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Surgeon Burnout: A Systematic Review

Francesca M Dimou, MD^{#1,2}, David Eckelbarger, BS^{#1}, and Taylor S Riall, MD, FACS, PhD³

¹Department of Surgery, The University of Texas Medical Branch, Galveston, TX

²Department of Surgery, University of South Florida, Tampa, FL²

³Department of Surgery, University of Arizona, Banner-University Medical Center, Tucson, AZ

These authors contributed equally to this work.

INTRODUCTION

Burnout is a syndrome characterized by emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment caused by work-related stress.^{1,2} Physicians are at increased risk for burnout as a result of long work hours, delayed gratification, challenges with work and home balance, and challenges associated with patient care, especially in the changing healthcare environment.^{1,3-5}

In a recent study, more than half of physicians met criteria for burnout. In addition, the prevalence of burnout increased 10% in U.S. physicians between 2011 and 2014.⁶ The prevalence of burnout was lower in a probability-based sample of the general U.S. working population, with no increase over the same time period. This increase was observed across specialties, with many specialties reporting well over 50% of physicians being burned out.⁶ This disturbing trend is likely multifactorial, with increasing demands in clinical productivity, difficulty in funding research endeavors, more patients to care for with fewer resources, changes in reimbursement, rising student debt, and difficulty balancing personal and work life.⁷⁻¹⁰

Burnout is especially prevalent in surgical specialties. In the 2015 Medscape Physician Lifestyle Report, burnout rates ranged from 37-53% across specialties, with general surgeons nearly topping the list at 50%.¹¹ Burnout has severe adverse consequences, including substance abuse, disruptive behavior, absenteeism, attrition, strained personal relationships, divorce, depression, suicidal ideation, and suicide.¹²⁻¹⁴ Over the past decade, awareness has been raised and the ability to accurately assess and identify physicians suffering from burnout has improved. The aim of this systematic review was to provide a

Corresponding Author: Francesca M Dimou, MD, Research Fellow, University of Texas Medical Branch, 301 University Blvd, Galveston, TX 77555, Phone: 386-717-6865, ; Email: frdimou@utmb.edu

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concise review and identify studies reporting on identification, prevention, or intervention for surgeons suffering from burnout.

METHODS

Articles were identified by searching the MEDLINE Ovid and PubMed databases from 2000 to present as well as from reference lists of reviewed articles. A combination of the following medical subject headings (MeSH) were used to conduct the literature search and included: surgeons, internship, residency, surgical subspecialties, physicians, professional burnout, personnel turnover, student dropouts, attrition, job satisfaction, work schedule tolerance, and psychological stress. Two of the authors reviewed abstracts independently, and studies including identification, prevention, or intervention for burnout among surgeons were selected for review. The study selection diagram is reported in Figure 1.

Inclusion and Exclusion criteria

Articles written after 2000 were excluded if they: 1) were non-English, 2) did not include surgeons or surgical residents (surgical subspecialties were included), 3) did not address identification of burnout, risk factors, consequences of burnout, prevention, or intervention for surgeons dealing with burnout, 4) were case studies, case reports, comments, reviews, or editorials, or 5) were done outside of the United States given different medical practices and training. Cross-reference of article citations in identified articles was done to ensure all appropriate articles were included. Randomized-controlled trials, non-randomized controlled trials, longitudinal cohort studies with intervention, cross-sectional studies, and observational studies were included.

Measures of Burnout

Studies identifying burnout in surgeons were most commonly done through surveys and/or longitudinal studies (Table 2), and focused on the three main components of burnout: emotional exhaustion, depersonalization, and personal accomplishment. The Maslach Burnout Inventory (MBI) was the most commonly used tool to measure burnout. Other tools used to measure wellbeing, depression, grit, and quality of life in the identified studies included the Physician Well-Being Index (PWBI), the Dupuy Psychological General Well-Being Scale (PGWB), the Linear Analog Scale Assessment of Quality of Life (LASA QOL), the Primary Care Evaluation of Mental Disorders (PRIME-MD), the Medical Outcomes Study Short Form (SF-12) and the Grit and Short Grit Scale. The assessment tools are summarized in Table 1.

RESULTS

A total of 140 articles were identified from the database search (Figure 1); 110 articles were excluded for the following reasons: 1) non-surgical subspecialty/non-English (N=94), 2) study design (N=2), 3) editorial or case report/case series (N=6), and 4) review article (N=8). Thus, 30 studies were identified from the database search and included in the review. Nine additional studies were identified via cross-referencing article citations and were included in the review. Overall, 39 articles related to assessment of burnout, assessment of

wellbeing, risk factors associated with burnout, consequences of burnout, interventions for burnout, or prevention of burnout and were included in the review (Table 2).

Prevalence of Burnout Among Surgeons

Shanafelt et al.⁵ did one of the earliest and largest studies of burnout in surgeons in 2009 (Table 2). They surveyed 24,922 members of the American College of Surgeons with 7,905 respondents (32%). Over half of the responders were age 50 or older and 13% were women. Over 90% were either married or had a partner, 21% of responders had gone through a divorce, and 88% had children. Over half of the responders were in private practice, 29% in academic practice, and approximately 4% were retired.

Based on the MBI (Table 1), 40% of surgeons met criteria for burnout, defined as a high emotional exhaustion score and/or a high depersonalization score.⁵ When broken down into the three components of burnout (emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment), 31.7% of respondents reported high in emotional exhaustion, 26% scored high in depersonalization, and 12.8% percent reported a low sense of personal accomplishment. Thirty percent screened positive for depression based on the PRIME-MD (Table 1) scale. While over 70% of respondents reported they would become a surgeon again,⁵ only 51% wanted their children to pursue a surgical career. Furthermore, 36% of these surgeons were concerned they did not have enough time for their home life.

Similar results have been found in other studies focusing on various surgical subspecialties. An earlier study in 2001 surveyed 521 general and orthopedic surgeons; both specialties had comparatively high degrees of burnout with 32% of respondents scoring high in emotional exhaustion; 13% scored high in depersonalization, and 4% scored low in personal accomplishment.⁸ Kuerer and colleagues¹⁵ reported 28% prevalence of burnout amongst surgical oncologists based on MBI criteria, with 30% screening positive for depression on the PRIME-MD scale. Kuerer's findings coincide with results from Balch and colleagues¹⁶ who surveyed 407 surgical oncologists and found 36.1% reported burnout compared to 39.8% of surgeons from other specialties. Most studies in other subspecialties reported overall burnout rates and rates of moderate burnout exceeding 30% (Table 2).^{5-8,12,17-28}

Over time, the prevalence of burnout among surgeons has increased. The recent Medscape Physician Lifestyle report documented burnout rates among various specialties ranging from 37-53%, with general surgeons nearing the top of the list at 50%.¹¹ A 2015 study by Shanafelt and colleagues⁶ evaluated the change in prevalence of burnout and satisfaction with work-life balance in physicians compared to other US workers between 2011 and 2014. Nineteen percent of the 35,922 physicians invited to participate completed surveys. When assessed using the MBI, 54% of physicians reported at least one symptom of burnout in 2014 compared with 46% in 2011 ($P < 0.001$). Satisfaction with work-life balance also declined in physicians between 2011 and 2014 (48% vs. 41%; $P < 0.001$). Specifically, the prevalence of burnout among surgeons was 53% in 2014, which was an increase from 40% in their 2009 study.^{5,6}

Interestingly, despite reported high rates of burnout across surgical specialties, over half of those surveyed in these studies would choose to become a surgeon again if given the option.^{4,5,16,25,29}

Risk factors

Several studies have identified factors associated with burnout in surgeons (Table 3). The most commonly reported factor contributing to burnout was difficulty with work-life balance.^{3,4,15,21,25} Younger physicians were more likely to experience burnout. Studies evaluating the effect of marriage and children on physician burnout have yielded mixed results (Table 3).^{5,25,26,30} Marriage decreased burnout in other studies and, not surprisingly, depended on factors such as the quality of the marriage and spouse profession. Interactions between quality of the marriage, gender, and children have not been explored and may explain the observed differences.

Work hours and nights on call played a significant role in burnout (Table 3).^{5,12,15,16,25,28,29,31} Two studies compared burnout rates before and after implementation of work-hour regulations to determine if work-hour regulations decreased burnout rates.^{31,32} A 2002 study surveyed orthopedic surgery residents and faculty before and after the implementation of the initial 80-hour workweek.³¹ Among residents, the decrease in work hours resulted in improved scores on the personal accomplishment scale of the MBI, but work-hour regulations did not affect faculty positively or negatively with regard to burnout. However, the study does not report specific numbers of residents and faculty affected by burnout, only that a trend exists towards decreased depersonalization and emotional exhaustion among residents.

Another 2006 study reported on surgical resident burnout before and after the 80-hour workweek.³² Using the MBI, it was reported that residents had lower emotional exhaustion, but no significant difference in depersonalization or career satisfaction.

Gender is a significant risk factor for burnout with women being more likely to experience burnout (Table 3). Dyrbye and colleagues¹² surveyed 1,043 female and 6,815 male surgeons. Despite equal work hours between men and women, women more likely to experience burnout and depression compared to their male counterparts. Based on the MBI scale, 43.3% of women surgeons met criteria for burnout compared to 39% of men (P-value=0.008).¹² Women were more likely to experience work-home conflicts, exhibit depressive symptoms, feel less able to rely on their spouse for childcare, and be more likely to hire a caretaker at home.¹² In addition, women were more likely to report their spouse's career took priority over their own.

A surgeon's practice setting and specialty also plays a role in burnout. A 2008 survey sent to fellows of the American College of Surgeons compared demographics of surgeons who practiced in an academic versus private practice setting.¹⁷ Nights on call, younger age, and work hours were associated with greater likelihood of burnout, which was similar to previously reported studies. Yet, in a multivariable analysis, private surgeons were significantly more likely to experience burnout compared to those in an academic setting (OR 1.17; 95% CI 1.02-1.34). With regards to specialty, trauma surgeons (OR 1.41; 95% CI

1.09-1.83) were more likely to experience burnout and pediatric surgeons were least likely (OR 1.18; 95% CI 1.02-1.38).

Multiple additional factors have been associated with burnout and further include the inability to cope with patients' suffering and death²¹, debt load²⁵, lack of administrative support²¹ (i.e. arranging coverage for holidays, conferences, work leave) and legal issues.²¹ Conversely, intrinsic human characteristics such as grit and perseverance have been identified as protective factors against burnout. Salles et al.³³ conducted a study investigating the personal qualities of residents across multiple subspecialties; the MBI was used to measure burnout and the Grit and Short Grit Scale (Table 1) was used to quantify grit and perseverance. Personal wellbeing was also measured using the Dupuy Psychological General Well-Being Scale (PGWB, Table 1). Over the study period, residents with higher scores for grit were less likely to experience burnout and more likely to have improved overall wellbeing.

Consequences of burnout

Burnout has many potential adverse consequences including medical errors, suicide, depression, and absenteeism.^{1,14,34-36} A 2010 study by Shanafelt et al.³⁶ measured the association between self-reported medical errors and burnout. Of 7,905 surgeons surveyed, 700 (8.9%) surgeons self-reported committing a medical error in the three months prior to the survey.³⁶ Surgeons who reported errors had significantly higher mean scores of the emotional exhaustion (27.5 vs. 20.3; $P < 0.0001$) and depersonalization (10.3 vs. 6.3; $P < 0.0001$) subscale of the MBI, and significantly lower personal accomplishment scores (39.1 vs. 40.8; $P < 0.0001$) compared to those who did not report medical errors. Reporting a medical error was associated with almost a doubling in the risk of screening positive for depression on the PRIME-MD scale (54.9% vs. 27.5%; $P < 0.0001$). Reporting an error was associated with a decrease in mental quality of life score on the Medical Outcomes Study Short Form (SF-12; Table 1), which was reported as significant. In addition, medical errors were more common with longer work hours (surgeons who reported a medical error worked an average of 4.6 more hours per week), more time spent in the operating room, and more nights on call per week.

Suicidal ideation and suicide are other potential severe adverse consequences of burnout. In a study of 7,825 surgeons across specialties, 509 (6.4%) surgeons admitted to having a suicidal ideation in the year prior to the survey.¹⁴ The prevalence among surgeons aged 25 to 34 years and 35 to 44 years were similar to that of the general population within the same age groups. However, suicidal ideation among surgeons aged 45 to 54 years, 55-64 and older than 65 compared to the age-matched general population were 1.5 to 3.0 times more common (7.6% vs. 5.0%; $P = 0.008$).¹⁴ Additionally, 41% of these surgeons admitted to self-prescribing medication or obtaining anti-depressant prescriptions from colleagues.

In the 509 surgeons who reported suicidal ideation, 77.8% of them scored high on the PRIME-MD scale for depression (Table 1). This was significantly higher compared to surgeons without suicidal ideation (26.7%; $P < 0.001$). In a multivariable logistic regression model, each 1-point increase in the emotional exhaustion scale of the MBI was associated with a 7% increase in the odds of suicidal ideation (OR 1.07; 95% CI 1.06-1.08). Likewise,

for each 1-point increase in the depersonalization scale the odds of suicidal ideation increased 11% (OR 1.11; 95% CI 1.09-1.12) and for each 1-point decrease in the personal accomplishment scale the odds increased by 5% (OR 1.05; 95% CI 1.04-1.06).

Interventions

Studies reporting interventions to help surgeons who are experiencing burnout are extremely limited. In 2014, Shanafelt and colleagues³⁷ reported results of a three-step intervention to identify burnout and improve physician wellbeing. First, participating general surgeons were asked to take the PWBI (Table 1). Second, surgeons who completed the PWBI were subsequently provided with immediate feedback regarding their overall wellbeing relative to physician norms. Likewise, they were surveyed on six specific dimensions (fatigue, career satisfaction, risk of distress contributing to medical errors, mental quality of life, suicidal ideation, and meaning in work) and provided their scores relative to other physicians. Participants were also given feedback on each specific dimension in relation to other physicians. Finally, physicians were asked whether they found the feedback useful and if they planned to make changes based on this feedback.

Of the 1,150 surgeons, 89% reported they were at or above average for wellbeing. Of physicians who scored in the lower third on the PBWI relative to other physicians (N=275), 70% reported their wellbeing as average or above average. Only 50% (N=546) of respondents found the tool useful and those with higher wellbeing scores were more likely to find the tool useful. Overall, 529 (47%) surgeons stated they would consider making changes based on this feedback; 30% wanted to reduce burnout, 39% wanted to improve work-life balance, 27% wanted to reduce fatigue, and 34% wanted to improve career satisfaction. Despite individualized feedback given to surgeons, fewer than half wanted to make changes based on the feedback. Ironically, physicians with the lowest wellbeing scores expressed the lowest intent to make changes. However, the study did not provide follow-up information regarding actual changes based on this feedback.

Prevention

Only one study was found in the literature search that indirectly attempted to prevent burnout by reducing resident stress. Chung and colleagues³⁸ evaluated the effect of a goal-oriented work load to improve efficiency of a surgical service to help reduce stress among residents; stress was measured in all residents and compared before and after the intervention. The study collected daily activity logs from all residents on a trauma service and reorganized the roles of each resident, morning rounds, and overall time spent doing specific tasks. After reorganization, there was a significant increase in residents being on time to conference, the operating room, and clinic. More importantly, stress had decreased and work satisfaction improved even though physical fatigue did not decrease among residents.

DISCUSSION

Burnout among surgeons is increasing at an alarming rate with current reports exceeding 50%.^{6,11} In addition, as all studies rely on self-reporting and survey data with limited

response rates, the prevalence of surgeon burnout is likely underreported. In the articles presented, burnout has documented association with multiple adverse consequences including depression, suicidal ideation, decreased quality of life, and increased likelihood of medical errors.

With current changes in healthcare, the demands on physicians both at academic healthcare institutions and in private practice are expanding rapidly and include increasing regulation, increased demands on clinical productivity, difficulty getting funding, more people to care for with fewer resources, inefficient systems, the electronic medical record, introduction of ICD-10 coding, rising student debt, and difficulty balancing professional and personal lives. These challenges are going to continue. While changes in the system are imperative, providing individual surgeons the skills to respond to the stress in their environment may be the key to preventing burnout.

This review highlights the increased recognition of the problem, with numerous and increasing studies documenting the increasing prevalence since 2000. While the large body of work presented in this review has raised awareness about burnout and the ensuing collateral damage, it also highlights the fact there is little to offer surgeons who are already burned out. The only intervention study provided to surgeons was in the form of feedback regarding their results on the PWBI relative to physician norms. Although the study did address the participant's willingness to make personal changes, resources or methodology were not offered, and the longterm benefit, specifically sustained changes, were not measured. Moreover, burnout represents the extreme end of the spectrum and efforts to teach resilience and decrease physician perceived stress before burnout occurs have not been systematically studied.

Outside of surgery, there are several programs in their infancy designed to promote wellbeing and prevent burnout by teaching physicians to respond to the stress they experience on a daily basis. Such programs are based on evidence from other fields that positive psychology, resilience, and improved emotional intelligence can increase wellbeing and individuals' ability to respond to stress.

McCue and colleagues³⁹ provided a four-hour stress-management workshop for internal, pediatric, and medicine-pediatric residents. The same workshop was given a total of three times over the course of three weeks and focused on social support structures, interpersonal skills, time and priority management, personal health, identifying harmful stress responses, and an overall healthy mindset. Burnout was measured using the MBI two weeks prior to the start of the workshop and measured again six weeks following completion. It was found that residents who participated had decreased emotional exhaustion and burnout compared to those without the intervention. However, participants did report improved perceived management of stress following the workshop.

A study from the Mayo clinic randomized 74 physicians from the Department of Medicine to an intervention including physician discussion groups focusing on reflection, mindfulness, and shared experiences.⁴⁰ When given the MBI after the intervention, burnout was reported in 54% of the intervention group and 43% in the control group. Relative to controls, study

participants reported increased work engagement and decreased depersonalization 12 months following the intervention.⁴⁰ However, measures of depression, burnout, and emotional exhaustion did not change with the intervention. The Mayo Clinic subsequently developed a physician wellbeing program,⁴¹ providing physicians with resources on burnout and preventative strategies against distress.

Stanford University recently gained national recognition with implementation of their Life in Balance program offered to residents. This program was implemented in response to a resident suicide.⁴² Investigation into the benefits of this program remain to be published, but is an important move towards helping surgeons deal with burnout and its dangerous consequences^{13,14,43}

Although these wellbeing programs show promise, these programs are rare, especially in surgery. In the future, such programs may prevent burnout and/or provide a resource for helping physicians dealing with burnout syndrome, but further data is necessary to evaluate their benefit. To design effective programs, further evaluation of the complex factors that influence surgeon burnout is warranted. For example, the interaction between gender, marriage, children, and burnout has not been systematically studied and may explain the inconsistencies in previous studies. In addition, such insights may provide guidance in identifying surgeons at even higher risk for burnout and developing targeted support for specific high risk groups.

CONCLUSIONS

While awareness of the problem is essential, future endeavors need to provide solutions, both in providing resources and pathways for surgeons who are already burned out and, more importantly, teaching skills to help surgeons respond effectively to their environment and prevent burnout. Surgeons undergo an immense amount of stress throughout their training and careers. Interventions for those with burnout are severely lacking and warrant developing specific protocols to reduce burnout among surgeons across the country. Systematic evaluation of the structure, effectiveness, and resources required for existing programs needs to be done to better understand what does and does not work; feedback from those participating in these programs can provide a significant amount of information and help physicians from all specialties. Given the many consequences of burnout reported by several studies, development and implementation of effective programs may help physicians before the problem dramatically affects their lives.

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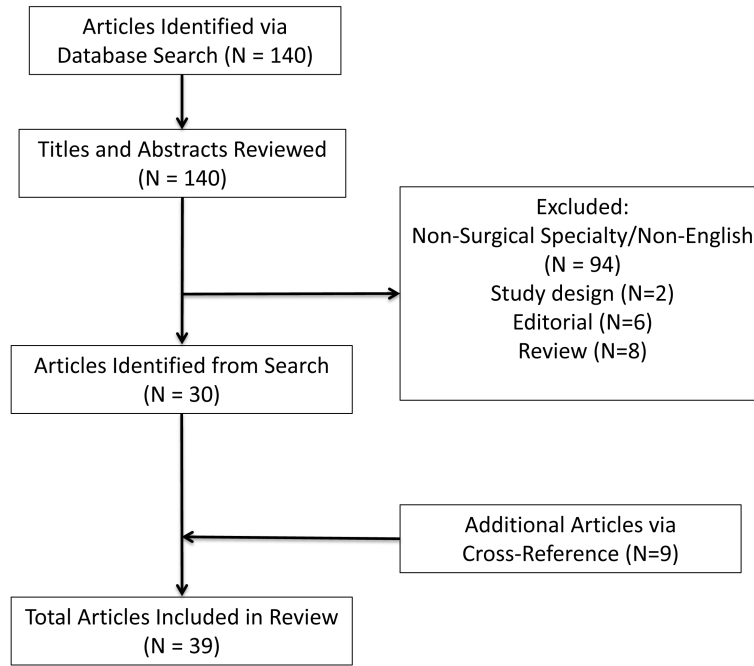


Figure 1. Selection diagram of studies included in the systematic review investigating burnout among surgeons and surgical subspecialties.

Table 1

Tools Used to Measure Burnout and/or Well-Being

Assessment tool	Components measured/addressed	Notes
MBI ^{4,8,12,14-17,20-26,28-33,36,37,44-49}	<ul style="list-style-type: none"> Emotional exhaustion Depersonalization Personal accomplishment 	A score ≥ 7 on the emotional exhaustion subscale and/or ≥ 10 on the depersonalization subscale qualify as professional burnout
PWBI ³⁷	<ul style="list-style-type: none"> Burnout Depression Fatigue Physical QOL Mental QOL 	Also known as the Mayo Clinic Physician Well-being Index. Initially validated in United States medical students and subsequently adapted to physicians.
Dupuy PGWB ³³	<ul style="list-style-type: none"> Anxiety Depression Positive well-being Self-control General health Vitality 	22-item questionnaire providing a single measure of well-being
LASA QOL ^{4,21}	QOL over the past week including: <ul style="list-style-type: none"> Physical Emotional Spiritual Intellectual 	5-item assessment tool primarily used for measuring quality of life
Grit and short grit scale ³³	<ul style="list-style-type: none"> Perseverance Long-term goals 	Used to quantify grit; has been shown that grit is an independent predictor of achievement even after controlling for IQ and grade point average
Medical outcomes study short form (SF-12) ³⁶	<ul style="list-style-type: none"> Physical QOL Mental QOL 	Condensed from the original 36-item long form used to measure QOL
PRIME-MD ^{14,50}	Evaluates the 4 groups of mental disorders listed below, in addition to eating disorders: <ul style="list-style-type: none"> Mood Anxiety Somatoform Alcohol 	Items developed based on the <i>Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition</i>

LASA QOL, linear analog scale assessment of quality of life; MBI, Maslach burnout inventory; PGWB, psychological general well-being scale; PWBI, physician well-being index; PRIME-MD, primary care evaluation of mental disorders scale; QOL, quality of life

Table 2

Characteristics of Studies Included in Systematic Review Specifically Reporting Burnout Rates and Psychiatric Distress Among Surgeons and Surgical Subspecialties

Author (y)	Study design	Specialty	Sample, n	Burnout/psychiatric distress
Antiel ⁴⁴ (2013)	Longitudinal	General surgery	156	Emotional exhaustion: 28% of residents experienced weekly Depersonalization: 28% of residents experienced weekly
Balch ¹⁷ (2011)	Cross-sectional	Multiple	345	Specialty with greatest burnout: Trauma-52% Specialty with lowest burnout: Pediatric-31%
Balch ¹⁶ (2011)	Cross-sectional	Surgical oncology	407	36%
Barrack ³¹ (2006)	Cross-sectional	Orthopedics	100	Psychiatric comorbidity: 33% of residents
Bertges ⁷ (2005)	Cross-sectional	Transplant	209	38%
Campbell ⁸ (2001)	Cross-sectional	General surgery orthopedics	521	32%
Chung ³⁸ (2007)	Prospective control	General surgery	14	N/A
Contag ¹⁸ (2010)	Cross-sectional	Microvascular	60	High burnout: 2% Moderate burnout: 73% Low burnout: 2%
Cruz ⁴⁵ (2007)	Cross-sectional	Ophthalmology	101	9%
Dyrbye ¹² (2011)	Cross-sectional	Multiple	7858	Women: 43.3% Men: 39.0%
Dyrbye ⁵¹ (2012)	Cross-sectional	Multiple	7197	36% of surgeons with work-home conflict had burnout
Gelfand ¹⁹ (2004)	Cross-sectional	General surgery	64	Residents/faculty: High emotional exhaustion score: 58% /12% High depersonalization score: 56%/25% High personal accomplishment score: 62%/28%
Golub ⁴⁷ (2007)	Cross-sectional	Otolaryngology	684	High burnout: 10% Moderate burnout: 76% Low burnout: 14%
Golub ²⁰ (2008)	Cross-sectional	Otolaryngology	351	High burnout: 4% Moderate burnout: 66% Low burnout: 30%
Guest ⁴ (2011)	Cross-sectional	Surgical oncology	72	42%/72%
Guest ²¹ (2011)	Cross-sectional	Surgical oncology	72	N/A
Hutter ³² (2006)	Cross-sectional	General surgery	116	Before/after work hour restrictions: Emotional exhaustion score: 29.1 [*] /23.1 [†] Depersonalization score: 14.8 [*] /11.8 [*] Personal accomplishment score: 37.8 [†] /38.6 [†]
Jesse ²² (2015)	Cross-sectional	Transplant	289	Emotional exhaustion: 40% Depersonalization: 17% Personal accomplishment: 24%
Johns ²³ (2005)	Cross-sectional	Otolaryngology	107	High burnout: 2% Moderate burnout: 81% Low burnout: 16%
Klimo ²⁹ (2013)	Survey	Neurosurgery	85	Emotional exhaustion score: 13 [‡] // Depersonalization score: 4 [‡] // Personal accomplishment score: 39 [‡] //

Author (y)	Study design	Specialty	Sample, n	Burnout/psychiatric distress
Kuerer ¹⁵ (2007)	Cross-sectional	Surgical oncology	549	28%
Oreskovich ¹³ (2012)	Cross-sectional	Multiple	7197	35% of surgeons with alcohol abuse had burnout 30% of surgeons with alcohol misuse had burnout
Quershi ⁴⁸ (2015)	Survey	Plastic surgery	1691	Burnout: 29.7%
Saleh ²⁴ (2007)	Survey	Orthopedics		Emotional exhaustion score: 24 [†] Depersonalization score: 9.2 [‡] Personal accomplishment score: 28 ^{*¶}
Saleh ⁵² (2009)	Survey	Orthopedics	195	High emotional exhaustion: 38%
Salles ³³ (2014)	Longitudinal	Multiple	141	N/A
Sargent ²⁶ (2004)	Survey	Orthopedics	45	Faculty/residents [¶] : Emotional exhaustion score: 16.6/27.7 [§] Depersonalization score: 6.6 [‡] /15.1 [§] Personal accomplishment: 42.8 ^{*¶} /36.3 [§]
Sargent ²⁶ (2009)	Survey	Orthopedics	648	High burnout Residents: 56% Faculty: 28%
Sargent ²⁷ (2011)	Survey	Orthopedics	907	Faculty: 28% Residents: 56% Resident spouses: 30% Faculty spouses: 13%
Shanafelt ⁵ (2009)	Cross-sectional	Multiple	7905	Burnout: 40%
Shanafelt ³⁶ (2010)	Cross-sectional	Multiple	7905	High rates of depersonalization and emotional exhaustion associated with medical errors
Shanafelt ¹⁴ (2011)	Cross-sectional	Multiple	7905	Significant increase in suicidal ideation in surgeons with burnout (OR 1.9; p<0.001)
Shanafelt ²⁸ (2012)	Cross-sectional	Multiple	1330 [#]	General and surgical subspecialties burnout rates ranging between 40% and 45%
Shanafelt ³⁰ (2012)	Cross-sectional	Multiple	7,197	Emotional exhaustion: 22.9% Depersonalization: 14.9%
Shanafelt ³⁷ (2014)	Longitudinal	Multiple	1150	Well-being in bottom 30% relative to national norm: 24%
Shanafelt ⁶ (2015)	Cross-sectional	Multiple	1006 [#]	General and surgical subspecialties burnout rates ranging between 50% and 64%
Streu ⁴⁹ (2014)	Survey	Plastic surgery	506	Emotional exhaustion score: 29% [*] Depersonalization score: 16% [*] Personal accomplishment: 5% [‡]
Zare ⁵³ (2004)	Longitudinal	General surgery	108	Psychologic stress: 30% above 90 th percentile 72% above 50 th percentile
Zare ⁵⁴ (2005)	Longitudinal	General surgery	130	Psychologic stress: 24% above 90 th percentile

* high score on MBI

† medium score on MBI

‡ low score on MBI

§ above comparative norm

// mean score

¶ median score

number of general surgeons and surgical subspecialties surveyed in the study

MBI, Maslach burnout inventory

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Table 3
Studies Identifying Commonly Reported Risk Factors Associated with Burnout Among Surgeons

Study (y)	Outcome of interest	Work/life balance	Age/years in practice	Marriage/kids	Hours worked/nights on call	Gender	Financial
Balch ¹⁶ (2011)	Burnout		Increased risk with younger age		Increased risk with number of hours worked Increased risk with number of nights on call		Decreased risk with incentive based pay
Barrack ³¹ (2006)	Burnout	Increased risk with conflict between work/home life balance	Increased risk with younger age		Increased risk with number of hours worked	Increased risk in women	Increased risk if having financial concerns
Bertges ⁷ (2005)	Burnout		Increased risk with younger age			Increased risk in women	
Campbell ⁸ (2001)	Burnout	Increased risk if there is imbalance between career/personal life	Increased risk with younger age		Increased risk with less weeks of vacation		
Dyrbye ¹² (2011)	Burnout	Increased risk with conflict between work/home life balance			Increased risk with number of hours worked	Increased risk in women	
Guest ²¹ (2011)	Burnout	Increased risk if time is taken from personal responsibilities					
Klimo ²⁹ (2013)	Professional stressors				Increased risk with number of nights on call		Increased risk with low collections/billing
Kueter ¹⁵ (2007)	Burnout	Increased risk with low physical QOL Increased risk with low job satisfaction	Increased risk with younger age		Increased risk with number of hours worked	Increased risk in women	
Sargent ²⁵ (2004)	Burnout	Increased risk with conflict between work/home life balance		Decreased risk with being a parent Decreased risk with quality of marriage	Increased risk with number of hours worked	Increased risk in women	
Sargent ²⁶ (2009)	Burnout	Increased risk with poor work/life balance	Increased risk if a PGY2	Decreased risk with marriage			
Shanafelt ⁵ (2009)	Burnout		Increased risk with younger age Increased risk with more years in practice	Increased risk if has children Increased risk if spouse is healthcare professional	Increased risk with number of hours worked		Increased risk with compensation based billing

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Study (y)	Outcome of interest	Work/life balance	Age/years in practice	Marriage/kids	Hours worked/nights on call	Gender	Financial
Shanafelt ³⁰ (2012)	Burnout/QOL			Increased QOL if married	Increased risk with number of hours worked Increased risk with number of nights on call		

PGY, postgraduate year; QOL, quality of life