. All statistical analyses were performed using SPSS, version 24.

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RESULTS

Surveys were distributed electronically to 44 orthopedic residency programs across the United States and Canada. After surveys were administered, we received a total of 279 responses from 41 institutions across North America. Demographic data and associated mean MHI-5 scores of all resident respondents are shown in Table 1. Women were found to have a significantly lower MHI-5 score than men: 64.8 compared with 73.4 ($p = 0.002$). PGY2 and PGY3 residents had significantly lower scores compared with research residents, 68.0 and 66.5 respectively versus 82.0 ($p = 0.03$). We found no statistical significance between age, race or ethnicity, and MHI-5 score. There was no association between MHI-5 score and fellowship subspecialty choice. There was a significant difference in mental health scores between those working <80 hours and those working >80 per week

TABLE 1. Demographic Table of All Survey Respondents With Associated MHI-5 Scores and Standard Deviations

	N (%)	MHI Score Mean (SD)
Sex		
Male	228 (81.6%)	73.4 (16.8)
Female	51 (18.4%)	64.8 (17.8)
Age		
25-29	141 (50.5%)	70.7 (18.1)
30-35	129 (46.2%)	72.8 (17.9)
36-40	9 (3.3%)	74.7 (10.3)
Training Level		
PGY1	50 (17.8%)	73.2 (18.7)
PGY2	49 (17.6%)	68.0 (18.5)
PGY3	55 (19.7%)	66.5 (17.5)
PGY4	61 (21.9%)	74.9 (18.3)
PGY5	58 (20.8%)	74.3 (15.6)
Research Resident	6 (2.2%)	82.0 (8.2)
Race		
White	240 (86.0%)	72.4 (17.2)
African American	9 (3.2%)	68.4 (17.4)
Asian	21 (7.6%)	68.8 (19.3)
Other	9 (3.2%)	66.2 (28.4)
Ethnicity		
Hispanic	6 (2.3%)	68.0 (25.2)
Not Hispanic	259 (97.7%)	71.7 (17.8)

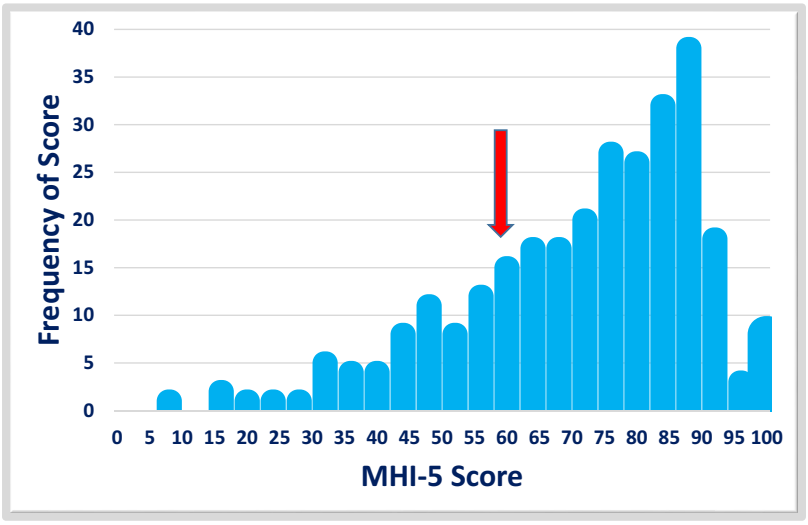

FIGURE 2. Distribution of MHI-5 scores among all survey respondents. The red arrow indicates the utilized cut point of 60.

(76.5 versus 67.2; $p < 0.001$). When examining the amount of debt, there was no significance when considering debt in $50,000 increments but when separated out into <$300,000 and >$300,000, there was a statistically significant difference ($p = 0.011$). There was no significant association with where the respondent's current residency program was on their original rank list and a greater MHI-5 score.

The distribution of individual MHI-5 scores is shown in Figure 2. With the designated cut point of 60, 26.1% of respondents ($n = 73$) are identified as having some underlying depression or anxiety. The results of the responses to the 5 individual survey questions are presented in Figure 3. Within the month preceding the survey, only 5% of responders ($n = 15$) reported "being a happy person," while 14.6% of responders ($n = 44$) reported "feeling calm and peaceful." Additionally, 50.5% of responders ($n = 153$) had been "a very nervous person" and 35.3% of responders ($n = 107$) had "felt downhearted and blue." 11.2% of responders ($n = 34$) had "felt so down in the dumps that nothing could cheer them up" in the past month.

We found numerous statistically significant features of programs that correlated with greater MHI-5 scores, listed in Table 2. Greater MHI-5 scores were seen in respondents who felt their program offered them an adequate level of surgical independence ($p < 0.001$) and volume/case variety ($p = 0.011$), mentorship and education opportunities ($p < 0.001$), preparation for independent practice ($p < 0.0001$) and resources on how to find a job ($p = 0.002$). Additionally, those who felt that their programs did not provide them with adequate resources to deal with personal or work-related issues had a significantly lower MHI-5 score ($p < 0.001$) compared with those who felt supported by their programs. Further, there was a significant correlation between MHI-5 score and self-reported overall quality of life as shown in Figure 4.

DISCUSSION

This study illustrates the high percentage of poor mental health in trainees across United States and Canadian orthopedic surgery residency programs based off of reported MHI 5 scores. Additionally, this survey has identified several program characteristics that are correlated with improved mental health scores. There are some significant correlates with poor mental health that programs cannot control, such as educational debt, self-reported quality of life, and overall satisfaction with residency choice. However, there are many features that residency programs can affect, particularly enforcing ACGME duty hour restrictions and ensuring that residents have adequate resources to deal with both personal and professional issues.

There are several limitations to this study. Primarily, this is a relatively small sample size compared to the number of orthopedic surgery residents across North America. We estimate that the survey was distributed to a total of 1,088 residents at 44 programs in the United States and Canada. This is roughly 25% of the total orthopedic surgery resident population at 161 programs in the United States and 17 programs in Canada. We sought to perform a pilot study with a smaller subset of the overall population to evaluate the value of pursuing a larger scale project in the future. We received responses from 279 residents at 41 institutions for an overall response rate of 26%. It is unclear why the response rate was low, but was comparable to the previously

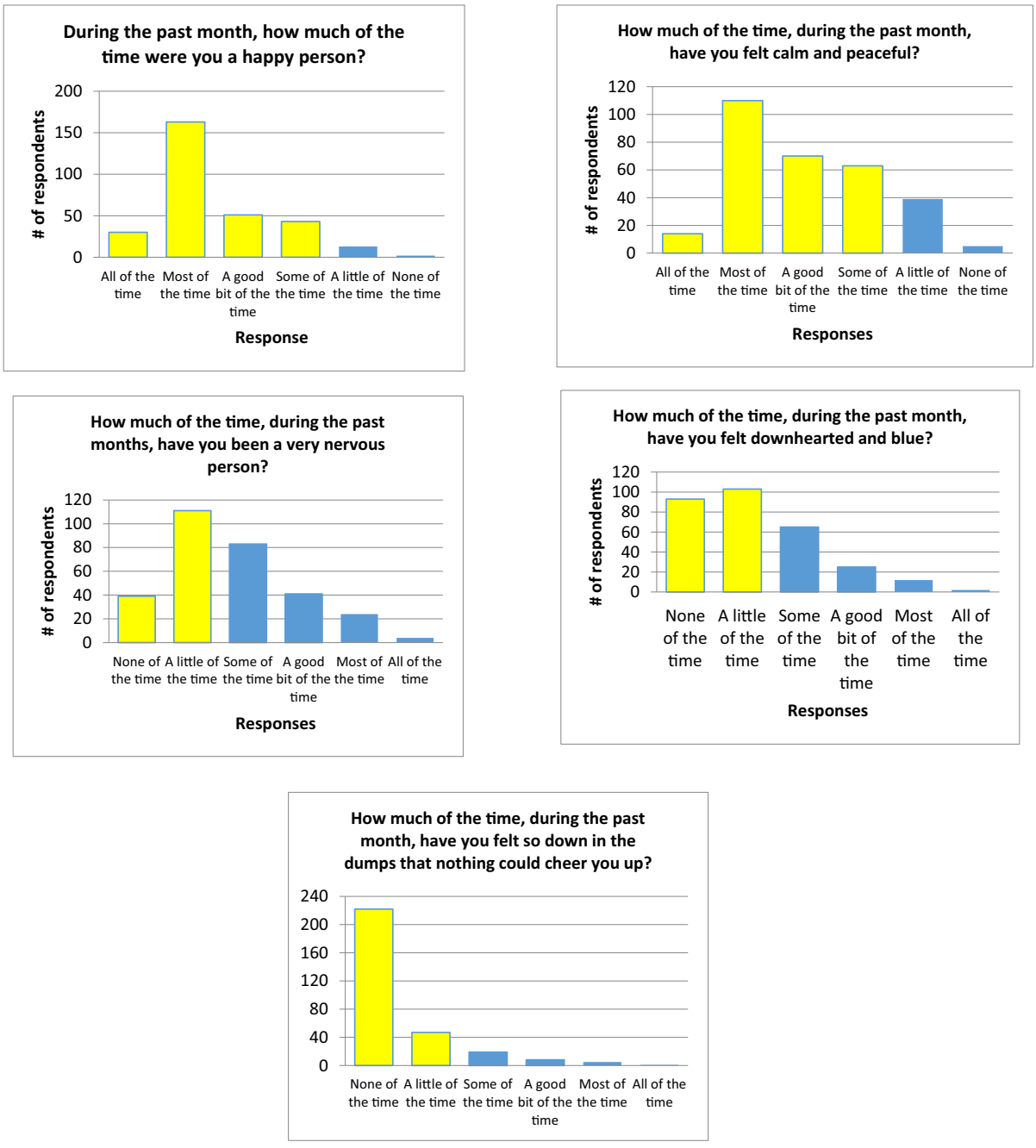

FIGURE 3. Individual MHI 5 questions with associated responses of all survey respondents. Yellow colored bars indicate a "Positive" response and blue indicates a "Negative" response.

completed survey on quality of life in orthopedic surgeons.[10] Anonymous surveys and those exceeding 1000 words historically have a poor response rate within the medical field.[17,19] It is possible that there is a selection bias in the residents that did respond. They may work less hours, have more free time, or have a greater quality of life which allowed them the ability to respond to the survey. If this was the case, this survey may actually under-report the level of depression in residents. However, the converse may also be true with the residents with lower mental health scores preferentially responding. Finally, this survey did not assess for other significant personal factors including relationship status, nonhospital support networks or substance abuse habits, which may play an integral role in overall resident mental health.

Our study revealed 26.1% of the orthopedic surgery residents who responded to our survey were below the

TABLE 2. Residency Program Characteristics Significantly Associated With Greater MHI-5 Scores and Their Associated p Values

Program Characteristic	p Value
Level of surgical independence	$p < 0.001$
Caliber or reputation of faculty	$p = 0.024$
Volume and variety of cases	$p = 0.011$
Mentorship opportunities	$p < 0.001$
Educational opportunities (core conferences, cadaver labs, lectures, etc)	$p < 0.001$
Overall satisfaction with program	$p < 0.001$
Program provides adequate resources to deal with personal or work-related issues	$p < 0.001$
Overall quality of life (work and outside residency)	$p < 0.001$
Feel like program has prepared resident for independent practice	$p < 0.001$
Resident would select same program again	$p < 0.001$
Educational modules to help understanding of finance of orthopedic surgery	$p = 0.035$
Understanding of different employment models	$p = 0.021$
Program provides resources on how to find a job	$p = 0.002$
Worked less than 80 hours/week	$p < 0.001$
Debt >$300K	$p = 0.011$

FIGURE 4. Graph illustrating correlation of MHI-5 score and reported quality of life.

selected cut point which would indicate poor mental health. This number is consistent with previously published studies examining depression in residents across all specialties.[1,4-8] While it is reassuring that orthopedic surgery residents are not scoring worse than other specialties on depression screening questionnaires, this is still a concerning percentage and merits further dialogue. Additionally, 11.2% of responders had "felt so down in the dumps that nothing could cheer them up" in the past month which is equally alarming as the overall incidence of depression in orthopedic surgery residents surveyed. Given that the estimated relative risk for suicide mortality in physicians is as high as 3.4 in male doctors and 5.7 in female doctors compared with the general population, it is essential that each orthopedic training program implement programs to help residents that present with depression or depressive symptoms.[20]

Our study revealed 2 main demographic factors that correlated with worse mental health scores: gender and year in residency. To our knowledge, this is the first study to illustrate a gender difference in mental health within orthopedics. This is consistent with the increased incidence of depression in females in the general population of both the United States and Canada.[21-23] Women make up a significantly smaller percentage of orthopedic surgery residents; only 13% of United States orthopedic surgery residents are women.[24] It has been previously discussed that some barriers to women in orthopedic surgery include lack of female mentors and faculty at training programs, perceived inability for a work/life balance or inadequate physical strength; these factors were not specifically explored in our survey.[25,26] It is possible that these potential barriers to women entering the field are the same issues that result in the decreased MHI-5 scores in female residents, but additional work would be required to further define these issues.

Consistent with previous studies in other specialties, we found a significant correlation between year of residency and MHI-5 with the lowest scores found in PGY2 and PGY3 residents and highest scores in research residents.[1,4,8,9] Junior residents often shoulder the majority of the call burden and as a result work an increased number of hours compared to other years.[10]

Several studies have illustrated the decrease in resident burnout when working less than 80 hours per week, including one prior study in orthopedics.[1,4,8,9,11] Our study corroborated that working greater than 80 hours per week was associated with lower mental health scores and decreased quality of life. Enforcing this ACGME-mandated regulation may improve resident mental health. However, care must be taken to balance this with resident education, including both operative experience and academic training. Working over 80 hours a week was associated with lower MHI-5 scores, but respondent satisfaction with many specific program educational features are associated with improved MHI-5 scores, emphasizing the delicate balance that programs must strike.

Programs should consider using this list of factors associated with greater mental health scores to target areas for improvement among their faculty and within their educational curriculum. Respondents who were satisfied with their level of surgical independence, volume and variety of cases, reputation of faculty, as well as educational opportunities had higher MHI-5 scores. Programs can continue to improve upon their conference and lecture curricula while ensuring that there are ample hands-on labs, either with cadavers or sawbones.

Further, we showed a correlation between resident satisfaction and their perceived readiness for independent practice, not just surgically but also from a practice structure standpoint. We suggest that programs consider a seminar series to educate residents on practice development as well as the business of medicine.

Finally, having the support of their programs is a very important predictor of resident mental health and overall quality of life. Program support comes in the form of not only strong mentors, but also adequate resources to manage both personal and professional issues that arise. Both of these factors were significantly correlated with greater MHI-5 scores and quality of life in the residents surveyed. A previous survey of orthopedic surgery residents revealed that nearly all residents believed mentors were critical or beneficial to their training; in fact, residents most satisfied with the mentorship at their program had a formal mentor program in place and were able to choose their mentor.[27] Providing their trainees with access to formal mentors would be a simple step that programs can take to improve mental health within the residency. Further, providing adequate resources to address personal and professional issues, while also ensuring that residents have the time to engage in them, is paramount to decreasing the rates of poor mental health within programs. Additionally, we need to improve upon the identification of "at-risk" trainees so changes can be implemented at the individual and program level.

Results from this study identify several demographic and program-specific features correlated with mental health scores, both positively and negatively, in orthopedic surgery residents across North America. We suggest several ways programs can continue to improve program structure and support of their residency trainees in order to improve overall mental health. This should serve as a pilot study to apply for additional funding to complete a larger scale, more in depth study across the field of orthopedic surgery. Additional work is necessary to fully explore the reasons behind these differences as well as the effects program changes have on mental health of their residents. We hope this study will stimulate dialogue, future research and possible changes within residency programs to improve the overall well-being of orthopedic surgery residents across the United States and Canada.

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SUPPLEMENTARY INFORMATION

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