Incorporation of a Physical Education and Nutrition Program Into Neurosurgery: A Proof of Concept Pilot Program

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BACKGROUND: Balancing the demands of a busy medical career with personal wellness can be daunting, and there is little education on these principles available to physicians in training.

OBJECTIVE: To implement a voluntary wellness initiative in our neurosurgery department to promote healthy lifestyle choices. This report details the baseline data collected as part of this quality improvement initiative.

METHODS: The wellness initiative was implemented in July 2015 and available to all faculty and resident physicians in the Department of Neurological Surgery in collaboration with the Medical University of South Carolina Wellness Center. All participants were provided a Fitbit Surge HR wrist monitor (Fitbit, Boston, Massachusetts) and underwent baseline physical and psychological testing.

RESULTS: Six faculty physicians and 9 residents participated. Overall physical fitness levels varied widely between subjects. Health screening demonstrated abnormalities in 80% of participants (elevated systolic blood pressure in 60%, elevated diastolic in 47%, elevated serum low-density lipoprotein in 53%). Body composition analysis demonstrated body weight higher than ideal in 69% (47% overweight; 13% obese). Recommended average body fat mass reduction was 25.4 pounds. Seventy-nine percent reported below-average quality of life compared with the average healthy adult. All subjects reported wanting more time for personal health.

CONCLUSION: Baseline health and psychological screenings in our department demonstrated alarmingly prevalent, previously undiagnosed abnormalities on cardiovascular and body weight screenings. Obstacles to leading a healthier lifestyle have been identified and solutions have been incorporated into the program. This quality improvement initiative may serve as a template for other programs seeking to improve physician physical and mental well-being.

KEY WORDS: Exercise, Lifestyle, Nutrition, Quality of life, Well-being, Wellness initiative

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BACKGROUND

Placing the needs of the patient above one's own needs has long been the call-of-duty badge worn by the physician. Indeed, emergent patient care needs trump immediate personal needs such as sleep, fatigue, hunger, and family commitments. However, personal health and well-being are paramount to leading long and productive careers. Balancing the demands of a busy medical career with personal wellness is a daunting but necessary skill to acquire, yet there is little education on these principles available to physicians in training. For the most part, organized exercise, diet, and/or personal fitness programs are entirely lacking in modern graduate medical education. In fact, most studies evaluating the

ABBREVIATIONS: BMI, body mass index; **ESS,** Epworth Sleepiness Scale; **HR,** heart rate

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exercise habits of resident physicians have demonstrated a significant reduction in exercise during graduate medical education compared with medical school.[1-4] In the context of long hours and alternating shift and sleep cycles, the lack of exercise and poor dietary choices may have negative short- and long-term consequences on physician physical and mental health.

Historically, "resident" physicians lived in the hospital and were entirely devoted to caring for their patients; thus, personal health was abandoned in the pursuit of a medical education. We now teach residents in the context of enforced duty-hour restrictions. However, it is commonplace for physicians (residents and faculty) to be "too busy" to frequent the doctor for routine visits such as health screenings that they themselves would outline for their own patients. Chronic diseases with courses that can be either modified or entirely prevented can thus go unnoticed for many years, causing irreparable damage; for example, undiagnosed hypertension or hypercholesterolemia leading to cardiovascular disease or stroke. In addition, there are increasing data suggesting that psychological distress and burnout are common among physicians and other health care providers. Approximately 45% to 70% of residents report burnout during training,[5-10] but these issues do not end with completion of residency. Nearly 50% of US physicians report symptoms of burnout.[11] With an expanding understanding of the health consequences of medicine on the provider, there has been an increasing focus on improving physician well-being.[12-14]

OBJECTIVES

In our Department of Neurosurgery, which is in a tertiary care academic medical center, we have implemented a voluntary wellness initiative involving both faculty and residents. This program encourages and educates participants in the importance of regular exercise, balanced nutrition, stress management, and adequate sleep, among others, in a team-based approach with scheduled exercise sessions and team-building activities (see the Wellness Protocol, **Supplemental Digital Content 1**, http://links.lww.com/NEU/A885). The aim is to increase awareness of the importance of a balanced lifestyle and provide support and resources to establish lifelong habits of personal health. This report details the baseline data that were collected as part of this quality improvement initiative to better define the starting point for this population.

METHODS

Study Design and Setting—Wellness Initiative

Participation in the wellness quality improvement initiative was voluntary and offered to all residents and faculty of the Department of Neurosurgery of the Medical University of South Carolina. The program has been named "La Sierra," in homage to the famed California high school of the same name that promoted physical education decades ago.

In brief, "Operation: La Sierra" was implemented in July 2015 and available on a voluntary basis to all faculty and resident physicians, physician extenders, and other staff members within the department. All participants agreed to wear a Fitbit Surge HR wrist monitor (Fitbit, Boston, Massachusetts) at all times (when appropriate) and undergo baseline physical and psychological testing as well as survey instruments. Weekly wellness lectures on exercise, diet, alcohol avoidance, and mental health are incorporated into weekly departmental conferences. Team-based 1-hour exercise sessions with aid of physical trainers are incorporated into the work week. Healthy food choices are provided at conferences.

Participants

Six faculty neurosurgeons (2/3 of faculty, mean age 37.7 $\pm$ 6.4 years) and 9 neurosurgery resident physicians (mean age 30 $\pm$ 2.8 years) volunteered to participate in the Wellness Initiative. All participants are male. Resident participation represents postgraduate year 1 through 7. Faculty participants include both junior and senior faculty members.

Baseline Physical Data

All participants were provided a unique, confidential identifier to maintain anonymity only known to a single gatekeeper who is not in the Department of Neurosurgery. Data were collected in a protected, confidential fashion. All participants underwent baseline health screening information (vital signs, serum lipid panel) as well as body composition analysis (InBody, Cerritos, California). Body composition analysis includes lean body mass weight, body fat levels, visceral fat, and basal metabolic rate. Participants wore Fitbits on their wrist for 2 weeks before initiation of the program to track baseline heart rate during all hours of the day, individual activity (distance walked based on pedometer), sleep patterns (total amount of sleep, number of times restless, and amount of time awake each night), and calories burned (based on height, weight, sex, and distance traveled). Finally, general fitness assessments were obtained while supervised by a certified trainer and included the number of sit-ups and push-ups performed during 2 minutes, time to run 1 mile, and number of pull-ups performed, among others.

For health screening parameters, a normal systolic blood pressure was defined as systolic blood pressure $\leq$120 mm Hg, normal diastolic blood pressure was defined as diastolic blood pressure $\leq$80 mm Hg, and serum lipid panel normal ranges were defined by the hospital laboratory. Normal ranges were defined as total cholesterol, 100 to 199 mg/dL; low-density lipoprotein, 0 to 99 mg/dL; high-density lipoprotein, $>$39 mg/dL; triglycerides, 0 to 149 mg/dL; serum glucose, 65 to 99 mg/dL.

Psychological Assessments

Previously validated psychological instruments were administered to participants in private in a confidential manner. To assess baseline depression, anxiety, and quality of life, the Personal Health Questionnaire Depression Scale,[15] Generalized Anxiety Disorder 7-item Scale ,[16] and Quality of Life Scale[17,18] were administered, respectively.

Sleep Quality

The Epworth Sleepiness Scale (ESS)[19] was administered to assess baseline sleep deprivation. Fitbits were worn during sleep to track hours of sleep.

Perceptions of Fitness and Activity Survey

A fitness and well-being survey was composed and administered for the purposes of assessing participant opinions regarding personal health. Questions on this survey are displayed in Figure.

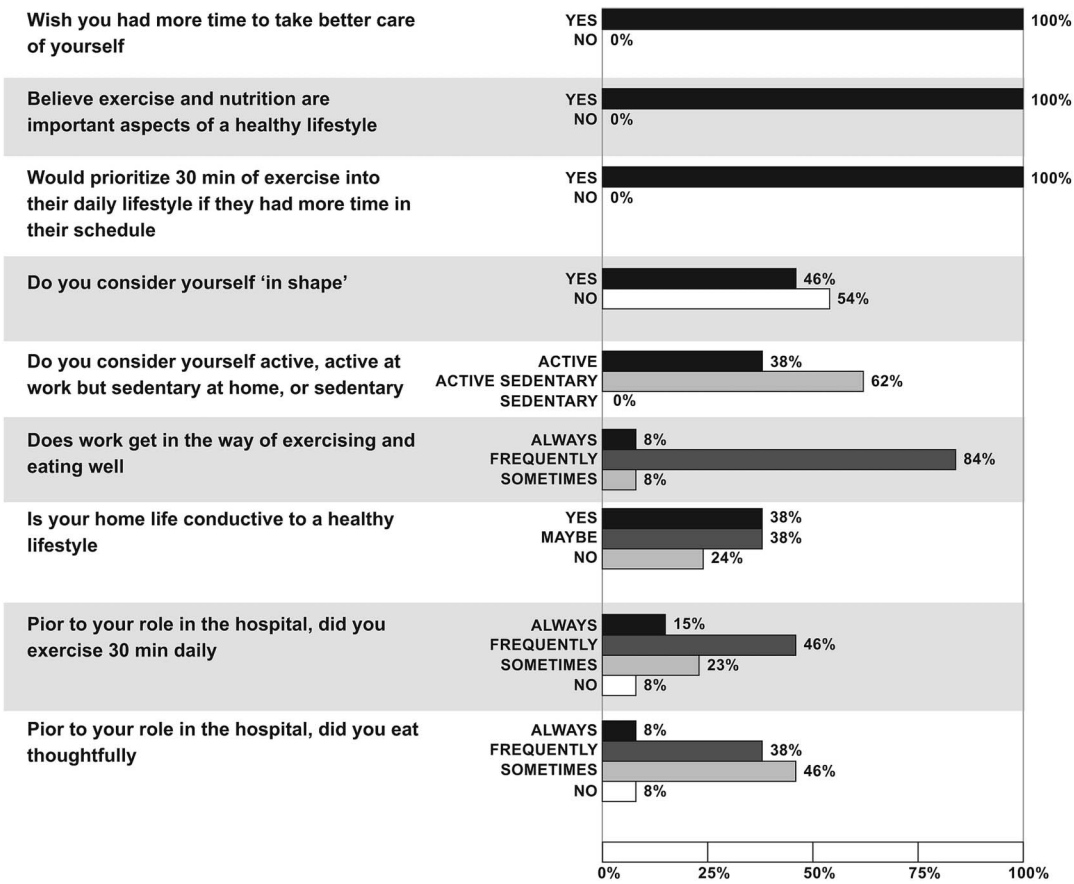

FIGURE. *Results of perceptions of fitness and activity surveys.*

RESULTS

Descriptive Data

Perceptions of Fitness and Activity

All participants completed the survey. All respondents indicated that they wished they had more time to take better care of themselves (Figure). Furthermore, all believe exercise and nutrition are important aspects of a healthy lifestyle and would prioritize incorporating 30 minutes of exercise into their daily lifestyle if they had more time in their schedule. Over half (n = 7; 54%) of the respondents considered themselves out of shape, and only 38% (n = 5) considered themselves to have an active lifestyle. The vast majority (n = 11; 84%) of respondents indicated that work frequently gets in the way of exercising and eating well.

Before assuming their current roles at the hospital, 46% (n = 6) frequently exercised at least 30 minutes per day, and 15% (n = 2) reported that they always exercised at least 30 minutes per day. Before assuming their current roles at the hospital, 46% (n = 6) sometimes ate thoughtfully and 38% (n = 3) frequently made thoughtful food choices.

Main Results

Health Screening

Health screening demonstrated abnormalities in 80% (n = 12) of participants. These included an elevated resting systolic blood pressure in 60% (n = 9), elevated resting diastolic blood pressure in 47% (n = 7), elevated serum fasting total cholesterol in 2 individuals (13%), elevated serum low-density lipoprotein in over half of participants (n = 8; 53%), and elevated serum triglycerides in 1 participant (7%).

Body composition analysis demonstrated body weight higher than ideal in 69% (n = 9). Body fat percentage was 21.5 ± 8.6% (range 10.7%-38.2%) and visceral fat level was 8 ± 5.4 (range 3-20). Average body mass index (BMI) was 27.6 ± 4.6 (range 23.3-40.3). Of participants, 47% were overweight based on BMI criteria, whereas 13% were defined as obese. Recommended average body fat mass reduction, calculated by InBody as the fat reduction required to reach ideal weight, was 25.4 ± 27.4 pounds (range 0.4-86 pounds).

Sleep Quality

Thirty-six percent (n = 5) of respondents indicated a possible sleep disorder, defined by a score of 10 or greater out of

a maximum score of 24 (Table). The mean ESS score was 8 ± 3.7 (range 0-15). The average amount of sleep obtained per resident per day was 6.5 ± 22.9 hours (range 6.2-8.4 hours).

Physical Fitness Assessments

Participants exhibited a wide range of baseline fitness levels as evidenced by the baseline fitness testing. The mean time to run 1 mile was 7 minutes and 59 seconds (range 5:59-15 minutes). Average number of pushups completed in 2 minutes was 45 (range 0-75), average sit-ups performed in 2 minutes was 52 (range 1-84), and mean number of pull-ups completed was 8 (range 0-18).

Activity Tracking

Fourteen days of activity were tracked continuously (for 9 residents) with the exception of time scrubbed into an operation. Participants walked an average of 10 030.6 ± 4717.3 steps daily, translating to walking 6.2 ± 2.9 miles. On average, 7761.9 ± 4139.7 steps (4.8 ± 2.6 miles) were performed during hours at work, representing 77% of the steps taken. Thus, only 2268.7 steps daily on average were taken during off hours.

Average caloric expenditure was 3153.3 ± 1552.1 calories daily. The average basal metabolic rate was 1906.6 ± 198.6 calories; therefore, the net daily difference was 1246.7 ± 276.5 calories.

Average basal heart rate (HR) was 61.2 ± 7.0 beats per minute (bpm). Average HR at work was 79.0 ± 11.9 bpm. On average, HR at work increased by 17.8 ± 5.0 bpm.

Psychological Assessments

Psychological assessment results are shown in Table. The mean score on the Personal Health Questionnaire Depression Scale was 5 ± 4.3 (range 1-18) out of a possible 24 points. Results from the survey indicate 62% of residents and faculty (n = 8) with minor or no depression (score of 1-4), 38% (n = 5) with mild depression (score of 5-9), and 1 (7%) with moderately severe depression (score of 15-19). None scored with severe depression (20-27). Over three-quarters of residents and faculty (n = 11; 79%) reported below-average quality of life compared with a healthy adult mean of 90 points.[18] Importantly, 1 individual (7%) reported moderately severe depression, the presence of generalized anxiety disorder, and a below-average quality-of-life score.

DISCUSSION

Key Results

This single-department, single-institution wellness initiative used multiple instruments and assessments to capture the baseline physical, physiological, and psychological conditions of its residents and faculty. The study has several important findings. Most notably, baseline assessments identified multiple previously undiagnosed medical conditions, including hypertension and hypercholesterolemia. In addition, 1 participant demonstrated findings consistent with moderate to severe depression and generalized anxiety disorder. Second, baseline data demonstrated a wide variability in physical fitness, with many individuals being in poor physical condition. BMI ranged from 23 to 40, but the average amount of weight loss required to achieve an ideal body weight was 25 pounds. Third, sleep data suggest that the overall amount and quality of sleep in this sample is poor. Fourth, when surveyed, most respondents (even the most active) indicated that they wished they could spend more time engaged in activities to improve personal health. The time commitment as a physician was identified as a major obstruction to achieving this goal. Overall, the findings of this study are worrisome and suggest that residents and faculty in our department have been neglecting personal health and well-being. As a whole, these data validate the intentions of "Operation: La Sierra" to restore the principles of healthy lifestyle through personal fitness, nutrition, and wellness education.

There has been little focus on physician wellness until recently. Studies suggest that resident physicians demonstrate a significant reduction in exercise during graduate medical education compared with medical school.[1-4] Reasons for the reduction in physical fitness during residency include fatigue from long working hours and lack of time to participate in exercise,[3] among others. Furthermore, dietary habits may deteriorate during the long hours of residency training, predisposing weight gain.[23,24] In addition, sleep deprivation with poor sleep quality is commonplace.[25] The psychological consequences of work-related stress are becoming well established. Burnout, a term used to describe

TABLE. Results of Psychological Assessments and Epworth Sleepiness Scale[a]

Assessment	Scoring Range	General Population Mean Score (SD)	Abnormal Range	Sample Mean Score (SD)	Sample Range	% Abnormal Scores
PHQ-8[15]	0-27[b]	6.6 (5.5)[20]	10 or higher	5.0 (4.3)	1-18	8
GAD-7[16]	0-21	3.0 (3.4)[21]	8 or higher	4.6 (4.3)	0-18	8
QOLS[17,18]	16-112	90[c,18]	Not defined	77.7 (14.7)	42-103	77[d]
Epworth[19]	0-24	4.6 (2.8)[22]	11 or higher	8.0 (3.7)	0-15	31

[a]GAD-7, Generalized Anxiety Disorder 7-item Scale; PHQ-8, Personal Health Questionnaire Depression Scale; QOLS, Quality of Life Scale; SD, standard deviation.
[b]Minimum depression (score 1-4), mild depression (5-9), moderate depression (10-14), moderately severe depression (15-19), severe depression (20-27).
[c]Mean score of 90 in general (healthy) population. Mean scores for patients with rheumatoid arthritis are 83, fibromyalgia 70, and post-traumatic stress disorder 61.[18]
[d]Percentage of sample with QOLS scores below general population average.

feelings of emotional exhaustion, low self-accomplishment, and depersonalization associated with the work environment, is gaining ground as an important marker for resident well-being. Anywhere from 47% to 70% of residents report burnout during training.[5-10] Those individuals who report burnout symptoms are probably more likely to make medical errors,[26,27] provide suboptimal care for their patients,[28] and display inappropriate or unprofessional behaviors.[29] In some instances, burnout leads to physicians quitting or changing specialties. In the specialty of general surgery, 1 in every 5 residents fail to complete residency training.[30,31] Among neurosurgeons, attrition rates approximate 15%.[32] Of those considering quitting their training program, sleep deprivation is the most cited reason for considering leaving, while support from other residents is one of the most common reasons for deciding to stay.[30]

Generalizability—Importance of Provider Well-being

The importance of provider well-being is becoming increasingly recognized. In family medicine, there are calls for shifting the widely accepted physician triple aim (improving patient experience and population health while reducing costs) to the quadruple aim, which includes improving the wellness of health care providers and staff.[12] Furthermore, the Accreditation Council of Graduate Medical Education has begun to focus on means of improving trainee well-being.[13] A few programs around the country have taken the initiative to introduce wellness initiatives on a small scale. A "resiliency" program to help family medicine residents at risk for burnout has been described,[33] as well as a wellness initiative for psychiatry residents.[34] The "La Sierra" program is unique in its approach, because it incorporates physical fitness and nutrition education into programmatic conferences with aid from dieticians, physical therapists, trainers, and mental health experts. In addition, Fitbits were provided for participant use so that study investigators and participants can track activity. Such monitors have been demonstrated in a previous randomized controlled trial to modestly affect physician activity.[35] Furthermore, body composition testing, laboratory studies, and psychological surveys were performed in an attempt to quantify the global personal health of our participants. In so doing, we identified a number of health concerns that have helped to evolve the goals and directions of the "La Sierra" program.

Interpretation

The baseline data are also important because they suggest that increasing awareness is not enough to effect change, because most participants acknowledge not exercising enough or eating healthy. Perception of fitness and activity was commonly suboptimal. Most indicated participating in little to no activity outside of work, and most endorsed the desire to be more active and acknowledge the importance of activity for well-being. This was true of residents as well, which is worth highlighting, considering there is a Wellness Center on campus located 1 block away from the teaching hospital whose membership cost is provided by the Graduate Medical Education office. Thus, it is clear that convenience alone (proximity and cost) does not promote exercise among resident physicians. More must be done to create a culture of wellness among both faculty and physicians in training. The majority of participants identified both work and home impediments to being more active, providing insight into obstacles that were then targeted with the wellness initiative. For example, exercise equipment (stationary bikes, treadmills, etc) have been supplied to the department and are available for resident use at all times.

Studies suggest that initiatives that encourage wellness may help to mitigate the influence of these perceived obstacles. Evidence from systematic reviews of interventions that promote physical activity have shown a positive effect on self-reported activity[36] and may result in persistent improvements in physical and mental quality of life in healthy individuals.[37] Dietary interventions may also improve quality of life.[38] Although we have yet to survey participants regarding their opinions, emotional well-being, and lifestyle choices since the initiation of the program, participants continue to actively participate in team-based exercise sessions and conferences, and seem persistently motivated and excited to comply with programmatic goals and objectives. Hospital administration has recognized its importance by acknowledging it as a Quality Improvement initiative, qualifying for a financial reward for the residents if it is successfully completed.

Continuous activity tracking revealed that the majority of daily caloric expenditure took place during the work day, with 4.8 miles walked throughout the hospital and 3153 calories expended on an average day. So while residents and faculty are relatively active during the day (as opposed to a sedentary job at which sitting occurs the majority of the day), it is clear that future efforts targeting weight loss will be of highest yield in the area of improved diet and nutrition. Dietary lectures have been implemented into the weekly department conference schedule as well as tours of the dining facilities available in the hospital with an emphasis on healthy options. The majority of participants are objectively overweight, with the need to lose body fat mass (25 pounds on average) while increasing lean mass. Thus, while most participants reached the 10 000 steps/day goal as recommended by the American Heart Association to decrease the likelihood of cardiovascular disease, it is evident that in this population this level of activity is not sufficient. The wellness initiative includes weekly scheduled time for training regimens led by certified instructors. Irregular sleep quality and high stress levels (mean HR at the hospital increased by 17.8 bpm) likely contribute to the relatively poor health of these young physicians. Sleep quantity was also poor across the board (6.5 hours on average). These results are likely due to the poor sleep hygiene prevalent in the field as a result of heavy call burden, long shifts, frequent interruptions, and unpredictable work schedules. Among neurosurgery faculty and residents, the mean ESS score was 8 ± 3.7. Data from Australia (n = 72) show that healthy, non-sleep-deprived adults without a chronic sleep disorder have a mean ESS score of 4.6 (95% confidence interval, 3.9-5.3) with a standard deviation of 2.8 and a range from 0 to 10.[18] Sleep hygiene and

stress management education has also been incorporated into the teaching conference rotation.

Universal Benefits of the Program

The present quality improvement initiative is notable because of the worrisome findings obtained from the in-depth physical and mental assessments. Although the sample of physicians is small and in a specialty characterized by high stress, its results are not necessarily poorly generalizable. Given the significant percentage of residents and attending physicians with symptoms of burnout, it is likely that similar patterns may be seen in other specialties with other sample characteristics. The present study suggests that voluntary wellness programs that provide physical and psychological assessments may be helpful in identifying previously undiagnosed physical or mental conditions and in promoting healthy choices that improve physician productivity and happiness. In our study, the recognition of 1 individual with worrisome psychological assessments allowed our department to promote counseling services that could be of benefit to this individual. Further, the awareness of hypertension and hypercholesterolemia in certain participants may encourage them to seek medical care and further promote healthy lifestyles when this otherwise would have gone undiagnosed and untreated. Based on these findings, health screening will be provided at least annually to all participants to track progress and hopefully promote adoption of healthier habits. We believe the "La Sierra" program may therefore have universal benefits in residency training programs and may serve as a template for other programs interested in enhancing physician wellness.

CONCLUSION

We have organized a voluntary wellness initiative within our department and residency program to promote exercise, healthy eating habits, and improved sleep to enhance physician well-being. Baseline health and psychological screenings have demonstrated alarmingly prevalent abnormalities on cardiovascular screenings, body composition, and mental health status. Furthermore, surveys have identified physician obstacles to leading a healthier lifestyle. These data justify the goals and objectives of the "La Sierra" program, which aims to improve the personal health and well-being of its physicians. It has become evident that a change in culture is required to achieve wellness among neurosurgery physicians at our institution, which may also be applicable to other centers across the country.

Disclosure

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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COMMENTS

The authors should be commended for encouraging the dialogue about this important topic. Although the findings are not as "alarming" in my opinion as what the authors suggest, they reinforce the widespread prevalence of physical and psychological malady among our peers. One limitation of the study is that it is descriptive, and only baseline information is reported. Furthermore, the data are limited to 1 center, although the demographics of the Medical University of South Carolina program likely reflect those of other departments and the United States population in general. We look forward to seeing the results of the intervention. Although the metrics for physical activity can be more easily targeted, those for burnout and other psychological phenomena are harder to measure. Given the mind-body continuum, however, it is likely that manipulation of 1 domain will likely impact the other.

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The article presents a well-thought-out approach to a very important concern. Specifically, the authors have, in my opinion, successfully defined a group of baseline variables that are consistent with personal wellness and hope to demonstrate that these could be improved by implementation of a specific protocol featuring opportunities for beneficial modifications in exercise, diet, and emotional health. The capability of feasibly conducting a successful program of wellness improvement in the midst of busy schedules in an academic medical center is appealing. Areas for future study could include follow-up data regarding the durability of the hopefully improved health variables over time and, if possible, some comparison to practice outcome metrics going forward. I would hope that improved wellness can be shown to be self-perpetuating over time and that it can be linked to objective improvements in other medical practice variables, such as completion of residency programs, improved patient outcomes, and other metrics of institutional success. In particular, I am impressed by the inclusion of the concept of staff well-being as a measurable and reportable goal of a successful medical center. The hopeful eventual success of this protocol may encourage additional medical professionals to participate in it. This outcome would lead to a greater number of trial participants, strengthening the data and conclusions, and would also contribute to an even greater potential improvement in the health of staff members at this and other medical settings.

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