Introduction

Physician wellness—a multidimensional descriptor that includes mental, social, emotional, and physical health—affects not only the physician but also their ability to care for their patients. Inadequate wellness may manifest as poor physical health, job dissatisfaction, and depression. Wellness issues may significantly affect resident physicians. In a 2014 survey of more than 1700 students and residents, the residents were more likely to have higher levels of fatigue, a lower quality of life, and screen positive for depression when compared with the general US population. Resident trainees are also at higher risk for burnout than their college graduate peers, a condition that can lead to increased risk of alcohol abuse and dependence, and suicidal ideation. As a consequence, the Accreditation Council for Graduate Medical Education (ACGME) and many individual residency programs have prioritized resident wellness. As an example, the ACGME Clinical Learning Environment Review’s Pathway to Excellence highlights the need for periodic education and monitoring for physician fatigue and burnout.

One approach to improving resident wellness is to encourage more physical activity. Exercise affords numerous health benefits, including improved sleep and eating habits, and a decreased incidence of type 2 diabetes. Physical activity also improves cognition, reduces depression and anxiety, and has been postulated to lower burnout and increase quality of life among practicing physicians. We hypothesized that residents with high physical activity levels are more likely to have better wellness. Life satisfaction, measured by the validated Satisfaction With Life Scale (SWLS), was used as a proxy for wellness in our study. To test our hypothesis, we evaluated the association between self-reported physical activity and our primary outcome of wellness, which was assessed among residents at 6 tertiary care academic anesthesia programs.

Methods

Participants and Data Collection

The study was deemed exempt from formal review by the institutional review board at the University of Chicago (IRB19-0673). A cross-sectional online survey was created using SurveyMonkey software (SurveyMonkey Inc, Portland, OR) and sent in May-June 2019 to 323 clinical anesthesia (CA) year 1, 2, and 3 residents at 6 anesthesia residency programs. Programs were chosen to include a diverse spread of geographical locations across the United States (eg, Midwest, East Coast). The number of residents per program varied from 27 to 75. At each program, surveys were distributed by a designated faculty member after approval from the residency program leadership. Written informed consent was not needed because continuation and completion of the survey implied consent, as stated at the beginning of the survey. To allow the survey to remain anonymous, respondent email addresses were unlinked from their responses. Only one response was allowed per survey invitation, and residents were informed that their participation in the survey was voluntary. All residents were sent a reminder email 1 week after initial contact.

Survey

The survey instrument included 4 questions for demographic data: age, gender, CA year, and work hours. Three subsequent questions pertained to physical activity, and 5 statements addressed wellness. A numerical value was requested for age, and all remaining demographic and physical activity questions were multiple choice. The 5 wellness statements were recorded using a 7-point Likert scale. The full survey as well as details for scoring are available in the Appendix.

Physical Activity Measurement

As a benchmark for physical activity, we used the 2018 US Department for Health and Human Services (USDHHS) “Physical Activity Guidelines for Americans.” These guidelines recommend: (1) participating in at least 150 minutes of moderate-intensity exercise per week, 75 minutes of vigorous-intensity exercise per week, or a combination of both and (2) performing
levels were more likely to have better wellness, we used a logistic regression model. A two-sided \( P < .05 \) was considered statistically significant. All statistical analysis was performed using R software version 3.0.1 (Vienna, Austria).

To verify that our results did not depend on our choice of wellness threshold (score of 20), we reperformed our analysis using a wellness score threshold of 23. This threshold was chosen because it was the median wellness score for our study participants. The results were similar: After logistic regression analysis with the new threshold, residents who met self-reported physical activity guidelines were still more likely to have high wellness scores (odds ratio [OR] 2.17, 95% confidence interval [CI] 1.01-4.67, \( P \) value .04).

### RESULTS

One hundred forty-one of the 323 residents contacted participated in the survey (43.6% response rate). One respondent was not included in analysis due to an incomplete survey (missing wellness responses), and one respondent who was included in the analysis failed to answer 1 question regarding CA year (Figure 1). The demographic characteristics and physical activity level of the residents are listed in Table 1. The mean age of participants was 31.5 years with 60 out of 140 (42.9%) respondents identifying as female. The greatest number of responses was received from CA-1 residents (\( n = 61 \)); CA-3 residents provided the fewest number of responses (\( n = 32 \)). Seventy-seven respondents (55%) reported work hours less than 60 hours per week. Thirty-eight (27.1%) residents self-reported physical activity consistent with USDHHS guidelines.

Eighty-six residents (61.4%) were classified as having high wellness based on their SWLS survey scores ranging from 20-35. No significant associations were found between demographic data and wellness, including age, gender, or clinical anesthesia training year (Table 1). Among those residents who met the physical activity guidelines, 29 (76.3%) had high wellness scores. Figure 2 displays the wellness scores between residents who met the USDHHS physical activity guidelines and those who did not. After logistic regression analysis, residents who met physical activity guidelines were more likely to have high wellness scores (OR 2.54, 95% CI 1.13-6.20, \( P \) value .03; Table 2).

### DISCUSSION

In this cross-sectional survey-based study, we observed that resident physicians who reported physical activity consistent with USDHHS guidelines were more likely to have better self-reported wellness, using life satisfaction as a proxy for wellness. We also found no clear relationship between other respondent factors including work hours, training year, gender, or age.

Numerous studies have found a positive correlation between wellness or life satisfaction with physical activity among the general population. A study by Maher et al evaluating 150 adults longitudinally found a weak positive correlation between physical activity and life satisfaction. Other studies have found similar positive correlations among other populations, including school-aged children, university students, and older adults.

The link between physical fitness and positive mood is described in the literature. One 2018 review found that many types of physical activity including exercise, yoga, and walking interventions can improve mental well-being across office-based settings. Exercise reduces anxiety, improves physical self-perception, and boosts global self-esteem. The World Health Organization has found that well-being plays an important role in job satisfaction and productivity, and multiple studies have reinforced the cost-effectiveness of physical activity interventions.

The physical activity levels of our study participants give some insight regarding their activity relative to other populations. A study evaluating activity levels of the general US population in 2008 using the USDHHS guidelines found that 18.2% were physically active versus 38% of residents in our study. However, one prior study demonstrated a relative decrease in physical activity in residents compared with attendings and medical students. In that study, this difference was strongly associated with work hours per week, suggesting that residents’ higher work hours affect their ability to participate in physical activities in their leisure time.

### Statistical Analysis

The primary outcome, wellness, was defined and established a priori at initiation of the study design. We classified high wellness as scores ranging from extremely satisfied to neutral (20-35) while scores ranging from extremely dissatisfied to slightly dissatisfied (5-19) were classified as low wellness. Survey responses with missing wellness scores were removed from analysis. Demographic characteristics were compared between residents with high and low self-perceived wellness using chi-square tests with Yates correction to evaluate the need of adjustment for confounders. To test the hypothesis that residents with high physical activity...
Existing data suggest that fitness initiatives improve wellness and satisfaction among physicians. A 2013 study\(^2\) tested the effect of a 12-week, team-based elective exercise program for residents and fellows on quality of life and burnout. The program engaged 23% of residents and fellows, and improved quality of life but not burnout. More recently, a 2017 study\(^3\) offered a 12-week wellness curriculum to residents in several specialties involving didactic sessions, positive thinking exercises, and competitions to promote physical fitness. In that study, all programs that participated chose to continue these sessions after the 12-week period ended due to strong participant satisfaction with the curriculum.

Our observational study did not intervene but rather examined current physical activity patterns and their relationship to self-perceived wellness. Our participants did not participate in an exercise program but did self-report their wellness based on their current individual exercise routine. Given residents’ typically heavy and highly variable work schedules, an important solution in implementing programs to encourage greater physical activity may be to offer individualized activity regimens and exercise programs to maximize participation. Systematic reviews suggest a dose-dependent effect of physical activity on mortality and prevention of chronic disease.\(^4\) However, the levels of physical activity required to improve mental well-being may differ from the levels of activity required to improve physical well-being.

Although most previous work on wellness targets multiple medical specialties, our study specifically evaluated anesthesia residents’ fitness and wellness. We cannot speculate as to potential differences in responses between our results and how residents from other specialties may respond, but anesthesiology practice does involve both a considerable amount of physical activity and long periods of relative stillness. In addition, anesthesiologists mostly practice alone and must navigate intermittent periods of high stress and acuity. As a result, correlations between physical activity and wellness, and drivers of self-satisfaction may be different between anesthesiologists and other medical specialists.

Our results raise the possibility that developing fitness programs or other opportunities for physical activity may improve wellness among anesthesia residents. Focusing on ways to improve resident well-being should remain a high priority for training programs, as provider well-being has been correlated to better patient care and decreased medical errors,\(^5\) in addition to improved resident satisfaction. Specifically, in light of the time constraints on anesthesia residents, future work should focus on identifying time-effective, convenient opportunities to expose residents to exercise-based wellness improvement strategies.

Our study has limitations. Our survey response rate was 43%, which introduces the possibility of responder bias that may have confounded our results. Specifically, a higher proportion of CA-1 residents responded to our survey compared with CA-3 residents. However, our response rates are similar to other studies\(^6\),\(^7\) and it is not clear whether non-responders would be more or less likely to exercise or demonstrate positive wellness. The question regarding resident work hours was based on self-recall and could have led to inaccurate reporting. Furthermore, the subjectivity of the wellness questions in our survey may have led to potential misinterpretation. However, wellness is inherently subjective and we used a survey tool that has been repeatedly validated\(^8\) as consistent with more involved strategies such as in-depth interviews. Additionally, while we verified our results using the median wellness score of our participants, the average wellness score of all residents is unclear, and our results would need to be confirmed through larger studies. The use of life satisfaction as a proxy measure of wellness may leave out other components of wellness. While it was created to measure the judgmental component of well-being, it may not cover all emotional aspects that contribute to wellness. However, there is no single instrument that is widely used in the literature to measure wellness. Our measurement of physical activity was dependent on accurate reporting by our participants, which opens opportunities for inaccurate reporting. Additionally, there may have been variations between what residents considered for their physical activity count; some only would have considered purposeful physical activity after hours while others may have included physical activity incurred at work. However, for this initial study, the survey used was the most efficient and cost-effective way to evaluate the relationship between physical activity and wellness. Future studies would benefit from the use of accelerometers or other means for objective reporting of physical activity. Furthermore, our survey was only sent to 6 large academic centers, and results may not be generalizable. Finally, because our data are observational only, we cannot speak to a causative relationship between exercise and wellness. It is possible that generally well residents are more motivated to exercise.

In conclusion, we found that anesthesia resident physicians who self-described as meeting USDHHS guidelines for physical fitness had an increased likelihood of better self-perceived wellness. Age, gender, and training year did not affect self-described wellness. Further work is needed to determine whether exposing anesthesia residents to fitness opportunities improves their self-described wellness and patient care.

References

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Abstract

Background: Wellness among resident physicians is important to their well-being and ability to provide clinical care. The relationship between physical activity and wellness among anesthesia residents has not yet been evaluated. We surveyed anesthesia residents to evaluate their levels of physical activity and self-perceived wellness scores. We hypothesized that residents with high self-reported physical activity levels would be more likely to have higher wellness scores.

Methods: Three hundred and twenty-three anesthesia residents were invited to participate in this cross-sectional survey study. The survey included questions regarding demographics (age, gender, clinical anesthesia year, work hours), physical activity (based off the US Department of Health and Human Services [USDHHS] guidelines), and wellness (using the Satisfaction With Life Scale). The relationship between wellness and physical activity levels was evaluated.

Results: One hundred forty-one residents responded (43.6% response rate). Thirty-eight (27.1%) residents met our activity threshold for physically active. Eighty-six respondents (61.4%) were classified as having high wellness based on their survey answers. No significant associations were found between demographic data and wellness, including age or clinical anesthesia training year. Among those residents who described physical activity consistent with USDHHS guidelines, 29 (76.3%) had high wellness scores. After logistic regression analysis, residents who achieved the physical activity guidelines were more likely to have high wellness scores (odds ratio 2.54, 95% confidence interval 1.13-6.20, P value .03).

Conclusions: Anesthesia resident physicians with high physical activity levels had higher self-perceived wellness scores.

Keywords: Residency, wellness programs, life quality, burnout, exercise, physical activity
Appendix

Appendix 1: Survey

Consent:
This survey is part of a research project studying resident wellness. Your participation in this research project is completely voluntary, and will not influence your training or evaluations in any way. By completing this survey, you are giving permission for use of your deidentified responses in aggregate form in order to evaluate influencing factors on resident wellness. Your name will not be associated with your responses in any way. The survey should take approximately 2 minutes to complete. If you have any questions about this survey or research project, you can contact Sarah Nizamuddin, MD at snizamuddin@dacc.uchicago.edu.

1. What is your age (in years)? ______
2. Please select your gender.
   a. Female
   b. Male
3. What is your CA year?
   a. CA-1
   b. CA-2
   c. CA-3
4. What is the average hours you work per week?
   a. <40 hours
   b. 40-50 hours
   c. 51-60 hours
   d. 61-70 hours
   e. >70 hours
5. In the past week, how often have you participated in vigorous-intensity aerobic physical activity (e.g. running, swimming laps, bicycling faster than 10 mph, hiking uphill)?
   a. <30 minutes per week
   b. 30-75 minutes per week
   c. 75-150 minutes per week
d. >150 minutes per week
6. In the past week, how often have you participated in moderate-intensity physical activity (e.g. brisk walking, recreational swimming, yard work)?
   a. <30 minutes per week
   b. 30-75 minutes per week
   c. 75-150 minutes per week
d. >150 minutes per week
7. In the past week, how often have you engaged in muscle-strength training that worked most major muscle groups (e.g. legs, hips, back, abdomen, chest, shoulders, arms)?
   a. Never
   b. 1 time per week
   c. 2 times per week
d. 3 or more times per week

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Appendix continued

Below are five statements that you may agree or disagree with. Using the scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

8. In most ways my life is close to my ideal.
9. The conditions of my life are excellent.
10. I am satisfied with my life.
11. So far I have gotten the important things I want in life.
12. If I could live my life over, I would change almost nothing.

Scoring of survey (not available to survey responders):
Items 6-8:
- **Meets physical activity level if:** [5 = c or d], [6 = d], or [5+6 = equivalent to 75 min vigorous or 150 min of moderate activity] AND 7 = c or d.
- Total equivalent minutes of physical activity = vigorous activity minutes + [moderate activity minutes/2]

Items 9-13:
- **Wellness:** Add scores for questions 8-12:
  - 31 - 35 Extremely satisfied
  - 26 - 30 Satisfied
  - 21 - 25 Slightly satisfied
  - 20 Neutral
  - 15 - 19 Slightly dissatisfied
  - 10 - 14 Dissatisfied
  - 5 - 9 Extremely dissatisfied
Figures

Figure 1. Flow diagram of study participants. Abbreviation: CA, clinical anesthesia.

Figure 2. Wellness scores among residents: distribution of wellness scores among survey respondents.
### Tables

#### Table 1. Study Demographic Characteristics in Residents with High and Low Self-Perceived Wellness

<table>
<thead>
<tr>
<th></th>
<th>Total, n = 140</th>
<th>Wellness (^b)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High, n = 86</td>
<td>Low, n = 54</td>
</tr>
<tr>
<td>Work hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>77 (55.0)</td>
<td>49 (57.0)</td>
<td>28 (51.9)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>63 (45.0)</td>
<td>37 (43.0)</td>
<td>26 (48.2)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>60 (42.9)</td>
<td>31 (36.1)</td>
<td>29 (53.7)</td>
</tr>
<tr>
<td>Male</td>
<td>80 (57.1)</td>
<td>55 (64.0)</td>
<td>25 (46.3)</td>
</tr>
<tr>
<td>CA year (^c)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA-1</td>
<td>61 (43.6)</td>
<td>35 (40.7)</td>
<td>26 (49.1)</td>
</tr>
<tr>
<td>CA-2</td>
<td>46 (32.9)</td>
<td>29 (33.7)</td>
<td>17 (32.1)</td>
</tr>
<tr>
<td>CA-3</td>
<td>32 (22.9)</td>
<td>22 (25.6)</td>
<td>10 (18.9)</td>
</tr>
<tr>
<td>Age</td>
<td>31 (3.4)</td>
<td>30.7 (3.4)</td>
<td>31.49 (3.4)</td>
</tr>
</tbody>
</table>

Abbreviation: CA, clinical anesthesia.

\(^a\) Data presented as n (%), except for age which is presented as mean (SD).

\(^b\) According to Satisfaction With Life Scale scores: extremely dissatisfied-slightly dissatisfied = low wellness; neutral-extremely satisfied = high wellness.

\(^c\) One record removed from CA year category due to missing response (n = 139).

#### Table 2. Physical Activity Levels and Logistic Regression Analysis According to Resident Wellness

<table>
<thead>
<tr>
<th>Physically Active (^b)</th>
<th>Total</th>
<th>Wellness (^c)</th>
<th>Logistic Regression Analysis for High Wellness Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>No</td>
<td>102</td>
<td>(72.9)</td>
<td>57   (66.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>38</td>
<td>(27.1)</td>
<td>29   (33.7)</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; NA, not applicable; OR, odds ratio; ref., reference.

\(^a\) Data listed as n (%) except for OR, CI, and P value.

\(^b\) Designated for those respondents who fulfill the Health and Human Services guidelines for physical activity.

\(^c\) According to Satisfaction With Life Scale scores: extremely dissatisfied-slightly dissatisfied = low wellness; neutral-extremely satisfied = high wellness.