

Burnout among surgeons: Lessons for psychiatrists

This review summarizes risk factors and identifies potential interventions

Burnout is an occupational phenomenon and a syndrome resulting from unsuccessfully managed chronic workplace stress. The characteristic features of burnout include feelings of exhaustion, cynicism, and reduced professional efficacy.¹ A career in surgery is associated with demanding and unpredictable work hours in a high-stress environment.²⁻⁸ Research indicates that surgeons are at an elevated risk for developing burnout and mental health problems that can compromise patient care. A survey of the fellows of the American College of Surgeons found that 40% of surgeons experience burnout, 30% experience symptoms of depression, and 28% have a mental quality of life (QOL) score greater than one-half an SD below the population norm.^{9,10} Surgeon burnout was also found to compromise the delivery of medical care.^{9,10}

To prevent serious harm to surgeons and patients, it is critical to understand the causative factors of burnout among surgeons and how they can be addressed. We conducted this systematic review to identify factors linked to burnout across surgical specialties and to suggest ways to mitigate these risk factors.

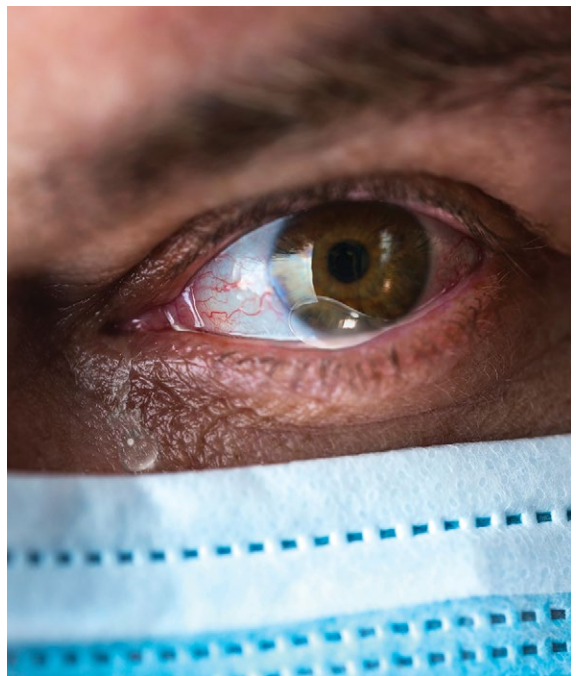
Methods

To identify studies of burnout among surgeons, we conducted an electronic search of Ovid MEDLINE, Ovid PsycInfo, SCOPUS, Cochrane Database of Systematic Reviews, and Cochrane Central Register of Controlled Trials. The headings and keywords used are listed in *Supplemental Table 1*

Disclosures

The authors report no financial relationships with any companies whose products are mentioned in this article, or with manufacturers of competing products.

doi: 10.12788/cp.0383



SERHI MILEKHIN/SHUTTERSTOCK

Harshavardhan Bollepalli, BS

College of Arts and Sciences
Saint Louis University
St. Louis, Missouri

Robert Evans, BS

College of Arts and Sciences
Saint Louis University
St. Louis, Missouri

Seth Ludford, BS

College of Arts and Sciences
Saint Louis University
St. Louis, Missouri

Angela Spencer, MLS

Health Sciences Reference
Librarian
Assistant Professor
Saint Louis University
St. Louis, Missouri

Suma Chand, PhD

Professor
Department of Psychiatry
and Behavioral Neuroscience
Saint Louis University School
of Medicine
St. Louis, Missouri



Burnout among surgeons

Clinical Point

As one might expect, increased time spent on work, decreased leisure time, and an inability to meet family commitments are linked to burnout



Discuss this article at www.facebook.com/MDedgePsychiatry

(available at www.mdedge.com/psychiatry). Studies met the inclusion criteria if they evaluated residents or attendings, used a tool to measure burnout, and examined any surgical specialty. Studies were excluded if they were published before 2010; were conducted outside the United States; were review articles, commentaries, or abstracts without full text articles; evaluated medical school students; were published in a language other than English; did not use a tool to measure burnout; or examined a nonsurgical specialty. Our analysis was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)¹¹ and is outlined in the *Supplemental Figure* (available at www.mdedge.com/psychiatry).

Results

Surgical specialties and burnout

We identified 56 studies^{2-10,12-58} that focused on specific surgical specialties in relation to burnout. *Supplemental Table 2*^{2-10,12-58} (available at www.mdedge.com/psychiatry) lists these studies and the surgical specialties they evaluated.

Work/life balance factors

Fifteen studies^{2-5,14,15,18,19,22,32,34,38,39,47,57} examined the role of work/life balance in burnout. *Table 1*^{2-5,14,15,18,19,22,32,34,38,39,47,57} (page 25) lists the work/life factors these studies identified as being linked to burnout. Six studies^{2,4,18,22,32,47} discussed how decreased leisure time was linked to burnout. Eleven studies^{2,4,14,15,19,22,34,38,39,42,57} associated inability to meet family commitments with burnout. A lack of time to spend with family and not having adequate time to raise children was more prevalent among women. Seven studies^{2,3,18,22,32,34,47} implicated increased time commitment to work as playing a role in burnout. This increased time commitment was also found to be a compounding variable for other factors, such as limited time for family and leisure.

Work hours

Fifteen studies^{2,7,14,20,21,30,34,41,42,44-46,50,52,56} examined work hours and burnout. Of these, 14^{2,7,14,20,21,30,34,42,44-46,50,52,56} found a correlation between increased work hours and

burnout, while only 1 study⁴¹ found no correlation between these factors.

Medical errors

Six studies^{2,14,18,43,49,52} discussed the role of burnout in medical errors. Of these, 5^{2,14,43,49,52} reported a correlation between burnout and medical errors, while 1 study¹⁸ found no link between burnout and medical errors. The medical errors were self-reported.^{14,49} They included actions that resulted in patient harm, sample collection error, and errors in medication orders and laboratory test orders.²

Institutional and organizational factors

Eighteen studies^{3,13,14,18,20,22,23,29,30,36-38,44,45,47,54,56,57} examined how different organizational factors play a role in burnout. Four studies^{3,13,20,37} discussed administrative/bureaucratic work, 4^{20,45,54,57} mentioned electronic medical documentation, 2^{22,30} covered duty hour regulations, 3^{18,45,57} discussed mistreatment of physicians, and 6^{13,18,23,44,47,56} described the importance of workplace support in addressing burnout.

Physical and mental health factors

Eighteen studies^{6,7,14,15,17,20,26,27,29,34,43,44,48,52,54,57-59} discussed aspects of physical and mental health linked to burnout. Among these, 3^{34,43,59} discussed the importance of physical health and focused on how improving physical health can reduce stress and burnout. Three studies^{6,17,58} noted the prevalence of suicidal ideation in both residents and attendings experiencing prolonged burnout. Five studies^{26,29,43,44,48} described the systematic barriers that inhibit physicians from getting professional help. Two studies^{7,27} reported marital status as a factor for burnout; participants who were single reported higher levels of depression and suicidal ideation. Five studies^{6,14,15,54,57} outlined how depression is associated with burnout.

Strategies to mitigate burnout

Fifteen studies^{2,4,5,14,20,22,33,36,47,51,53,55-58} described strategies physicians use to cope with burnout. *Table 2*^{2,4,5,14,20,22,33,36,47,51,53,55-58} (page 27) outlines the strategies postulated and reported by these studies as helpful in reducing

Table 1

Work/life balance factors linked to burnout

Study	Surgical specialty	Resident or attending	Sample size	Instrument(s)	Work/life balance factors
Antiel et al ²² (2013)	General surgery	Resident	100	MBI, SF-8	Decreased leisure time, excessive time commitment to work, decreased family time
Balch et al ¹⁴ (2010)	American College of Surgeons	Both	7,905	MBI	Decreased family time
Barrack et al ⁵⁷ (2006)	Orthopedic	Both	100	MBI	Excessive time commitment to work, decreased family time
Chow et al ¹⁸ (2021)	Cardiothoracic surgery	Resident	108	MBI	Decreased leisure time, excessive time commitment to work
Coombs et al ² (2020)	Plastic surgery	Resident	146	MBI, Stanford Professional Fulfillment	Decreased leisure time, excessive time commitment to work, decreased family time
Crowe et al ⁴⁷ (2021)	Plastic surgery	Resident	668	Nonvalidated	Decreased family time
Dyrbye et al ¹⁵ (2011)	American College of Surgeons	Resident	7,905	SAS-9	Decreased family time
Ha et al ⁴ (2020)	General surgery	Resident	23	Nonvalidated	Decreased leisure time, decreased family time
Khalafallah et al ⁵ (2020)	Neurosurgery	Resident	167	MBI	Excessive time commitment to work
Khalafallah et al ³⁸ (2020)	Neurosurgery	Attending	407	aMBI	Decreased family time
Klimo et al ³ (2013)	Neurosurgery	Attending	85	MBI	Decreased leisure time, excessive time commitment to work
Lam et al ¹⁹ (2021)	Dermatology	Attending	137	MBI, resilience profile	Decreased family time
McAbee et al ³⁹ (2015)	Neurosurgery	Attending	783	MBI	Decreased family time
Smeds et al ³² (2020)	General surgery	Resident	157	Nonvalidated	Decreased leisure time, excessive time commitment to work
Williford et al ³⁴ (2018)	General surgery	Both	147	MBI	Decreased leisure time, excessive time commitment to work, decreased family time

aMBI: abbreviated Maslach Burnout Inventory; MBI: Maslach Burnout Inventory; SF-8: Short Form Health Survey; SAS-9: Statistical Analysis System

Clinical Point

Physicians may turn to maladaptive behaviors such as substance abuse to cope with stress and burnout

burnout. Two studies^{2,4} mentioned that physicians may turn to maladaptive behaviors, such as substance abuse, to cope with stress and burnout. Four studies^{2,4,53,56} mentioned the importance of social support in fighting burnout and building resilience. Ten studies^{2,5,14,20,22,33,36,47,57,58} described the benefits of institutional interventions, such as what administrators can do to reduce the rate of

burnout. Three studies^{5,36,53} postulated different adaptive behaviors physicians can implement to reduce burnout.

Take-home points

Research that focused on work/life balance and burnout found excessive time commitment to work is a major factor associated



Burnout among surgeons

Clinical Point

The amount of time spent on electronic medical records and documentation contributes to burnout

with poor work/life balance. Residents who worked >80 hours a week had a significantly higher burnout rate.⁵⁶ One study found that 70% of residents reported not getting enough sleep, 30% reported not having enough energy for relationships, and 39% reported that they were not eating or exercising due to time constraints.⁴ A high correlation was found between the number of hours worked per week and rates of burnout, emotional exhaustion, and depersonalization. Emotional exhaustion and depersonalization are aspects of burnout measured by the Maslach Burnout Inventory (MBI).²⁴ The excessive time commitment to work not only contributes to burnout but also prevents physicians from getting professional help. In 1 study, both residents (56%) and attendings (24%) reported that 1 of the biggest barriers to getting help for their burnout symptoms was the inability to take time off.³⁴ Research indicates that the hours worked per week and work/home conflicts were independently associated with burnout and career satisfaction.¹⁵ A decrease of weekly work hours may give physicians time to meet their responsibilities at work and home, allowing for a decrease in burnout and an increase in career satisfaction.

Increased work hours have also been found to be correlated with medical errors. One study found that those who worked 60 hours per week were significantly less likely to report any major medical errors in the previous 3 months compared with those who worked 80 hours per week.⁹ The risk for the number of medical errors has been reported as being 2-fold if surgeons are unable to combat the burnout.⁴⁹ On the other hand, a positive and supportive environment with easy access to resources to combat burnout and burnout prevention programs can reduce the frequency of medical errors, which also can reduce the risk of malpractice, thus further reducing stress and burnout.⁴³

In response to resident complaints about long duty hours, a new rule has been implemented that states residents cannot work >16 hours per shift.³⁰ This rule has been found to increase quality of life and prevent burnout.³⁰

The amount of time spent on electronic medical records and documentation has been a major complaint from doctors and was identified as a factor contributing to burnout.⁴⁵ It can act as a time drain that impedes the physician from providing optimal patient care and cause additional stress. This suggests the need for organizations to find solutions to minimize this strain.

A concerning issue reported as an institutional factor and associated with burnout is mistreatment through discrimination, harassment, and physical or verbal abuse. A recent study found 45% of general and vascular surgeons reported being mistreated in some fashion.⁵⁷ The strategies reported as helpful for institutions to combat mistreatment include resilience training, improved mentorship, and implicit bias training.⁵⁷

Burnout has been positively correlated with anxiety and depression.⁶ A recent study reported that 13% of orthopedic surgery residents screened positive for depression.⁴⁴ Higher levels of burnout and depersonalization have been found to be closely associated with increased rates of suicidal ideation.¹⁷ In a study of vascular surgeons, 8% were found to report suicidal ideation, and this increased to 15% among vascular surgeons who had higher levels of depersonalization and emotional exhaustion,⁵⁸ both of which are associated with burnout. In another study, surgery residents and fellows were found to have lower levels of personal achievement and higher levels of depersonalization, depressive symptoms, alcohol abuse, and suicidal ideation compared to attending physicians and the general population.⁵⁴ These findings spell out the association between burnout and depressive symptoms among surgeons and emphasize the need for institutions to create a culture that supports the mental health needs of their physicians. Without access to supportive resources, residents resort to alternative methods that may be detrimental in the long run. In a recent study, 17% of residents admitted to using alcohol, including binge drinking, to cope with their stress.⁴

Table 2

Strategies for reducing burnout

Study	Surgical specialty	Resident or attending	Sample size	Instrument(s)	Strategies
Antiel et al ²² (2013)	General surgery	Resident	100	MBI, Short Form Health Survey, SF-8	Institutional intervention
Balch et al ¹⁴ (2010)	American College of Surgeons	Both	7,905	MBI	Institutional intervention
Balch et al ⁵¹ (2011)	Surgical oncologists	Both	407	MBI	Adaptive
Barrack et al ⁵⁷ (2006)	Orthopedic	Both	100	MBI	Social support
Carlson et al ²⁰ (2021)	Ear, nose, and throat	Both	340	MBI, PHQ-9, Expanded Physician Well-being Index, PHQ-2	Institutional intervention
Cheng et al ⁵³ (2020)	Urology	Both	476	MBI	Adaptive
Chia et al ⁵⁸ (2022)	Vascular surgery	Resident	475	Nonvalidated	Institutional intervention
Coleman et al ⁵⁶ (2021)	Vascular surgery	Attending	960	MBI	Institutional intervention
Coombs et al ² (2020)	Plastic surgery	Resident	146	MBI, Stanford Professional Fulfillment	Social support, institutional intervention
Crowe et al ⁴⁷ (2021)	Plastic surgery	Resident	668	Nonvalidated	Institutional intervention
Ha et al ⁴ (2020)	General Surgery	Resident	23	Nonvalidated	Social support
Janko et al ⁵⁵ (2019)	Vascular	Resident	177	OLBI, Perceived Stress Scale, SS-5	Social support
Khalafallah et al ⁵ (2020)	Neurosurgery	Resident	167	MBI	Institutional intervention
Song et al ³⁶ (2020)	General, vascular, cardiac, plastic, and urologic surgery	Resident	25	MBI	Institutional intervention
Wetzel et al ³³ (2011)	General surgery	Attending	16	Nonvalidated	Institutional intervention

PHQ: Patient Health Questionnaire; MBI: Maslach Burnout Inventory; SF-8: Short Form Health Survey; OLBI: Oldenburg Burnout Inventory; SS-5: Medical Outcomes Study Social Support Scale

Clinical Point

Socializing, mindfulness, volunteering, and exercising have been found to be protective against burnout

Burnout and depression are linked to physical health risks such as cardiovascular disease, diabetes, substance abuse, and male infertility.⁶ Exercise has been shown to be beneficial for stress reduction, which can lead to changes in metabolism, inflammation, coagulation, and autonomic function.⁶ One study of surgeons found aerobic exercise and strength training were associated with lower rates of burnout and a higher quality of life.⁵⁹

The amount of burnout physicians experience can be determined by how they respond to adversities. Adaptive behaviors

such as socializing, mindfulness, volunteering, and exercising have been found to be protective against burnout.^{6,37,54} Resilience training and maintaining low stress at work can decrease burnout.³⁷ These findings highlight the need for physicians to be trained in the appropriate ways to combat their burnout symptoms.

Unfortunately, seeking help by health care professionals to improve mental health has been stigmatized, causing physicians to not seek help and instead resort to other ways to cope with their distress.^{26,34} While some of these coping methods may be



Burnout among surgeons

Clinical Point

Access to mental health services can be embedded within regular wellness checks for physicians

Related Resources

- Pahal P, Lippmann S. Building a better work/life balance. *Current Psychiatry*. 2021;20(8):e1-e2. doi:10.12788/cp.0158
- Gibson R, Hategan A. Physician burnout vs depression: recognize the signs. *Current Psychiatry*. 2019;18(10):41-42.

positive, others—such as substance abuse or stress eating—can be maladaptive, leading to a poor quality of life, and in some cases, suicide.⁵⁴ It is vital that effective mental health services become more accessible and for health care professionals to become aware of their maladaptive behaviors.³⁴

Institutions finding ways to ease the path for their physicians to seek professional help to combat burnout may mitigate its negative impact. One strategy is to embed access to mental health services within regular wellness checks. Institutions can use wellness checks to provide resources to physicians who need it. These interventions have been found to be effective because they give physicians a safe space to seek help and become aware of any factors that could lead to burnout.¹⁸ Apart from these direct attempts to combat burnout, program-sponsored social events would also promote social connectedness with colleagues and contribute to a sense of well-being that could help decrease levels of burnout and depression.¹³ Mentorship has been shown to play a crucial role in decreasing burnout among residents. One study that examined the role of mentorship reported that 55% of residents felt supported, and of these, 96% felt mentorship was critical to their success.¹⁸ The role of institutions in helping to improve the well-being of surgeons is highlighted by the finding that increasing workplace support results in psychological resilience that can mitigate burnout at its roots.²⁹

Bottom Line

Surgeons are at risk for burnout, which can impact their mental health and reduce their professional efficacy. Both institutions and surgeons themselves can take action to prevent burnout and treat burnout early when it occurs.

References

1. World Health Organization. *International Statistical Classification of Diseases and Related Health Problems (ICD)*. 11th ed. World Health Organization; 2019.
2. Coombs DM, Lanni MA, Fosnot J, et al. Professional burnout in United States plastic surgery residents: is it a legitimate concern? *Aesthet Surg J*. 2020;40(7):802-810.
3. Klimo P Jr, DeCuypere M, Ragel BT, et al. Career satisfaction and burnout among U.S. neurosurgeons: a feasibility and pilot study. *World Neurosurg*. 2013;80(5):e59-e68.
4. Ha GQ, Go JT, Murayama KM, et al. Identifying sources of stress across years of general surgery residency. *Hawaii J Health Soc Welf*. 2020;79(3):75-81.
5. Khalafallah AM, Lam S, Gami A, et al. A national survey on the impact of the COVID-19 pandemic upon burnout and career satisfaction among neurosurgery residents. *J Clin Neurosci*. 2020;80:137-142.
6. Al-Humadi SM, Cáceda R, Bronson B, et al. Orthopaedic surgeon mental health during the COVID-19 pandemic. *Geriatric Orthop Surg Rehabil*. 2021;12:21514593211035230.
7. Larson DP, Carlson ML, Lohse CM, et al. Prevalence of and associations with distress and professional burnout among otolaryngologists: part I, trainees. *Otolaryngol Head Neck Surg*. 2021;164(5):1019-1029.
8. Streu R, Hawley S, Gay A, et al. Satisfaction with career choice among U.S. plastic surgeons: results from a national survey. *Plast Reconstr Surg*. 2010;126(2):636-642.
9. Shanafelt TD, Balch CM, Bechamps GJ, et al. Burnout and career satisfaction among American surgeons. *Ann Surg*. 2009;250(3):463-471.
10. Shanafelt TD, Balch CM, Bechamps G, et al. Burnout and medical errors among American surgeons. *Ann Surg*. 2010;251(6):995-1000.
11. Moher D, Liberati A, Tetzlaff J, et al; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg*. 2010;8(5):336-341.
12. Yesantharao P, Lee E, Kraenzlin F, et al. Surgical block time satisfaction: a multi-institutional experience across twelve surgical disciplines. *Perioperative Care Operating Room Manage*. 2020;21:100128.
13. Nituica C, Bota OA, Blebea J. Specialty differences in resident resilience and burnout - a national survey. *Am J Surg*. 2021;222(2):319-328.
14. Balch CM, Shanafelt TD, Dyrbye L, et al. Surgeon distress as calibrated by hours worked and nights on call. *J Am Coll Surg*. 2010;211(5):609-619.
15. Dyrbye LN, Shanafelt TD, Balch CM, Satele D, Sloan J, Freischlag J. Relationship between work-home conflicts and burnout among American surgeons: a comparison by sex. *Arch Surg*. 2011;146(2):211-217.
16. Mahoney ST, Irish W, Strassle PD, et al. Practice characteristics and job satisfaction of private practice and academic surgeons. *JAMA Surg*. 2021;156(3):247-254.
17. Shanafelt TD, Balch CM, Dyrbye L, et al. Special report: suicidal ideation among American surgeons. *Arch Surg*. 2011;146(1):54-62.
18. Chow OS, Sudarshan M, Maxfield MW, et al. National survey of burnout and distress among cardiothoracic surgery trainees. *Ann Thorac Surg*. 2021;111(6):2066-2071.
19. Lam C, Kim Y, Cruz M, et al. Burnout and resiliency in Mohs surgeons: a survey study. *Int J Womens Dermatol*. 2021;7(3):319-322.
20. Carlson ML, Larson DP, O'Brien EK, et al. Prevalence of and associations with distress and professional burnout among otolaryngologists: part II, attending physicians. *Otolaryngol Head Neck Surg*. 2021;164(5):1030-1039.

21. Nida AM, Googe BJ, Lewis AF, et al. Resident fatigue in otolaryngology residents: a Web based survey. *Am J Otolaryngol.* 2016;37(3):210-216.
22. Antiel RM, Reed DA, Van Arendonk KJ, et al. Effects of duty hour restrictions on core competencies, education, quality of life, and burnout among general surgery interns. *JAMA Surg.* 2013;148(5):448-455.
23. Appelbaum NP, Lee N, Amendola M, et al. Surgical resident burnout and job satisfaction: the role of workplace climate and perceived support. *J Surg Res.* 2019;234:20-25.
24. Elmore LC, Jeffe DB, Jin L, et al. National survey of burnout among US general surgery residents. *J Am Coll Surg.* 2016;223(3):440-451.
25. Garcia DI, Pannuccio A, Gallegos J, et al. Resident-driven wellness initiatives improve resident wellness and perception of work environment. *J Surg Res.* 2021;258:8-16.
26. Hochberg MS, Berman RS, Kalet AL, et al. The stress of residency: recognizing the signs of depression and suicide in you and your fellow residents. *Am J Surg.* 2013;205(2):141-146.
27. Kurbatov V, Shaughnessy M, Baratta V, et al. Application of advanced bioinformatics to understand and predict burnout among surgical trainees. *J Surg Educ.* 2020;77(3):499-507.
28. Leach PK, Nygaard RM, Chipman JG, et al. Impostor phenomenon and burnout in general surgeons and general surgery residents. *J Surg Educ.* 2019;76(1):99-106.
29. Lebares CC, Greenberg AL, Ascher NL, et al. Exploration of individual and system-level well-being initiatives at an academic surgical residency program: a mixed-methods study. *JAMA Netw Open.* 2021;4(1):e2032676.
30. Lindeman BM, Sacks BC, Hirose K, et al. Multifaceted longitudinal study of surgical resident education, quality of life, and patient care before and after July 2011. *J Surg Educ.* 2013;70(6):769-776.
31. Rasmussen JM, Najarian MM, Ties JS, et al. Career satisfaction, gender bias, and work-life balance: a contemporary assessment of general surgeons. *J Surg Educ.* 2021;78(1):119-125.
32. Smeds MR, Janko MR, Allen S, et al. Burnout and its relationship with perceived stress, self-efficacy, depression, social support, and programmatic factors in general surgery residents. *Am J Surg.* 2020;219(6):907-912.
33. Wetzel CM, George A, Hanna GB, et al. Stress management training for surgeons—a randomized, controlled, intervention study. *Ann Surg.* 2011;253(3):488-494.
34. Williford ML, Scarlet S, Meyers MO, et al. Multiple-institution comparison of resident and faculty perceptions of burnout and depression during surgical training. *JAMA Surg.* 2018;153(8):705-711.
35. Zubair MH, Hussain LR, Williams KN, et al. Work-related quality of life of US general surgery residents: is it really so bad? *J Surg Educ.* 2017;74(6):e138-e146.
36. Song Y, Swendiman RA, Shannon AB, et al. Can we coach resilience? An evaluation of professional resilience coaching as a well-being initiative for surgical interns. *J Surg Educ.* 2020;77(6):1481-1489.
37. Morrell NT, Sears ED, Desai MJ, et al. A survey of burnout among members of the American Society for Surgery of the Hand. *J Hand Surg Am.* 2020;45(7):573-581.e516.
38. Khalafallah AM, Lam S, Gami A, et al. Burnout and career satisfaction among attending neurosurgeons during the COVID-19 pandemic. *Clin Neurol Neurosurg.* 2020;198:106193.
39. McAbee JH, Ragel BT, McCartney S, et al. Factors associated with career satisfaction and burnout among US neurosurgeons: results of a nationwide survey. *J Neurosurg.* 2015;123(1):161-173.
40. Shakir HJ, McPheeters MJ, Shallwani H, et al. The prevalence of burnout among US neurosurgery residents. *Neurosurgery.* 2018;83(3):582-590.
41. Govardhan LM, Pinelli V, Schnatz PF. Burnout, depression and job satisfaction in obstetrics and gynecology residents. *Conn Med.* 2012;76(7):389-395.
42. Driesman AS, Strauss EJ, Konda SR, et al. Factors associated with orthopaedic resident burnout: a pilot study. *J Am Acad Orthop Surg.* 2020;28(21):900-906.
43. Lichstein PM, He JK, Estok D, et al. What is the prevalence of burnout, depression, and substance use among orthopaedic surgery residents and what are the risk factors? A collaborative orthopaedic educational research group survey study. *Clin Orthop Relat Res.* 2020;478(8):1709-1718.
44. Somerson JS, Patton A, Ahmed AA, et al. Burnout among United States orthopaedic surgery residents. *J Surg Educ.* 2020;77(4):961-968.
45. Verret CI, Nguyen J, Verret C, et al. How do areas of work life drive burnout in orthopaedic attending surgeons, fellows, and residents? *Clin Orthop Relat Res.* 2021;479(2):251-262.
46. Sarosi A, Coakley BA, Berman L, et al. A cross-sectional analysis of compassion fatigue, burnout, and compassion satisfaction in pediatric surgeons in the U.S. *J Pediatr Surg.* 2021;56(8):1276-1284.
47. Crowe CS, Lopez J, Morrison SD, et al. The effects of the COVID-19 pandemic on resident education and wellness: a national survey of plastic surgery residents. *Plast Reconstr Surg.* 2021;148(3):462e-474e.
48. Qureshi HA, Rawlani R, Mioton LM, et al. Burnout phenomenon in U.S. plastic surgeons: risk factors and impact on quality of life. *Plast Reconstr Surg.* 2015;135(2):619-626.
49. Streu R, Hansen J, Abrahamse P, et al. Professional burnout among US plastic surgeons: results of a national survey. *Ann Plast Surg.* 2014;72(3):346-350.
50. Zhang JQ, Riba L, Magrini L, ET AL. Assessing burnout and professional fulfillment in breast surgery: results from a national survey of the American Society of Breast Surgeons. *Ann Surg Oncol.* 2019;26(10):3089-3098.
51. Balch CM, Shanafelt TD, Sloan J, et al. Burnout and career satisfaction among surgical oncologists compared with other surgical specialties. *Ann Surg Oncol.* 2011;18(1):16-25.
52. Wu D, Gross B, Rittenhouse K, et al. A preliminary analysis of compassion fatigue in a surgeon population: are female surgeons at heightened risk? *Am Surg.* 2017;83(11):1302-1307.
53. Cheng JW, Wagner H, Hernandez BC, et al. Stressors and coping mechanisms related to burnout within urology. *Urology.* 2020;139:27-36.
54. Koo K, Javier-DesLoges JF, Fang R, ET AL. Professional burnout, career choice regret, and unmet needs for well-being among urology residents. *Urology.* 2021;157:57-63.
55. Janko MR, Smeds MR. Burnout, depression, perceived stress, and self-efficacy in vascular surgery trainees. *J Vasc Surg.* 2019;69(4):1233-1242.
56. Coleman DM, Money SR, Meltzer AJ, et al. Vascular surgeon wellness and burnout: a report from the Society for Vascular Surgery Wellness Task Force. *J Vasc Surg.* 2021;73(6):1841-1850.e3.
57. Barrack RL, Miller LS, Sotile WM, et al. Effect of duty hour standards on burnout among orthopaedic surgery residents. *Clin Orthop Relat Res.* 2006;449:134-137.
58. Chia MC, Hu YY, Li RD, et al. Prevalence and risk factors for burnout in U.S. vascular surgery trainees. *J Vasc Surg.* 2022;75(1):308-315.e4.
59. Shanafelt TD, Oreskovich MR, Dyrbye LN, et al. Avoiding burnout: the personal health habits and wellness practices of US surgeons. *Ann Surg.* 2012;255(4):625-633.

Clinical Point

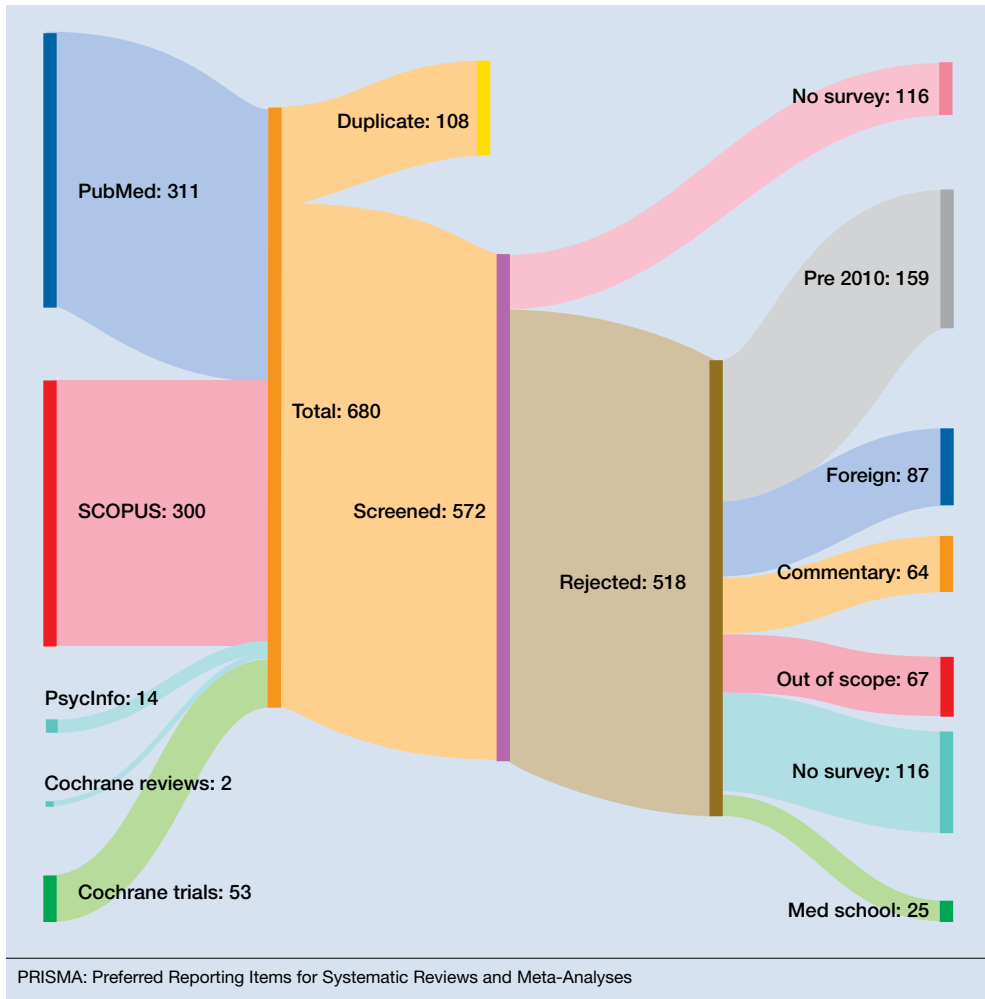
Increasing workplace support results in psychological resilience that can mitigate burnout at its roots



Burnout among surgeons

Supplemental Figure

Application of PRISMA method



Supplemental Table 1

Headings and keywords that directed the systematic literature review

Category	Heading	Keywords
Burnout	Professional, psychological, job satisfaction, work schedule tolerance, work-life balance, psychological stress, occupational stress	Burnout, "burn out" exhaustion, "job satisfaction," "work schedule tolerance, "work-life balance," and an adjunctive search of stress with the terms work or job or career
Surgeon	Internship and residency, physicians, and surgeons	Resident, intern, physicians, attending, fellow, fellows, fellowship, and surgeon
Surgery	General surgery, specialties, and surgical	Surgery or surgical or surgeons
Interventions	Resilience, psychological, meditation, mindfulness, and quality of life	Not applicable



Burnout among surgeons

Supplemental Table 2

Studies of burnout in different surgical specialties

Study	Surgical specialty	Resident or attending	Sample size	Instrument(s)
Yesantharao et al ¹² (2020)	12 disciplines	Both	159	Nonvalidated
Nituica et al ¹³ (2021)	ACGME programs	Both	682	MBI
Balch et al ¹⁴ (2010)	American College of Surgeons	Both	7,905	MBI
Dyrbye et al ¹⁵ (2011)	American College of Surgeons	Resident	7,905	SAS-9
Mahoney et al ¹⁶ (2021)	American College of Surgeons	Attending	3,807	Nonvalidated
Shanafelt et al ⁹ (2009)	American College of Surgeons	Attending	7,905	Validated survey
Shanafelt et al ¹⁰ (2010)	American College of Surgeons	Attending	7,197	Nonvalidated
Shanafelt et al ¹⁷ (2011)	American College of Surgeons	Attending	7,905	Validated survey
Chow et al ¹⁸ (2021)	Cardiothoracic surgery	Resident	108	MBI
Lam et al ¹⁹ (2021)	Dermatology	Attending	137	MBI, resilience profile
Carlson et al ²⁰ (2021)	Ear, nose, and throat	Both	340	MBI, PHQ-9, Expanded Physician Well-being Index, PHQ-2
Larson et al ⁷ (2021)	Ear, nose, and throat	Both	340	MBI, Wellness index
Nida et al ²¹ (2016)	Ear, nose, and throat	Resident	178	Nonvalidated, ESS
Antiel et al ²² (2013)	General surgery	Resident	100	MBI, SF-8
Appelbaum et al ²³ (2019)	General surgery	Resident	160	Nonvalidated
Elmore et al ²⁴ (2016)	General surgery	Resident	665	MBI
Garcia et al ²⁵ (2021)	General surgery	Resident	36	Nonvalidated
Ha et al ⁴ (2020)	General surgery	Resident	23	Nonvalidated
Hochberg et al ²⁶ (2013)	General surgery	Resident	17	Nonvalidated
Kurbatov et al ²⁷ (2020)	General surgery	Resident	53	MBI
Leach et al ²⁸ (2019)	General surgery	Both	106	CIPS, a validated, single-item burnout score
Lebares et al ²⁹ (2021)	General surgery	Resident	64	ESRT
Lindeman et al ³⁰ (2013)	General surgery	Resident	66	MBI
Rasmussen et al ³¹ (2021)	General surgery	Resident	363	Nonvalidated
Smeds et al ³² (2020)	General surgery	Resident	157	Nonvalidated
Wetzel et al ³³ (2011)	General surgery	Attending	16	Nonvalidated
Williford et al ³⁴ (2018)	General surgery	Both	147	MBI
Zubair et al ³⁵ (2017)	General surgery	Resident	738	WRQoL
Song et al ³⁶ (2020)	General, vascular, cardiac, plastic, and urologic surgery	Resident	25	MBI
Morrell et al ³⁷ (2020)	Hand surgery	Attending	595	Mini Z Burnout Assessment Tool
Khalafallah et al ⁵ (2020)	Neurosurgery	Resident	167	MBI
Khalafallah et al ³⁸ (2020)	Neurosurgery	Attending	407	aMBI
Klimo et al ³ (2013)	Neurosurgery	Attending	85	MBI
McAbee et al ³⁹ (2015)	Neurosurgery	Attending	783	MBI

Supplemental Table 2 continued

Study	Surgical specialty	Resident or attending	Sample size	Instrument(s)
Shakir et al ⁴⁰ (2018)	Neurosurgery	Resident	255	Fisher's exact test
Govardhan et al ⁴¹ (2012)	Obstetrics/ gynecology	Resident	49	MBI-HSS
Al-Humadi et al ⁶ (2021)	Orthopedic	Both	1,379	PHQ-9
Barrack et al ⁵⁷ (2006)	Orthopedic	Both	100	MBI
Driesman et al ⁴² (2020)	Orthopedic	Resident	27	MBI
Lichstein et al ⁴³ (2020)	Orthopedic	Resident	661	aMBI, PHQ-2
Somerson et al ⁴⁴ (2020)	Orthopedic	Resident	203	Nonvalidated
Verret et al ⁴⁵ (2021)	Orthopedic	Both	148	MBI
Sarosi et al ⁴⁶ (2021)	Pediatric	Attending	338	The Compassion Fatigue and Satisfaction Self-Test
Coombs et al ² (2020)	Plastic surgery	Resident	146	MBI, Stanford Professional Fulfillment
Crowe et al ⁴⁷ (2021)	Plastic surgery	Resident	668	Nonvalidated
Qureshi et al ⁴⁸ (2015)	Plastic surgery	Attending	1,691	MBI
Streu et al ⁴⁹ (2014)	Plastic surgery	Attending	502	MBI
Streu et al ⁸ (2010)	Plastic surgery	Attending	505	Nonvalidated
Zhang et al ⁵⁰ (2019)	Plastic surgery	Attending	660	PFI
Balch et al ⁵¹ (2011)	Surgical oncologists	Both	407	MBI
Wu et al ⁵² (2017)	Trauma surgery	Attending	178	ProQOL
Cheng et al ⁵³ (2020)	Urology	Both	476	MBI
Koo et al ⁵⁴ (2021)	Urology	Resident	415	MBI
Janko et al ⁵⁵ (2019)	Vascular	Resident	177	OLBI, perceived stress scale, SS-5
Chia et al ⁵⁸ (2022)	Vascular surgery	Resident	475	Nonvalidated
Coleman et al ⁵⁶ (2021)	Vascular surgery	Attending	960	MBI

ACGME: Accreditation Council for Graduate Medical Education; aMBI: abbreviated Maslach Burnout Inventory; CIPS: Clance Impostor Phenomenon Scale; ESRT: Enhanced Stress Resilience Training; ESS: Epworth Sleepiness Scale; MBI: Maslach Burnout Inventory; MBI-HSS: Maslach Burnout Inventory-Human Services Survey; OLBI: Oldenburg Burnout Inventory; PFI: Professional Fulfillment Index; PHQ: Patient Health Questionnaire; ProQOL: Professional Quality of Life Scale; SAS-9: Statistical Analysis System; SF-8: Short Form Health Survey; SS-5: Medical Outcomes Study Social Support Scale; WRQoL: Work-Related Quality of Life Scale