

Original Research

A Two-Year Longitudinal, Cross-Sectional Evaluation of Resident Physician Burnout: An Exploration of the Effects of Stress, Satisfaction, Exercise and EMR

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Abstract

Background

There is a need for better understanding of trajectory of burnout in clinical training and what factors are associated with resident well-being and burnout overtime. This study examined medical resident burnout and physical activity throughout different times of the academic year, across several different medical specialties and postgraduate years (PGY), over two years.

Methods

A resident wellness survey was administered throughout five different waves from summer 2018 to winter 2020. A total of 493 survey responses from seven subspecialties completed the survey. We used 474 responses for quantitative statistical analysis and 138 for qualitative thematic analysis.

Results

The average response rate was 47%, and ranged between 40% (Wave 3) and 56% (Wave 1). Three analyses were conducted: the first demonstrated significantly higher Satisfaction in Wave 1 as opposed to Wave 2. The second analysis showed significant correlations between Overall, Satisfaction, and Stress scores and exercise-based questions for female, male, and primary care cohorts of residents. The third analysis showed that in 2018, interns and non-interns differed on Stress but did not differ on Satisfaction or Overall scores.

Conclusions

Similar levels of satisfaction, stress, and overall well-being were reported at different times in the academic year and from year to year. Exercise was not consistently related to resident well-being outcomes. These findings suggest a need for targeted interventions based on post-graduate year, time in the academic year and well-being drivers.

Keywords

graduate medical education; internship and residency; resident wellness; psychological burnout; professional burnout; physical activity; stress; job satisfaction; survey research

Introduction

Burnout can be defined as emotional exhaustion, depersonalization and decreased personal accomplishment within a work-related setting.¹ It affects over half of the physicians practicing in the United States, and is twice as predominant in medicine as in other occupations.² Many studies have reviewed this topic with varying populations and methods. They found that

burnout is related to an increased risk of medical errors, negative effects on patient safety, lower patient satisfaction and longer post-discharge recovery time.³ Cross-sectional studies on the general physician population have also found an increased risk of suicide as compared to the general population.⁴ Most critically, previous studies looking directly at resident physician burnout have found that burnout incites higher rates of depression than individuals who

are in the same age category, but have chosen a different career path.⁵ Despite these findings in resident physicians, additional evidence has shown that burnout may develop even before entering the first year of residency with initial depression symptoms, suicidal ideation and low sense of personal accomplishment being most prevalent during medical school.⁶⁻¹⁰ Following medical school, burnout, high fatigue and high depersonalization were magnified during residency and shown to improve in early-career physicians.

Burnout during residency might develop due to long work hours, lack of sleep, unbalanced schedules, emotional demands and the need to acquire a significant amount of clinical knowledge.¹¹ Previous research has shown the highest risk of burnout is in particular specialties such as emergency medicine, family medicine, general internal medicine and neurology, with additional findings that 4.3% of otolaryngology residents were burned out at the beginning of the year compared to 55.3% at the end of the year.^{5,12} Other researchers investigating psychiatry residents' burnout found that having a negative perception of their environment may lead to mental distress and emotional exhaustion/depersonalization. In internal medicine resident populations, burnout might lead to residents delivering suboptimal medical care, which could lead to the increase of medical errors and a decrease in professionalism.¹³ Alternatively, residents who have a positive perception of their learning environment experience less stress and burnout. Taken together, these studies demonstrate that the environment of the residency (and the perception thereof) plays a critical role in the prevalence of burnout in resident physicians.

Residents who have a greater amount of social support (i.e., family, friends, a supportive supervisor and mentor, etc.) tend to experience less symptoms of burnout during their medical training. Being immersed in a supportive work environment while having a feasible workload also have the possibility of reducing burnout.¹⁴ Olson and colleagues reported residents' physical activity level decreases once they begin their medical training.¹¹ In a study conducted by Mari and colleagues, they found that 100% of residents believed the session on Tai Chi and art therapy was the most impactful activity

during Wellness Day for improving wellness, 94% for the gym, walking and outdoor activities and 89% for mind-body exercises. Overall, 85% of the residents believed nutrition was the most impactful characteristic in terms of improving wellness, 62% reported fitness and 54% reported emotional health.¹⁵

The present study sought to examine medical resident burnout and physical activity throughout different times of the academic year, over several years. Our analysis explored three research questions:

Question 1: Are there significant differences between 5 Waves on Overall, Satisfaction and Stress subscales of the Mini-Z burnout inventory?

Question 2a: Is there a relationship between physical activity/exercise and Satisfaction and Stress subscales of the Mini-Z burnout inventory?

Question 2b: Is there a possible relationship between physical activity/exercise and Satisfaction and Stress subscales different for men and women as well as subspecialties?

Question 3: Are the differences in composite scores between Waves 1 and 2 and between interns and non-interns equivalent with the differences between Waves 3 and 4?

Methods

Design

The Resident Wellness Survey in this study is part of a larger quality improvement initiative in medical residency programs that the authors are a part of conducting. This convenience sample-based survey was administered in five waves. (**Table 1**) Wave 1 ($n = 94$) occurred in the summer of 2018, Wave 2 occurred in fall of 2018 ($n = 98$), Wave 3 ($n = 98$) occurred in the summer of 2019, Wave 4 occurred in the fall of 2019 ($n=100$) and Wave 5 occurred in the winter of 2020 ($n = 103$). The survey window for each wave lasted for one month, with an average of three email survey reminders. For this particular research, we excluded responses from a fellowship program because there were only two fellows at any given time and categorically incomparable to the resident responses. The survey was sent out to all residents in a form of a Survey Monkey link and participation was completely voluntary. We did not collect any identifiable information from the residents/fellows and took extra steps such as categorizing

Table 1. Demographic Characteristics by Wave of Survey Responses (Summer 2018 to Winter 2020)

Question Number	Wave 1 (n = 94)	Wave 2 (n = 98)	Wave 3 (n = 98)	Wave 4 (n = 100)	Wave 5 (n = 103)
Q16 (Age)	n (%)	n (%)	n (%)	n (%)	n (%)
18-24	1 (1.1)	1 (1)	0 (0)	1 (1)	1 (1)
25-34	72 (76.6)	86 (87.8)	81 (82.7)	82 (82)	85 (82.5)
35-44	15 (15.8)	8 (8.2)	14 (14.3)	14 (14)	14 (13.6)
45-54	3 (3.2)	3 (3.2)	3 (3)	2 (2)	3 (2.9)
Missing	3 (3.2)	0(0)	0(0)	0(0)	0(0)
Q17 (Gender)					
Female	39 (41.5)	45 (45.9)	39 (39.8)	41 (41)	45 (43.7)
Male	51 (54.3)	53 (54.1)	58 (59.2)	58 (58)	57 (55.3)
Other	0 (0)	0(0)	1 (1)	1 (1)	1 (1)
Missing	4 (4.3)	0(0)	0 (0)	0(0)	0 (0)
Q18 (PGY Level)					
PGY-1	46 (48.9)	53 (54.1)	46 (46.9)	31(31)	35 (34)
PGY-2	28 (29.8)	21 (21.4)	28 (28.6)	40(40)	40 (38.8)
PGY-3	17 (18.1)	23 (23.5)	20 (20.4)	26(26)	25 (24.3)
PGY-4	1 (1.1)	1 (1)	2 (2)	2(2)	3 (2.9)
PGY-5	0 (0)	0 (0)	2(2)	1(1)	0 (0)
Missing	2 (2.1)	0 (0)	0 (0)	0(0)	0 (0)
Q20 (Program Type)					
Family Medicine	30 (31.9)	39 (38.7)	35 (35.7)	30 (30)	47 (45.6)
Internal Medicine	16 (17)	21 (21.4)	21 (21.4)	23 (23)	26 (25.3)
Neurology	6 (6.4)	7 (7.1)	7 (7.1)	12 (12)	6 (5.8)
Transitional year	11 (11.7)	7 (7.1)	8 (8.2)	9 (9)	1 (1)
Surgery	13 (13.8)	11 (11.2)	9 (9.2)	12 (12)	7 (6.8)
Psychiatry	8 (8.5)	7 (7.1)	9 (9.2)	7 (7)	8 (8.7)
Podiatry	7 (7.4)	3 (3.1)	3 (3.1)	7 (7)	4 (3.9)
Missing	3 (3.2)	0(0)	0 (0)	0 (0)	0 (0)

age, so individual answers could not be traced back to the resident. The study was reviewed and deemed exempt by the HCA Healthcare Institutional Review Board.

Materials

The Resident Wellness Survey consisted of the Mini-Z burnout inventory (13 questions) and three questions regarding physical activity based on recommendations from the American College of Sports Medicine.^{16,17} The number, text

and response options of each question in the survey are listed in **Table 2**. Notably, the administration of this survey differed from the original Mini-Z burnout inventory such that Question 3 of the Mini-Z was broken into individual sub-questions (Questions 3.1–3.5 in our survey) in which respondents could choose “Yes” or “No” to each of the statements in lieu of choosing which statement the respondent agreed with most. All Likert-like survey items were coded as numerical analogues, and Questions 2

Table 2. Survey Question Numbers, Text and Response Options for Resident Wellness Survey

Question Number	Text	Response Options
Q1	Overall, I am satisfied with my current job:	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
Q2	I feel a great deal of stress because of my job:	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
Q3.1	I enjoy my work. I have no symptoms of burn-out.	No, Yes
Q3.2	I am under stress, and don't always have as much energy as I did, but I don't feel burned out.	No, Yes
Q3.3	I am definitely burning out and have one or more symptoms of burnout, e.g., emotional exhaustion.	No, Yes
Q3.4	The symptoms of burnout that I am experiencing won't go away. I think about work frustration a lot.	No, Yes
Q3.5	I feel completely burned out. I am at the point where I may need to seek help.	No, Yes
Q4	My control over my workload is:	Poor, Marginal, Satisfactory, Good, Optimal
Q5	Sufficiency of time for documentation is:	Poor, Marginal, Satisfactory, Good, Optimal
Q6	Which number best describes the atmosphere in your primary work area:	Calm, 2, Busy, 4, Hectic
Q7	My professional values are well aligned with those of my department leaders:	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
Q8	The degree to which my care team works efficiently together is:	Poor, Marginal, Satisfactory, Good, Optimal
Q9	The amount of time I spend on the electronic health record (EHR) at home is:	Excessive, Moderately High, Satisfactory, Good, Optimal
Q10	My proficiency with EHR use is:	Poor, Marginal, Satisfactory, Good, Optimal
Q11	How many days per week do you engage in at least 30 minutes of moderate intensity aerobic/cardio exercise?	0–7 Days
Q12	How many days per week do you engage in strength training (weights, pilates)?	0–7 Days
Q13	How many days per week do you engage in balance and coordination exercises (yoga, Tai Chi, or Qigong)?	0–7 Days

and 6 were reverse-coded to ensure all questions demonstrated the preferable response as the higher score. Three composite scores were calculated for each respondent: first, an Overall score was calculated which was the sum of the numerical analogues of every question from

the Mini-Z burnout inventory (Questions 1-10); second, a Satisfaction score was calculated as the sum of Questions 1, 3, 7 and 8; and finally, a Stress score was calculated as the sum of Questions 2, 5, 6 and 9. These composite scores were used as they correspond to two emergent

factors of the survey that have high internal consistency.¹⁸ We calculate Cronbach’s alpha calculations for the version of the Mini-Z in this study. For the overall instrument, Cronbach’s alpha was 0.81 (standardized). For the Satisfaction subscale, Cronbach’s alpha was 0.69 (standardized); and for the Stress subscale, Cronbach’s alpha was 0.70 (standardized).

Participants (Subject Population)

An anonymous survey was sent out to residents from 14 residency programs in four states, which are part of single healthcare system. We received a total of 493 survey responses across five data collection waves; demographic information about the sample from each wave is provided in **Table 1**. Since we did not track individual responses, it is possible for the same resident to take the wellness survey multiple times. The response rate for Wave 1 was 54% (94/175), 56% for Wave 2 (98/175), 40% for Wave 3 (98/245), 41% for Wave 4 (100/245) and 42% for Wave 5 (103/245). The average response rate across all five waves was 47%. The residents who responded came from seven different subspecialties. Most of the participants were between 25 and 34 years old, in their first two PGY years, and half came from either family or internal medicine programs. There were slightly more male program participants. A total of 20 respondents’ data were excluded from the statistical analysis: 12 for responding to multiple levels of sub-questions on Question 4, one for not responding to every question, three for not selecting “Male” or “Female” on the gender demographic question, and four for invalid responses to the program type demographic question. The exclusions yielded a total sample of $N = 474$ respondents. (**Table 1**)

Statistical Analysis

Descriptive statistics were calculated for each wave and means were compared for each composite score via omnibus one-way ANOVAs treating Wave as a between-subjects fixed independent variable and Score as the dependent variable. Composite scores were then correlated with the exercise-based questions (Questions 11–13). Two way ANOVAs were conducted to assess the differences in composite scores from summer to fall in 2018 and 2019 between intern and non-intern residents. Wave 5 was excluded from the latter two analyses as it was administered in a different time of year as the other waves. We classified all internal medicine and family medicine as Primary Care and all other residents from other programs as Specialty Care. A thematic approach was used to determine the reoccurring themes for the open-ended question on the survey.¹⁹ All statistical analyses were conducted using the R statistical suite.²⁰

Results

In the first analysis comparing composite scores, (**Table 3**) only one one-way ANOVA yielded a significant result in the Satisfaction score, $F(4, 469) = 4.65, p = .001$, with the main effect being driven by a significantly higher Satisfaction score in Wave 1 as compared to Wave 2, $t(179.48) = 4.11, p < .001$.

In the second analysis, correlation matrices and their significance tests were computed between the exercise-based questions (Questions 11–13) and composite scores. The analyses were conducted separately for each gender (Male or Female) and for each program type (Primary Care or Specialty). For the male respondents, the only significant correlation observed was

Table 3. Composite Score Means by Wave of Resident Responses (Summer 2018 to Winter 2020)^{a,b}

Composite Score	Wave 1 ($n = 94$)	Wave 2 ($n = 98$)	Wave 3 ($n = 98$)	Wave 4 ($n = 100$)	Wave 5 ($n = 103$)	$F(4,475)$	p
Overall	34.63 ± 5.50	32.55 ± 6.35	33.58 ± 6.08	34.17 ± 4.92	33.06 ± 5.29	2.03	0.088
Satisfaction	16.07 ± 2.24	14.57 ± 2.70	15.05 ± 2.55	15.17 ± 2.30	15.20 ± 2.18	4.65	0.001*
Stress	12.12 ± 2.86	11.39 ± 3.36	11.62 ± 3.06	12.05 ± 2.39	11.37 ± 2.69	1.47	0.211

^a Data are represented as the mean response plus or minus standard deviation (M ± SD).

^b Asterisk refers to significant at the $p = .05$ level.

a weak negative correlation between Q14 and Satisfaction, $r = -.27, p = .044$. In contrast, the female respondents in Waves 1, 2 and 3 had myriad significant correlations. In Wave 1, the following significant weak-to-moderate positive correlations were observed for female respondents: first, Q11 and Overall, $r = .324, p = .041$; second, Q11 and Satisfaction, $r = .356, p = .024$; third, Q12 and Overall, $r = .465, p = .003$; and fourth, Q12 and Stress, $r = .327, p = .039$. In Wave 2, significant weak-to-moderate positive correlations were observed between Q11 and Overall, $r = .325, p = .031$, between Q11 and Stress, $r = 4.12, p = .005$, and between Q13 and Stress, $r = .253, p = .019$.

When considering only the Primary Care residents (internal medicine and family medicine), significant correlations were observed in Waves 1, 3 and 5. For Wave 1, the following significant weak-to-moderate positive correlations were observed for primary care residents: first, Q11 and Overall, $r = .449, p = .002$; second, Q11 and Satisfaction, $r = .493, p = .001$; third, Q11 and Stress, $r = .316, p = .037$; fourth, Q12 and Overall, $r = .332, p = .028$; and fifth, Q12 and Satisfaction, $r = .357, p = .017$. For Wave 3, a significant weak positive correlation was observed between Q11 and Satisfaction, $r = .366, p = .007$. Additionally, significant weak-to-moderate negative correlations were observed between Q13 and Overall, $r = -.290, p = .033$, between Q13 and Satisfaction, $r = -.271, p = .047$, and between Q13 and Stress, $r = -.302, p = .026$. In Wave 5, the only significant weak positive correlation observed was between Q11 and Stress, $r = .282, p = .017$. No significant correlations were observed for the Specialty residents.

For the final statistical analysis, we sought to test if the same differences in composite scores between Waves 1 and 2 and between interns and non-interns were equivalent with the differences between Waves 3 and 4. In the Wave 1-to-2 cohort, each ANOVA yielded significant results: first, on the Overall composite score, a significant main effect of Wave, $F(1, 180) = 5.57, p < .05$, was observed demonstrating Wave 1 having higher Overall scores than Wave 2, $t(180.92) = 2.38, p < .01$. Second, on the Satisfaction composite score, a significant main effect of Wave was observed, $F(1, 180) = 16.54, p < .01$, demonstrating Wave 1 having higher Satisfaction scores than Wave 2, $t(179.48) = 4.11, p < .001$. Finally, on the Stress

score, a significant main effect of Intern status was observed, $F(1, 180) = 4.41, p < .05$, demonstrating interns as having higher Stress scores than non-interns was observed, $t(180.32) = 1.98, p < .05$. In the Wave 3-to-4 cohort, the only significant result was a significant cross-over interaction on the Satisfaction score between Wave and Intern status, $F(1, 1) = 6.60, p < .05$, with no main effects.

Our qualitative analysis found five main themes: (1) scheduling or administrative issues ($n = 212$), (2) personal or financial issues ($n = 63$), (3) wellness education or resources ($n = 39$), (4) neutral or ambivalent ($n = 51$) and (5) no answer or N/A ($n = 133$). Within those groups, eight reoccurring themes appeared across the waves: (1) electronic health records/electronic medical records (EHR/EMR), (2) long work hours, (3) documentation, (4) resident schedules, (5) gym availability, (6) resident wellness, (7) work/life balance and (8) salary increase. There were a total of 138 responses in Wave 5 (PGY-1 $n = 60$; PGY-2 $n = 45$; PGY-3 $n = 30$; PGY-4 $n = 2$; PGY-5 $n = 1$) excluded from thematic analysis as well, mirroring the statistical analyses described previously.

We found that during the fall months, themes such as long work hours, documentation, resident schedules, gym availability and salary increase were reported by PGY 1 residents more frequently than in the summer months. The stressors of working long hours back-to-back days, not having much time for documentation, gym availability, resident wellness, salary increase and work/life balance were discussed more frequently during the fall months by PGY 2s. Further, PGY-2s discussed their schedules more frequently during the summer months. PGY-3s frequently discussed long hours, gym availability and work/life balance during the fall months, and EHR/EMR and salary increase during the summer months. The topics documentation, resident schedules, and resident wellness were discussed equally by PGY-3s during both the summer and fall months. There were only a total of two responses from PGY-4s, and they both were from the summer (Wave 1) regarding EHR/EMR and documentation. One PGY-5 from the summer (Wave 3) reported about salary increase. When looking at all five PGY levels as a whole, EHR/EMR was the only theme that had the most responses during the summer months.

Discussion

The present study sought to examine medical resident burnout and physical activity throughout different times of the academic year, over several years. Our analysis explored three research questions which ultimately could lead to targeted interventions to improve resident well-being.

Are there significant differences between 5 Waves on Overall, Satisfaction and Stress subscales of the Mini-Z burnout inventory?

Though there was a statistically significant higher Satisfaction and Overall score subscale between Wave 1 and Wave 2, we overall did not find meaningful difference in overall average resident well-being, as measured by the three Mini-Z subscales in five separate cross-sectional time points.

This flat trajectory of satisfaction, stress and overall well-being suggests that programs should provide ongoing general interventions throughout the year, and between years, aimed at decreasing stress and increasing satisfaction rather than seasonally selected targeted efforts. Considering that most programs have an academic block schedule where at any given time a certain percentage of residents are scheduled in high stress environments (e.g., ICU rotations) while others are scheduled in lower stress environments (e.g., electives), the average well-being score at any given time would remain stable.

Is there a relationship between physical activity/exercise and Satisfaction and Stress subscales of the Mini-Z burnout inventory? Is a possible relationship between physical activity/exercise and Satisfaction and Stress subscales different for men and women as well as subspecialties?

One possible intervention for resident well-being that has a substantial evidence basis with regard to well-being in the general population is regular physical exercise. Physical exercise is associated with reduced symptoms of anxiety and low energy.²¹ Research has shown that aerobic exercise can be at least as effective at improving symptoms of depression as antidepressant medication and psychotherapy.^{22,23} In a review of strategies for preventing workplace depression, researchers found that interven-

tions to increase physical activity were among the most effective.²⁴

A growing body of research shows that physical exercise also improves brain functioning and cognition.²⁵ Greater amounts of physical activity (particularly aerobic) have been associated with improvements in memory, attention, verbal learning, and speed of cognitive processing.^{25,26}

Consistent with the prevailing literature on exercise, the ACGME specifically notes regular exercise (along with sleep and a balanced diet) should be part of an overall well-being focus for programs.²⁷

In this study, we found no association between any type of exercise and well-being outcomes for male residents or for non-primary care residents. For women there were small but inconsistent associations between primarily aerobic exercise and overall well-being. These associations were present in only two of the five waves and even trended toward a change in the direction of association in some waves, suggesting either a complex relationship or random variation. For residents in primary care residencies, three of the five waves showed various relationships though only aerobic exercise and stress (positively related) and aerobic exercise and satisfaction (also positively related) were seen in more than a single wave making the overall relationship tenuous and prone to chance. Overall, the demonstrated association between exercise and satisfaction, stress and well-being in residents was at best inconsistent. Because physical exercise is associated with reduced symptoms of anxiety and low energy, further research is required in this arena.²⁸

Given the strength of the association between exercise and mental health in the general population, the lack of a consistent association in residents is surprising. For some residents stress and dissatisfaction may lead them to exercise if they have either a developed habit of exercise in response to stress or they have strong beliefs in the power of exercise to help with stress. The lack of a clear and consistent association between exercise and resident well-being may stem from the Mini-Z and MBI measuring residency specific states while exercise impacts a more general well-being.

Using the Job-Demands-Resources model,^{29,30} workplace stress and burnout stems from work environments in which the demands consistently outstrip the resources available. Conversely, environments in which adequate resources create states capable of meeting job demands lead to residents who are engaged and satisfied. Exercise may play an indirect role in increasing intrapersonal resources via improved emotional and behavioral stability but likely does not have a direct effect on the day-to-day work environment of most residents. Improved workflow and efficiency, elimination of non-clinical duties, improved EHR and documentation platforms, more control of hours and schedule, supervisor leadership styles (supportive autonomy leadership), work related social support, finding meaning in work and some intrapersonal resources such as optimism, resilience, hope and self-efficacy (referred to as Psychological Capital) likely have more impact on resident well-being than more general mental health prescriptions such as exercise.²⁸

Are the differences in composite scores between Waves 1 and 2 and between interns and non-interns equivalent with the differences between Waves 3 and 4?

The majority of studies of resident well-being to date have used a single cross-sectional design rather than a longitudinal or multiple cross-sectional design. Thus, we are lacking robust data on the time course of well-being in residency with which to compare our data. Studies of medical students find a worsening of well-being over the course of medical school, particularly with the start of the clinical years.^{6,7,9,13} Once students transition to residency the various components of burnout show slightly different trajectories.

Though we found significantly higher average Satisfaction and average Overall score when we administered the survey in the summer of 2018 (Wave 1) than in the fall of 2018 (Wave 2), we were not able to replicate this result when comparing summer and fall resident responses in 2019 (Waves 3 and 4).

In our study, PGY-1s only differed in the second sample year with Wave 3 (summer) satisfaction being lower than Wave 4 (fall) satisfaction (whereas non-PGY-1s satisfaction was less in Wave 4 than in Wave 3). This same effect was

not seen in the first sample year; and thus, no consistent satisfaction effect was observed in our data related to PGY-1s versus more senior residents.

Overall, these findings are consistent with previous research. Once medical students transition to residency, the various components of burnout show slightly different trajectories. Depersonalization and overall burnout worsens with emotional exhaustion remaining high.^{10,31-33} Studies of the time course of burnout during residency vary in their findings with some showing stable high values throughout residency.^{12,33-37} Two three-wave studies of residents that combined longitudinal and cross-sectional data collection found depression and workplace engagement unchanged over time with burnout increasing with time, particularly between the start of residency and three months later.^{38,39}

Limitations

The present study was not without limitations. First, our initial design as a quality improvement initiative limited our ability to exert control over which residents responded the survey. This resulted in a partially-dependent sample of residents across waves with no method of tracking resident responses throughout the duration of the survey response period. Given this, we moved forward with parametric assumptions due to the fact that both parametric and nonparametric statistical methods require independent samples, rendering the approach moot. Second, our correlational analyses do not provide any information about causation—it's unclear if our composite scores of Stress and Satisfaction actually predict how much exercise a resident engages in, nor does it provide any information about how exercise might influence these outcome measurements. Third, the abundance of weak significant results that were observed in our data suggests that more concentrated research endeavors utilizing the Mini-Z Burnout Survey in residents might reveal stronger relationships between burnout, satisfaction or stress throughout a resident's education.

Conclusion

In a two-year survey of medical residents, we found that satisfaction, stress, and overall well-being remaining relatively unchanged at

different times in the academic year. Exercise was not consistently related to resident well-being outcomes. Together these findings suggest a need for interventions targeted to specific resident-focused well-being and for year-round efforts to improve the work and learning environment for resident physicians.

Conflicts of Interest

The authors declare they have no conflicts of interest.

Dr. Dziadkowiec, Mr. Durbin, and Ms. Novak are employees of HCA Healthcare Graduate Medical Education, an organization affiliated with the journal's publisher.

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