Current Trauma Reports (2023) 9:10–17
https://doi.org/10.1007/s40719-022-00246-0

WELLNESS FOR THE TRAUMA SURGEON (S ROGERS, SECTION EDITOR)

Environmental Factors Impacting Wellness in the Trauma Provider

Alexis Hess[1] · **Maddison Porter**[1] · **Saskya Byerly**[1]

Accepted: 28 September 2022 / Published online: 26 December 2022

Abstract

Purpose of Review The purpose of this review is to evaluate the recent literature on environmental factors impacting wellness for the acute care surgeon. This includes factors influencing physical, mental, and emotional well-being.

Recent Findings Recent studies have identified challenges to surgeon wellness including increased incidence of sleep deprivation, musculoskeletal pain and injuries, pregnancy complications, moral injury, posttraumatic stress disorder (PTSD), and burnout. Qualitative studies have characterized the surgeon's emotional response to occupational stress, adverse events, and surgical complications. Further descriptive studies offer interventions to prevent moral injury after adverse events and to improve surgeon work environment.

Summary Acute care surgeons are at increased risk of sleep deprivation, musculoskeletal pain and injury, pregnancy complications, moral injury, PTSD, and burnout. Surgeons experience feelings of isolation and personal devaluation after adverse events or complications, and this may lead to practice limitation and progression to PTSD and/or burnout. Interventions to provide mentorship, peer support, and education may help surgeons recover after adverse events. Further study is necessary to evaluate institution-driven interventional opportunities to improve surgeon well-being and to foster an inclusive and supportive environment.

Keywords Burnout · Moral Injury · Acute Care Surgeon Wellness · Second Victim Syndrome

Introduction

Physician wellness and specifically trauma and acute care surgeon wellness have been relatively unexplored until a decade ago. Recent literature has focused on the physical health challenges facing surgeons including achieving adequate nutrition, sleep, and exercise. Further studies have highlighted the physically demanding nature of surgery and its consequences of musculoskeletal pain and injuries. The increased risks for pregnant surgeons have also been demonstrated. Recent surveys of physician mental health have attempted to characterize and quantify moral injury, post-traumatic stress disorder (PTSD), and burnout among surgeons. There have also been qualitative studies of the surgeon's emotional responses to stress and adverse events which lead to PTSD and burnout as well as descriptions of institutional attempts to support surgeons in the aftermath of these events.

Physical Wellness

Shapiro et al. propose that the most effective way to encourage physician wellness and ameliorate burnout begins with improving physical and mental health [1]. Adequate exercise, healthy diet, and health maintenance with regular primary care physician visits and appropriate healthcare screening have been associated with decreased incidence of burnout, increased quality of life scores, and satisfaction with work-life balance for physicians [2, 3]. Among physical needs of physicians, Shapiro's article establishes the needs

This article is part of the Topical collection on *Wellness for the Trauma Surgeon*

✉ Alexis Hess
ahess9@uthsc.edu; hess.alexis@gmail.com

Maddison Porter
Mkane14@uthsc.edu

Saskya Byerly
Sbyerly1@uthsc.edu

[1] Department of General Surgery, University of Tennessee Health Science Center, 920 Madison Avenue, Memphis, TN 38163, USA

of sleep, food, hydration, and for new mothers, access and time for breastfeeding or pumping [1].

Sleep among acute care surgeons has been recently investigated using Whoop! wristband technology to record sleep patterns among 17 acute care surgeons in relation to their overnight call shifts. Coleman et al. found that sleep patterns consistent with chronic or acute sleep deprivation occurred on 64.8% of nights of sleep among these surgeons and that surgeons did not have restoration of baseline sleep patterns until the 3rd night after a call shift [4••]. Although many acute care surgeons experience chronic and acute sleep deprivation, surgeon fatigue does not impact operative outcomes according to a study conducted by the Eastern Association for the Surgery of Trauma (EAST). This study compared outcomes for complex emergency surgery cases between fatigued surgeons (no sleep in the prior 18 h) and non-fatigued surgeons (slept at least 3 out of the last 6 h). There was no difference in mortality or post-operative complications between the two groups [5]. Although patient outcomes may be unaffected, more work hours per week, fewer awake hours at home, and number of call shifts per week have been associated with poor physician work-life balance and burnout among trauma surgeons [2, 3]. Furthermore, in a recent survey of members of the American College of Surgeons, 26% of surgeons were considering leaving surgery in the next 2 years, and work time demands and personal time requirements were among the top reasons for leaving the field thereby contributing to the surgeon shortage [6].

In addition to the sleep deficit and work time demands that surgeons experience, the physical demands of a surgical career expose surgeons to increased risk of work-related musculoskeletal disorders (MSD). Musculoskeletal pain and injury contribute to decreasing career longevity among surgeons and proceduralists. Sixty-eight percent of surgeons and proceduralists experience work-related musculoskeletal pain, and 12% require a leave of absence, changes to their practice, or early retirement due to MSD [7, 8].

Intra-operative microbreaks for stretching exercises have been proposed in order to improve surgeon performance and musculoskeletal pain. Park et al. conducted a cohort study of cases in which surgeons were prompted to take 1.5 min microbreaks at 20–40 min intervals to perform stretching exercises targeting the neck, shoulders, back, wrists, hands, knees, and ankles. In this study, 67% of surgeons reported regularly working through pain in order to complete their scheduled operative cases, and 47% of surgeons were concerned that musculoskeletal pain may shorten their career. The cases in which targeted stretching microbreaks (TSMB) were performed were compared to cases without TSMB. There was no difference in mean operative time between the 2 groups, and TSMB improved post procedure pain scores for surgeons. TSMB resulted in improved perceived physical performance in 57% of surgeons and improved mental focus in 38%. Eighty-seven percent of surgeons stated that they intended to use TSMB in the future [9]. In a review of ergonomics training and microbreaks for MSD in surgeons, four studies of microbreaks showed them to be beneficial for surgeons by decreasing musculoskeletal pain, improving mental focus, and improving overall well-being [10]. Education modules in ergonomics and the use of microbreaks for surgical trainees has been proposed and has been shown to decrease reported physical discomfort in a small study of medical students and surgical residents of whom 80% reported musculoskeletal pain while in the operating room [11].

Perhaps the physical demands of a career in surgery are seen most profoundly in a recent study of pregnancy outcomes among surgeons. In a survey of 692 female surgeons, 42% had experienced pregnancy loss, more than twice the rate of the general population. When compared to a cohort of the non-surgeon female partners of male surgeons, female surgeons were significantly more likely to have major pregnancy complications (48% vs 27%, $p < 0.01$). Factors associated with major pregnancy complications included operating more than 12 h per week during the 3rd trimester, maternal age greater than 35 years old, multiple gestation, and requiring bedrest. Female surgeons had fewer children than their male counterparts and were more likely to delay having children because of training. Only 16.5% of female surgeons reduced their work schedules during pregnancy. Of the female surgeons who miscarried, 75% took no time off work to recover. The results of the study led to recommendations for limiting work schedules and overnight shifts for pregnant surgeons and recommendations to facilitate pregnancy during surgical training by improving maternity leave policies for residents [12••].

In a qualitative survey of surgical residents who had children during residency, a theme emerged that residents desired work modifications in the later stages of their pregnancy, and they believed that their work had a negative impact on maternal and fetal health. Respondents were also concerned that there was a stigma attached to pregnancy which made them appear weak or less committed to their training because of pregnancy and family obligations. Because of this stigma, trainees were reluctant to ask for the needed work modifications during pregnancy or for extended maternal leave [13•]. In another study which interviewed general surgery program directors, practical barriers were identified to extending maternity leave which included not finishing residency in time for fellowship and lack of funding to extend training into a sixth year of residency. There was a lack of formal policies for breastfeeding which posed challenges to allowing time and space for resident mothers to pump. Furthermore, there were negative associations with pregnancy including resentment from co-residents for having to cover for maternity leave and a perception of the returning

mother as appearing conflicted or distracted upon returning to work after maternity leave [14]. The reports from program directors in this study support the reported perception of female residents that there is a negative stigma attached to residents who have children during residency. There are many practical barriers to having children and breast feeding as a surgical resident. However, waiting to have children until after residency puts the mother at increased risk of major pregnancy complications due to advanced maternal age. Based on these studies, there is a grave need for institutional and colleague support for pregnant and breast feeding surgeons and trainees in order to improve maternal and fetal health among surgeons and support surgeon mothers.

Mental Well-Being: Moral Injury, Post Traumatic Stress Disorder, and Burnout

In addition to the physical challenges of a career in surgery, unique mental health challenges have been identified for general surgeons and particularly for the practice of trauma and acute care surgery. Surgeons experience moral injury related to poor patient outcomes and adverse events, witnessing the suffering or death of critically ill patients, and witnessing the imperfections of the healthcare system in caring for patients. Moral injury is defined as "a strong cognitive and emotional response that can occur following events that violate a person's moral or ethical code [15]." Moral injury can progress to second victim syndrome in which the physician experiences significant mental stress after an adverse patient event [16]. Moral injury and second victim syndrome can lead to PTSD as well as physician burnout [17]. Burnout is associated with decreased job satisfaction for surgeons and with increased likelihood of reported medical errors [18, 19].

In a recent meta-analysis, the rate of burnout among general surgeons was found to be as high as 69%. Across 27 studies reviewed, factors associated with burnout included being accused of malpractice, occupational stressors, low annual income, workplace violence, frustrating colleagues, insufficient study time, and poor work life balance [20]. Another review of 62 articles concerning burnout in surgeons found that younger age, female gender, single marital status, increased workload, conflict with colleagues and patients, and depression and substance abuse were associated with burnout [21]. In a survey of 7409 surgical residents, residents who were exposed to discrimination, abuse, or harassment were more likely to have frequent symptoms of burnout (OR 2.94, 95% confidence interval 2.58–3.36) and suicidal thoughts (OR 3.97, 95% confidence interval 2.25–4.19). Before adjusting for mistreatment, women were more likely than men to report burnout symptoms, but after adjusting for mistreatment, there was no difference between men and women in burnout symptoms (OR 0.9, 95% confidence interval 0.8–1) [22••].

Several recent survey studies have illustrated the prevalence of PTSD among acute care surgeons and its associated factors. In a survey of trauma surgeons, Joseph et al. found that 40% of respondents had PTSD symptoms and 15% met diagnostic criteria for PTSD. Factors associated with PTSD included male gender and increased operative volume and call duties and decreased time for relaxation and vacation [23]. Another survey study of attending physicians across multiple specialties found that 16% of general surgeons screened positive for PTSD. In this study, overwhelming work responsibilities was the most common stressor reported by physicians, and other factors associated with PTSD included emotional exhaustion, job dissatisfaction, lack of autonomy, working more than 60 h per week, female gender, and dissatisfaction with camaraderie at work [24]. A survey comparing trauma surgeons to non-trauma surgeons found rates of PTSD to be similar between the 2 groups (17% for trauma surgeons and 15% for non-trauma surgeons). The most common stressors for both groups were overwhelming work responsibilities, bad outcomes, and work-life discord [25]. PTSD has also been found to be increased in surgical residents as compared to attending surgeons with residents citing bullying as the most common stressor while attending surgeons cited overwhelming workload as the most common stressor [26]. During the era of the Covid-19 pandemic, additional stressors were found to be associated with PTSD among trauma surgeons including having people close to you contract Covid-19, family issues due to Covid-19, fear of going to work, and not having mental health resources provided at work [27].

In a survey of surgeons in the USA, PTSD was found to be significantly higher among surgeons with decreased job satisfaction (24% vs 7%, $p < 0.001$). Factors associated with poor job satisfaction included inadequate time with family or friends and inadequate time for extracurricular activities. Work environment variables associated with job satisfaction included autonomy, patient diversity, patient ownership, safe patient load, hospital culture, hospital support, camaraderie, and salary. Surgeons who worked 60 h or less per week had increased job satisfaction [19].

Across these surveys, increased work hours and work responsibilities and poor work-life balance are associated with PTSD (Table 1). This suggests that limiting work hours may help with PTSD among trauma surgeons. Interestingly, there are conflicting data regarding the association with gender and PTSD with some surveys showing it to be associated with male gender and some with female gender. A study of interviews looking at gender differences in surgeon burnout found that both genders identified that a lack of control over work life contributed to burn out. Factors that improved burnout were teaching,

Table 1 Environmental factors detrimental to surgeon well-being

Publication	Factors investigated	Results
Brown et al. 2021 [3]	Factors associated with poor work life balance or burnout	More work hours, fewer awake hours at home, feeling there is a better job
Mahoney et al. 2020 [6]	Reasons surgeons were considering leaving practice	Personal time requirement, overall work time demand, overall stress, dissatisfaction with EMR, family responsibility, inadequate reimbursement, sense of isolation, harassment, malpractice concern
Rangel et al. 2021 [12••]	Factors associated with increased pregnancy complications	Operating more than 12 h per week in the last trimester, maternal age 35 years or older, multiple gestation, requiring bed rest
Jackson et al. 2018 [19]	Factors associated with decreased job satisfaction	Working > 60 h per week, inadequate time with family and friends, inadequate time for extracurricular activities, not feeling well rested, dissatisfaction with work environment (autonomy, patient diversity, patient ownership, safe patient load, hospital culture, hospital support, camaraderie, salary)
Jesuyajolu et al. 2022 [20]	Factors associated with burnout	Being accused of malpractice, occupational stressors, low annual income, workplace violence, frustrating colleagues, insufficient study time, and poor work/life balance (long working hours, on-call duties, a lack of extracurricular activities and added clinical responsibilities after work)
Galaiya et al. 2020 [21]	Factors associated with burnout	Increased workload, more hours worked, working nights, poor working relationships, disputes, shaming, culture of bravado, conflict with patients, being accused of malpractice, lack of administrative support, inadequate time for administrative duties, anxiety over personal competence, lack of extra-curricular activities, sleep deprivation
Hu et al. 2019 [22••]	Factors associated with burnout	Increasing frequency of mistreatment, duty hour violations
Joseph et al. 2014 [23]	Factors associated with PTSD symptoms	Working at a center with 24-h resident coverage, operating 15 or more cases per month, having seven or more call duties per month, relaxing 4 h or less per day, and taking 2 weeks or less of vacation each year
Jackson et al. 2022 [24]	Factors associated with PTSD	Working > 60 h per week, emotional exhaustion, job dissatisfaction, lack of autonomy, dissatisfaction with camaraderie
Jackson et al. 2019 [25, 26]	Traumatic stressors for trauma surgeons	Feeling overwhelmed/lack of support, bad outcomes/malpractice, work-life discord, care for the critically injured, bullying by colleagues/staff
James et al. 2022 [27]	Factors associated with increased PTSD threshold score	Persons close to the surgeon contracting COVID19, family issues due to COVID-19, increased stress level, fear of going to work, risk of contracting COVID-19 from patients, risk of death due to caring for COVID-19 patients, mental health resources not provided
Lu et al. 2020 [28]	Themes associated with burnout	Anxiety and frustration, family and parenting responsibilities, lack of control over schedule, poor impression of personal value, lack of workflow efficiency, lack of administrative transparency

teamwork, collegiality, control over one's time, and a sense of leadership support. Male participants perceived leadership support more consistently than female participants. Both genders perceived that there was a bias against family life responsibilities and parenting when it came to career advancement. Female participants consistently noted gender biases negatively impacting work life [28].

Emotional Well-Being: the Emotional Stress Response to Difficult Cases and the Road to Moral Injury and Burnout

In a survey of practicing surgeons, 80% reported having an adverse intraoperative event in the last year, and 84% of surgeons reported negative emotional responses to that event including anxiety, guilt, sadness, shame, embarrassment, or anger [29]. Recent qualitative studies have explored surgeon's emotional responses to stressful operating room environments and to bad outcomes and adverse events and have described institutional attempts to support surgeons and help facilitate healthy coping strategies. A study from the University of Toronto found that surgeons describe feeling a state of loss of control during difficult or stressful cases with physiologic, cognitive, and emotional consequences. Surgeons recount feeling trapped in the operating room, rushing or irrational thoughts, feeling judged by their colleagues and anesthesiologists for poor performance, and not feeling that there were resources available to help deal with the stress due to the culture of surgery [30]. Another qualitative study interviewed multiple surgeons across the state of Michigan regarding their emotional responses to operative complications. Surgeons noted feelings of sadness, anxiety, frustration, grief, and failure when encountering operative complications. They related their feelings of personal responsibility and of failing the patient and their family which lead to lack of self-confidence [31].

Luu et al. constructed a model of the surgeon's response to complications based on interviews of 20 surgeons after they encountered adverse events (Fig. 1). Interestingly, surgeons believed that their emotional responses were unique and rare. Some senior surgeons were perceived as not having emotional reactions and were actually found to have similar emotional reactions to those of other surgeons. Female surgeons often attributed their strong emotional reactions to their gender. This study characterized the surgeon's response to adverse events into 4 phases. Phase 1 is called "the kick" and is the visceral and physiologic stress response to learning of an adverse event accompanied by feelings of failure and lack of personal value. Phase 2 is "the fall" in which the surgeon feels they are spiraling out of control and can experience depression affecting their personal or family life as well as their work. In this stage, surgeons go over the event and search for why and how it happened. Surgeons also often worry about their reputation. Phase 3 is "the recovery" after time passes and emotions become less raw, and this often requires speaking about the case with colleagues, family, and friends. In this phase, surgeons often try to learn from the experience so that their knowledge will benefit their future patients. Phase 4 is "the impact" or the effect of the complication on the surgeon's sense of self and the effect on their practice long term. This phase seemed to have one of two outcomes. Some surgeons limited their scope of practice in order to avoid encountering that particular complication. Other surgeons had renewed confidence and continued their current scope of practice while becoming more careful to avoid the adverse event in the future [32••].

Several institutions have published their interventions to improve surgeon work environment and well-being

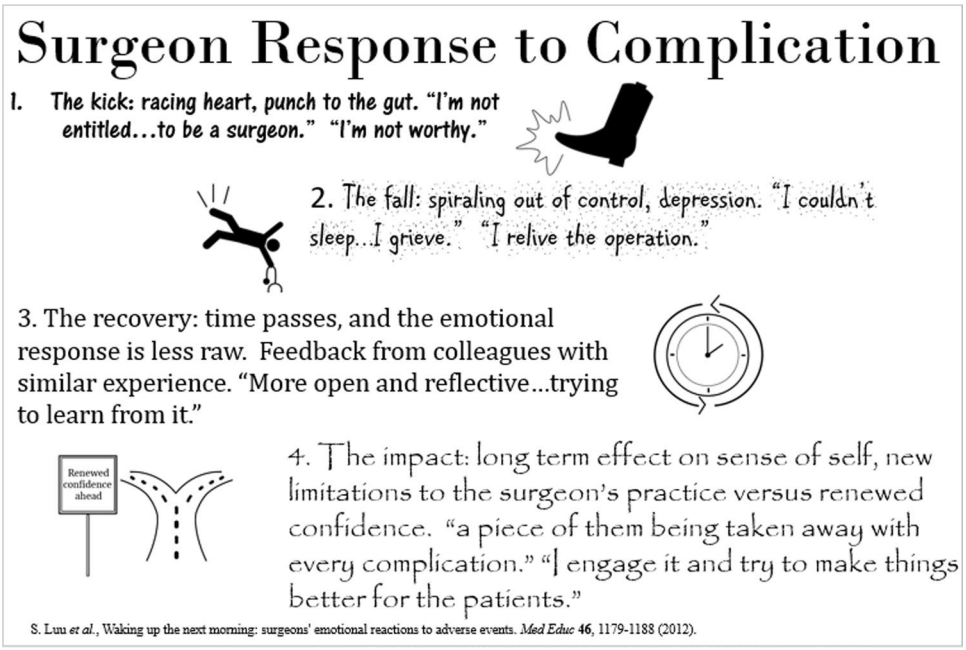

Fig. 1 The 4 phases of the surgeon's response to an adverse event based on the qualitative study by Luu et al. entitled Waking up the Next Morning: Surgeons' Emotional Reactions to Adverse Events. Quotes are direct from surgeon responses to the survey

Table 2 Institutional initiatives to improve surgeon emotional well-being

Lillemoe et al. 2021 [17]	Institution of moral injury small group sessions led by faculty three times per year during resident conference time
Walker et al. 2022 [33]	Interventions based on surgeon feedback including hiring administrative assistants and adding faculty hires to decrease administrative burden and overwhelming workload
Zhu et al. 2021 [34•]	Provided coaching session with a senior surgeon to surgeons who had a common bile duct injury during a lap cholecystectomy
El Hechi et al. 2020 [35]	Provided peer support outreach and intervention to surgeons involved in major adverse events
Dickinson et al. 2021 [36]	Instituted intra-operative mentoring of junior faculty in which surgeons in their first 3 years of practice may ask for senior partner participation in their cases. Senior partners uniformly agreed to participate. Full wRVU credit was given for junior faculty and the senior surgeon

after adverse events (Table 2). A single institution study interviewed their surgeons to determine factors that would improve their career fulfillment and then implemented changes based on these interviews. The institution hired administrative assistants to decrease the burden of administrative tasks and hired additional faculty to reduce the call burden and clinical load for surgeons [33]. In order to support surgeons after adverse events, one institution implemented a peer-to-peer coaching program for surgeons after common bile duct injury during laparoscopic cholecystectomy. This included educational modules as well as review of the anatomy of their specific case with a senior hepatobiliary surgeon who performed the bile duct repair. Participants stated that this review with a senior colleague aided in their self-confidence and emotional recovery from the complication. Surgeons asked for increased emphasis on the emotional impact of the complication for the surgeon's well-being during the session. Respondents stated that factors contributing to the success of the session included a non-judgmental atmosphere, a collegial relationship with their coach, and an interactive format with the ability to ask questions [34•]. Another institution initiated a peer support program for surgeons who had experienced a difficult patient outcome. A resident or attending physician would meet with the affected peer after an adverse event, with 47 of these meetings occurring over the course of a year. Participants felt the program had a positive impact on the safety and support culture in the department [35]. In order to encourage mentoring of junior faculty during difficult operative cases, one institution asked for agreement from senior partners to act as co-surgeon when needed for difficult cases for partners in their first 3 years of practice. They also allowed for a full wRVU credit for both the junior faculty and the senior surgeon when operating together for a difficult case [36].

Discussion and Future Directions

In the past 5 years, many studies of surgeon wellness have illustrated the challenges facing the physical, mental, and emotional health of acute cares surgeons. There is still much work to be done to clarify the role and implementation of institutional policies that support surgeon well-being. In the realm of physical wellness, time outside of work is a recurrent theme including time for family, exercise, health maintenance, and hobbies. Adequate staffing to reduce the burden of administrative tasks and less intensive call schedules may contribute to improved surgeon quality of life and physical wellness. Microbreaks have been shown to improve musculoskeletal pain as well as surgeon performance and focus. Future directions would include institutional initiatives educating surgeons and trainees on incorporation of microbreaks as standard surgical practice.

There is a desperate need for support for families and especially for surgeon mothers. The historical employer perspective of the male surgeon as the norm and the female surgeon as problematic since women may become pregnant and may require accommodations for pregnancy and nursing is outdated. A culture shift that allows for maternity and paternity leave as well as work accommodations for pregnant surgeons is overdue. Involved parenthood among surgeons should not be seen as an aberration or as undesirable by institutions but instead should be expected and supported. Valuing diversity and inclusion means not only accepting diverse persons into the field of surgery but also accommodating diverse persons and creating a culture and environment which allows them to thrive and contribute to the field. For pregnant women, this means accommodating their needs for maternal and fetal health. Rangel et al. demonstrated increased pregnancy complications among mothers who operate more than 12 h per week in the late stages of their pregnancy and for mothers with advanced maternal age greater than 35 years [12••]. Academic leadership, Accreditation Council for Graduate Medical Education, and institutional policies must anticipate and accommodate these health considerations in advanced pregnancy for surgeons and surgical trainees. The logistics of this may mean extension of residency or delaying fellowship start dates so that it is practical for women and men to take maternity and paternity leave. Pregnancy and breastfeeding accommodations should be seen as normal and expected to maintain a

diverse workforce rather than perceived as an inconvenience or a liability.

Moral injury, second victim syndrome, burnout, and PTSD are common challenges to the surgeon's mental and emotional health. Recent qualitative studies show that surgeons often feel isolated in their emotional response to adverse events. Education on the frequency of moral injury and burnout may ameliorate the perception of isolation. The 4-phase model of a surgeon's emotional response to adverse events is both a helpful and relatable educational tool for surgeons. Open discussion from surgeon leaders to normalize the emotional response to adverse events may help create a culture of openness, non-judgemental discussion, and support. Surgical coaching programs may help surgeons to improve their operative performance and aid in emotional recovery as in the Zhu study by offering mentorship and education for surgeons in the aftermath of surgical complications [34•]. Further studies on interventions to aid in emotional recovery and prevent the progression to second victim syndrome, PTSD, and burnout are required.

Conclusion: How Can Surgeon and Institutional Leadership Support Physical, Mental, and Emotional Well Being for Surgeons?

Surgeon leaders and institutions have several areas for improvement in supporting surgeon well-being. Providing adequate administrative and surgeon staffing so that surgeons have time outside of their clinical duties for family, hobbies, and exercise may improve mental and physical health. Educating surgeons on the prevalence of musculoskeletal injuries and the benefits of intra-operative microbreaks for stretching exercises may mitigate surgeon musculoskeletal pain and improve operative performance. Supporting surgeon mothers with work accommodations in the late stages of pregnancy, adequate maternity and paternity leave for trainees and attending surgeons, and time and space for breast feeding may support surgeon mothers and improve maternal and fetal health and foster a more diverse work force. Furthermore, programs to support the surgeons' emotional recovery from adverse events and surgeon education regarding the stages of emotional response to complications may ameliorate feelings of isolation and aid in emotional recovery.

Declarations

Conflict of Interest The authors have no conflicts of interest to disclose.

References

Papers of particular interest, published recently, have been highlighted as:
• Of importance
•• Of major importance

1. Shapiro DE, et al. Beyond Burnout: A Physician Wellness Hierarchy Designed to Prioritize Interventions at the Systems Level. Am J Med. 2019;132:556–63.
2. Shanafelt TD, et al. Avoiding burnout: the personal health habits and wellness practices of US surgeons. Ann Surg. 2012;255:625–33.
3. Brown CVR, Joseph BA, Davis K, Jurkovich GJ. Modifiable factors to improve work-life balance for trauma surgeons. J Trauma Acute Care Surg. 2021;90:122–8.
4.•• Coleman JJ, et al. To Sleep, Perchance to Dream: Acute and Chronic Sleep Deprivation in Acute Care Surgeons. J Am Coll Surg. 2019;229:166–74. **This paper identified that the majority of trauma surgeons studied had chronic or acute sleep deprivation and described the sleep patterns of surgeons after trauma call. Normal sleep cycle was not achieved until the third night post call.**
5. Schuster KM, et al. Can acute care surgeons perform while fatigued? An EAST multicenter study. J Trauma Acute Care Surg. 2018;85:476–84.
6. Mahoney ST, et al. Survey of the US Surgeon Workforce: Practice Characteristics, Job Satisfaction, and Reasons for Leaving Surgery. J Am Coll Surg. 2020;230:283-293.e281.
7. Epstein S, et al. Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionalists: A Systematic Review and Meta-analysis. JAMA Surg. 2018;153: e174947.
8. Stucky CH, et al. Surgeon symptoms, strain, and selections: Systematic review and meta-analysis of surgical ergonomics. Ann Med Surg (Lond). 2018;27:1–8.
9. Park AE, et al. Intraoperative "Micro Breaks" With Targeted Stretching Enhance Surgeon Physical Function and Mental Focus: A Multicenter Cohort Study. Ann Surg. 2017;265:340–6.
10. Koshy K, et al. Interventions to improve ergonomics in the operating theatre: A systematic review of ergonomics training and intra-operative microbreaks. Ann Med Surg (Lond). 2020;55:135–42.
11. Allespach H, Sussman M, Bolanos J, Atri E, Schulman CI. Practice Longer and Stronger: Maximizing the Physical Well-Being of Surgical Residents with Targeted Ergonomics Training. J Surg Educ. 2020;77:1024–7.
12.•• Rangel EL, et al. Incidence of Infertility and Pregnancy Complications in US Female Surgeons. JAMA Surg. 2021;156:905–15. **This paper compared female surgeons to their peers and determined that female surgeons are at increased risk of miscarriage and pregnancy complications. Risk factors for pregnancy complications included more than 12 hours of operative time per week in the third trimester and maternal age greater than 35 years.**
13.• Rangel EL, et al. Perspectives of pregnancy and motherhood among general surgery residents: A qualitative analysis. Am J Surg. 2018;216:754–9. **This was a qualitative study interviewing surgeons who were pregnant during residency and identified the barriers to taking maternity leave and breast feeding.**
14. Castillo-Angeles M, Smink DS, Rangel EL. Perspectives of US General Surgery Program Directors on Cultural and Fiscal Barriers to Maternity Leave and Postpartum Support During Surgical Training. JAMA Surg. 2021;156:647–53.

15. Williamson V, Murphy D, Phelps A, Forbes D, Greenberg N. Moral injury: the effect on mental health and implications for treatment. Lancet Psychiatry. 2021;8:453–5.
16. Bakshi AS, et al. Second Victim Syndrome in Trauma Practitioners and Other Ancillary Staff. Am Surg. 2022;88(9):2258–60.
17. Lillemoe HA, Geevarghese SK. Stopping the Progression of Moral Injury: A Priority During Surgical Training. Ann Surg. 2021;274:e643–5.
18. Hewitt DB, et al. Association of Surgical Resident Wellness With Medical Errors and Patient Outcomes. Ann Surg. 2021;274:396–402.
19. Jackson TN, et al. The Physician Attrition Crisis: A Cross-Sectional Survey of the Risk Factors for Reduced Job Satisfaction Among US Surgeons. World J Surg. 2018;42:1285–92.
20. Jesuyajolu D, Nicholas A, Okeke C, Obi C, Aremu G, Obiekwe K, Obinna I. Burnout among surgeons and surgical trainees: A systematic review and meta-analysis of the prevalence and associated factors. Surg Pract Sci. 2022;10:100094.
21. Galaiya R, Kinross J, Arulampalam T. Factors associated with burnout syndrome in surgeons: a systematic review. Ann R Coll Surg Engl. 2020;102:401–7.
22.•• Hu YY, et al. Discrimination, Abuse, Harassment, and Burnout in Surgical Residency Training. N Engl J Med. 2019;381:1741–52. **This survey of residents correlated burnout and suicidal ideation with discrimination and harrassment.**
23. Joseph B, et al. Unveiling posttraumatic stress disorder in trauma surgeons: a national survey. J Trauma Acute Care Surg. 2014;77:148–54 (discussion 154).
24. Jackson TN, et al. Traumatized attendings - When the doctor has the disease. Am J Surg. 2022;223:626–32.
25. Jackson TN, et al. The Crossroads of Posttraumatic Stress Disorder and Physician Burnout: A National Review of United States Trauma and Nontrauma Surgeons. Am Surg. 2019;85:127–35.
26. Jackson T, et al. Trends in Surgeon Wellness (Take a Sad Song and Make It Better): A Comparison of Surgical Residents, Fellows, and Attendings. Am Surg. 2019;85:579–86.
27. James MK, Robitsek RJ, McKenzie K, Valenzuela JY, Esposito TJ. COVID-19 induced PTSD: Stressors for trauma and acute care surgeons. Am J Surg. 2022;224:843–8.
28. Lu PW, Columbus AB, Fields AC, Melnitchouk N, Cho NL. Gender Differences in Surgeon Burnout and Barriers to Career Satisfaction: A Qualitative Exploration. J Surg Res. 2020;247:28–33.
29. Han K, et al. The Surgeon as the Second Victim? Results of the Boston Intraoperative Adverse Events Surgeons' Attitude (BISA) Study. J Am Coll Surg. 2017;224:1048–56.
30. McQueen S, Mobilio MH, Moulton CA. Fractured in surgery: Understanding stress as a holistic and subjective surgeon experience. Am J Surg. 2021;221:793–8.
31. Vitous CA, Byrnes ME, De Roo A, Jafri SM, Suwanabol PA. Exploring Emotional Responses After Postoperative Complications: A Qualitative Study of Practicing Surgeons. Ann Surg. 2022;275:e124–31.
32.•• Luu S, et al. Waking up the next morning: surgeons' emotional reactions to adverse events. Med Educ. 2012;46:1179–88. **This qualitative study of interviews of surgeons regarding their emotional responses to complications developed a model of the stages of surgeons' response to adverse events.**
33. Walker HR, et al. "I need to have a fulfilling job": A qualitative study of surgeon well-being and professional fulfillment. Am J Surg. 2022;223:6–11.
34.• Zhu A, et al. Helping the Surgeon Recover: Peer-to-Peer Coaching after Bile Duct Injury. J Am Coll Surg. 2021;233:213-222. e211. **This study described a successful intervention involving a senior surgeon coaching junior surgeons after common bile duct injury. This intervention helped with emotional recovery.**
35. El Hechi MW, et al. Design and Impact of a Novel Surgery-Specific Second Victim Peer Support Program. J Am Coll Surg. 2020;230:926–33.
36. Dickinson KJ, Sachdeva AK, Bass BL. It's OK to Ask for Help: Destigmatizing Mentoring for Junior Surgeons. Ann Surg. 2021;273:e52–4.