
Surgeon Distress as Calibrated by Hours Worked and Nights on Call

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- BACKGROUND:** The relationships of working hours and nights on call per week with various parameters of distress among practicing surgeons have not been previously examined in detail.
- STUDY DESIGN:** More than 7,900 members of the American College of Surgeons responded to an anonymous, cross-sectional survey. The survey included self-assessment of their practice setting, a validated depression screening tool, and standardized assessments of burnout and quality of life.
- RESULTS:** There was a clear gradient between hours and burnout, with the prevalence of burnout ranging from 30% for surgeons working <60 hours/week, 44% for 60 to 80 hours/week, and 50% for those working >80 hours/week ($p < 0.001$). When correlated with number of nights on call, burnout exhibited a threshold effect at ≥ 2 nights on call/week (≤ 1 nights on call/week, 30%; ≥ 2 nights on call/week, 44% to 46%; $p < 0.0001$). Screening positive for depression rate also correlated strongly with hours and nights on call (both $p < 0.0001$). Those who worked >80 hours/week reported a higher rate of medical errors compared with those who worked <60 hours/week (10.7% versus 6.9%; $p < 0.001$), and were twice as likely to attribute the error to burnout (20.1% versus 8.9%; $p = 0.001$). Not surprisingly, work and home conflicts were higher among surgeons who worked longer hours or had ≥ 2 nights on call. A significantly higher proportion of surgeons who worked >80 hours/week or had >2 nights on call/week would not become a surgeon again ($p < 0.0001$).
- CONCLUSIONS:** Number of hours worked and nights on call per week appear to have a substantial impact on surgeons, both professionally and personally. These factors are strongly related to burnout, depression, career satisfaction, and work and home conflicts. (*J Am Coll Surg* 2010;211:609–619. © 2010 by the American College of Surgeons)
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The American College of Surgeon's Committee on Physician Health and Competency conducted a major survey about burnout among 7,905 American surgeons in 2008.¹ Overall results showed that 40% met the criteria for burnout, 30% screened positive for depression, and 28% had a statistically lower mental quality of life (QOL) score. The number of nights on call was significantly correlated with burnout in a multivariate analysis and inversely correlated with career satisfaction ($p < 0.001$). Hours worked correlated with burnout in a univariate analysis but not in the multivariate analysis.

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These results suggested that raw workload (ie, hours, nights on call) was a powerful contributor to personal and professional distress for practicing surgeons. These findings are consistent with the findings in surgical and medicine residents working >80 hours/week.²⁻⁹ In our previous report, we identified hours and nights on call as independent predictors of burnout and, conversely, nights on call had a negative correlation with career satisfaction.^{1,10} Given the association between distress parameters and quality of patient care, and the association between distress factors and career satisfaction, it was important to examine these two important benchmarks of workload more specifically. In this report, we performed a detailed analysis of the associations between hours worked and nights on call per week with various aspects of personal and professional distress parameters among American surgeons.

There is a spate of literature showing relationships between decreased physician wellness, especially depression and burnout, with decreased productivity, medical errors, early retirement, addictive behavior, and suicide ideation.^{1,2,10-13} Understanding the various components of

both personal and professional life that can have an adverse effect on physician wellness can be helpful when counseling individual surgeons, as well as for planning surgical workloads among surgical groups or departments.

METHODS

Participants

As reported previously,¹ we conducted a survey evaluating burnout and QOL among American surgeons in June 2008. The study was commissioned by the American College of Surgeons Governor's Committee on Physician Competency and Health with IRB oversight by the Mayo Clinic IRB. Of the 24,922 American College of Surgeons members surveyed, 7,905 (32%) returned surveys. A detailed description of the survey and analysis of the rates of burnout, QOL, and symptoms of depression among all surgeons responding to the 2008 American College of Surgeons survey has been published.¹

Data collection

The survey included 61 questions about a wide range of variables, including demographic information, practice characteristics, and career satisfaction. Standardized survey tools were used to identify burnout,¹⁴⁻¹⁷ mental and physical QOL,^{18,19} and symptoms of depression.^{20,21} Burnout was measured using the Maslach Burnout Inventory, a 22-item questionnaire considered a standard tool for measuring burnout.¹⁴⁻¹⁷ Surgeons with a high score for medical professionals on either the depersonalization and/or emotional exhaustion subscales were considered to have at least 1 manifestation of professional burnout.^{7,9,14,22} Symptoms of depression were identified using the 2-item Primary Care Evaluation of Mental Disorders.²⁰ Mental and physical QOL were measured using the Medical Outcomes Study Short Form^{18,19} with norm-based scoring methods used to calculate mental and physical QOL summary scores.¹⁹

Data was partitioned into cohorts comparing <60, 60 to 80, and >80 hours worked per week. Nights on call was sorted according to actual number per week (up to >3/week).

Statistical analysis

Descriptive statistics were used to characterize sample demographics. A sample of 7,905 observations as reported here produces percentage estimates accurate to 1.1% with 95% confidence. Comparisons between surgeons reporting errors and surgeons reporting no errors were tested using Wilcoxon Mann-Whitney U tests and Fisher's exact tests. Such comparisons with 7,200 and 700 surgeons reporting in the 2 groups has 80% power to detect an average

difference of 11% times the standard deviation, a small effect size.^{23,24} Accordingly, the p values in this report are not as important as the observed effect size. Consistent with recent advances in the science of QOL assessment,²⁴ we a priori defined a standard deviation in QOL scores as a clinically meaningful effect size.²³⁻²⁵ Multivariate associations among demographic characteristics, professional characteristics, and distress were assessed using logistic regression. Both forward and backward elimination methods were used to select substantial variables for the models where the directionality of the modeling did not impact the results. All analyses were done using SAS version 9 (SAS Institute Inc.).

RESULTS

Personal and professional characteristics of responders partitioned by hours worked and number of nights on call per week are shown in Tables 1 and 2.

Surgeon and practice characteristics

Younger surgeons worked more hours than their older colleagues ($p < 0.0001$, Table 1). Similarly, a larger proportion of younger surgeons worked ≥ 2 nights on call compared with those older than 50 years of age (69% versus 60%; $p < 0.0001$; Table 2). Surgeons practicing trauma, cardiovascular, and transplantation surgery worked the longest hours (Table 1), and surgeons practicing transplantation, cardiovascular, and urologic surgery reported the most nights on call (Table 2). Surgeons who were salaried with bonus pay based on billing were likely to work more hours per week ($p < 0.0001$). Surgeons who received incentive pay based entirely on billing were more likely to work a greater number of nights per week on call ($p < 0.0001$). Interestingly, those surgeons who practiced in an academic setting worked longer hours, but had fewer nights on call. Consequently, 23.6% of academic surgeons worked >80 hours/week compared with 15.6% for those who worked in a community setting ($p < 0.0001$; Table 1). In contrast, 29.5% academic surgeons were on call ≥ 2 call nights/week compared with 46.8% of community surgeons ($p < 0.0001$; Table 2).

Burnout rates

A strong correlation gradient between hours worked and burnout rate was observed with the prevalence of burnout ranging from 30.1% for surgeons working <60 hours to 50% for those working >80 hours/week ($p < 0.0001$) (Fig. 1A). Emotional exhaustion rate and depersonalization rates also correlated strongly with hours worked per week ($p < 0.0001$) (Figs. 1B, 1C). Burnout also correlated with number of nights on call per week. A threshold effect

Table 1. Surgeon Characteristics Sorted by Hours Worked per Week (percentages reported in parentheses)

	<60 Hours (n = 2,876)	60–80 Hours (n = 3,587)	>80 Hours (n = 1,336)	p Value
Surgical practice, n (%)				<0.0001
Missing	18	17	3	
Cardiothoracic	104 (21.7)	230 (48)	145 (30.3)	
Colorectal	95 (31.9)	160 (53.7)	43 (14.4)	
Dermatologic	2 (100)	0 (0)	0 (0)	
General surgery	1,206 (37.8)	1,480 (46.4)	505 (15.8)	
Head and neck	180 (48.9)	165 (44.8)	23 (6.3)	
Neurologic surgery	52 (28.4)	100 (54.6)	31 (16.9)	
Obstetrics/gynecologic	49 (47.6)	33 (32)	21 (20.4)	
Ophthalmologic	130 (72.6)	44 (24.6)	5 (2.8)	
Orthopaedic	81 (53.3)	56 (36.8)	15 (9.9)	
Pediatric	48 (19.9)	125 (51.9)	68 (28.2)	
Plastic	241 (52.7)	180 (39.4)	36 (7.9)	
Surgical oncology	108 (26.9)	223 (55.5)	71 (17.7)	
Transplantation	19 (15.4)	64 (52)	40 (32.5)	
Trauma	34 (9.9)	156 (45.5)	153 (44.6)	
Urologic	142 (45.5)	141 (45.2)	29 (9.3)	
Vascular	133 (29.1)	241 (52.7)	83 (18.2)	
Other	234 (49.7)	172 (36.5)	65 (13.8)	
Primary practice setting, n (%)				<0.0001
Missing	1	2	1	
Private practice	1,657 (39.3)	1,904 (45.1)	658 (15.6)	
Academic medical center	513 (22.7)	1,214 (53.7)	533 (23.6)	
Veterans hospital	91 (59.1)	53 (34.4)	10 (6.5)	
Active military practice	33 (29.5)	56 (50)	23 (20.5)	
Not in practice or retired	180 (72.9)	52 (21.1)	15 (6.1)	
Other	401 (49.9)	306 (38.1)	96 (12)	
Gender, n (%)				0.0660
Missing	12	18	12	
Male	2,453 (36.5)	3,126 (46.5)	1,141 (17)	
Female	411 (39.6)	443 (42.7)	183 (17.6)	
Age categories, n (%)				<0.0001
Missing	14	14	9	
Age 50 y or older	1,839 (43.3)	1,838 (43.2)	575 (13.5)	
Age younger than 50 y	1,023 (29.1)	1,735 (49.4)	752 (21.4)	
Age				<0.0001
n	2,862	3,573	1,327	
Mean (SD)	54.6 (11.60)	50.0 (9.50)	48.3 (8.89)	
Median	55.0	50.0	48.0	
Q1, Q3	45.0, 64.0	42.0, 57.0	41.0, 55.0	
Range	(27.0-90.0)	(20.0-99.0)	(30.0-85.0)	
Primary method determining compensation, n (%)				<0.0001
Missing	76	57	18	
Salaried position no incentive pay	619 (22.1)	726 (20.6)	309 (23.4)	
Salaried with bonus based on billing	666 (23.8)	1,224 (34.7)	466 (35.4)	
Incentive pay based entirely on billing	1,161 (41.5)	1,309 (37.1)	444 (33.7)	
Other	354 (12.6)	271 (7.7)	99 (7.5)	

(continued)

Table 1. Continued

	<60 Hours (n = 2,876)	60–80 Hours (n = 3,587)	>80 Hours (n = 1,336)	p Value
SF-12 mental scale, median	53.3	51.1	49.8	<0.0001
High mental QOL (SF-12 55+), n (%)				<0.0001
Missing	161	143	54	
Yes	1,136 (42.9)	1,133 (42.8)	376 (42.2)	
No	1,579 (32.9)	2,311 (48.2)	906 (18.9)	
SF-12 physical scale, median	55.3	55.9	55.5	<0.0001
Depressed, n (%)				<0.0001
Missing	25	19	9	
Yes	717 (25.1)	1,097 (30.7)	518 (39)	
No	2,134 (74.9)	2,471 (69.3)	809 (61)	
Made major medical error in last 3 mos, n (%)				<0.0001
Missing	1	0	0	
Yes	199 (6.9)	352 (9.8)	143 (10.7)	
No	2,676 (93.1)	3,235 (90.2)	1,193 (89.3)	
Greatest contributing factor in medical error,* n (%)				0.0048
Missing	2,684	3,240	1,197	
A system issue	25 (13)	51 (14.7)	25 (18)	
Your degree of fatigue	8 (4.2)	27 (7.8)	12 (8.6)	
Lapse in concentration	27 (14.1)	51 (14.7)	11 (7.9)	
Lapse in judgment	78 (40.6)	106 (30.5)	31 (22.3)	
Lack of knowledge	12 (6.3)	12 (3.5)	7 (5)	
Degree of stress or burnout	17 (8.9)	44 (12.7)	28 (20.1)	
Other	25 (13)	56 (16.1)	25 (18)	
Ever gone through a divorce, n (%)				0.1480
Missing	26	19	11	
Yes	628 (22)	719 (20.2)	289 (21.8)	
No	2,222 (78)	2,849 (79.8)	1,036 (78.2)	
Conflict between work and personal life in last 3 wks, n (%)				<0.0001
Missing	18	24	11	
Yes	1,015 (35.5)	2,044 (57.4)	871 (65.7)	
No	1,843 (64.5)	1,519 (42.6)	454 (34.3)	
How resolved last work and personal conflict, n (%)				<0.0001
Missing	157	86	32	
Resolved in favor of work	762 (28)	1,365 (39)	609 (46.7)	
Resolved in favor of personal	330 (12.1)	434 (12.4)	136 (10.4)	
Resolved to meet both responsibilities	1,627 (59.8)	1,702 (48.6)	559 (42.9)	

*This question was only asked of those who reported an error in the last 3 months.
QOL, quality of life; SF-12, Medical Outcomes Study Short Form.

was observed at ≥ 2 Nights on call/week, with a burnout rate at 29.7% for ≤ 1 nights on call/week compared with 44.6% to 45.8% for ≥ 2 nights on calls/week ($p < 0.0001$) (Fig. 1D). Emotional exhaustion rate and depersonalization rates also correlated strongly with nights on call per week ($p < 0.0001$) (Figs. 1E, 1F).

Emotional health

Median mental QOL score was lower for those who worked >80 hours/week compared with those who

worked <60 hours/week (49.8 versus 53.3; $p < 0.0001$), as well as those who took ≥ 2 nights on call/week compared with those who took ≤ 1 nights on call/week (51.0 versus 53.6; $p < 0.0001$). Symptoms of depression also strongly correlated with hours of work and nights on call. Prevalence of a positive depression screen was higher for those surgeons who worked 80 hours/week and was 39% compared with 25% for those who worked <60 hours/week ($p < 0.0001$). Similarly, prevalence of a positive depression screen was 34.5% for those who had ≥ 2 night calls/week

Table 2. Surgeon Characteristics Sorted by Nights on Call per Week (percentages reported in parentheses)

	≤1 Night (n = 2,764)	2 Nights (n = 1,921)	3 Nights (n = 1,086)	>3 Nights (n = 1,977)	p Value
Surgical practice, n (%)					<0.0001
Missing	19	3	5	12	
Cardiothoracic	84 (17.6)	84 (17.6)	99 (20.7)	211 (44.1)	
Colorectal	111 (37.6)	64 (21.7)	33 (11.2)	87 (29.5)	
Dermatologic	2 (100)	0 (0)	0 (0)	0 (0)	
General	1,039 (32.8)	907 (28.6)	502 (15.8)	724 (22.8)	
Head and neck	170 (46.6)	82 (22.5)	34 (9.3)	79 (21.6)	
Neurologic	63 (34.6)	50 (27.5)	32 (17.6)	37 (20.3)	
Obstetrics/gynecologic	35 (34)	14 (13.6)	7 (6.8)	47 (45.6)	
Ophthalmologic	86 (48.6)	35 (19.8)	18 (10.2)	38 (21.5)	
Orthopaedic	89 (60.1)	27 (18.2)	8 (5.4)	24 (16.2)	
Pediatric	58 (24.2)	82 (34.2)	49 (20.4)	51 (21.3)	
Plastic	187 (41.2)	80 (17.6)	44 (9.7)	143 (31.5)	
Surgical oncology	235 (58.5)	60 (14.9)	20 (5)	87 (21.6)	
Transplant	8 (6.6)	24 (19.7)	24 (19.7)	66 (54.1)	
Trauma	124 (36.4)	132 (38.7)	33 (9.7)	52 (15.2)	
Urologic	114 (36.9)	69 (22.3)	47 (15.2)	79 (25.6)	
Vascular	118 (26)	141 (31.1)	93 (20.5)	101 (22.3)	
Other	222 (47.6)	67 (14.4)	38 (8.2)	139 (29.8)	
Primary practice setting, n (%)					<0.0001
Missing	0	1	1	0	
Private practice	1,135 (27.1)	1,097 (26.2)	665 (15.9)	1,297 (30.9)	
Academic medical center	1,022 (45.5)	557 (24.8)	233 (10.4)	432 (19.3)	
Veterans hospital	48 (31.4)	60 (39.2)	24 (15.7)	21 (13.7)	
Active military practice	38 (33.9)	29 (25.9)	25 (22.3)	20 (17.9)	
Not in practice or retired	179 (74.6)	17 (7.1)	17 (7.1)	27 (11.3)	
Other	342 (42.6)	160 (19.9)	121 (15.1)	180 (22.4)	
Gender, n (%)					0.0257
Missing	12	7	5	16	
Male	2,344 (35.1)	1,682 (25.2)	951 (14.3)	1,695 (25.4)	
Female	408 (39.4)	232 (22.4)	130 (12.5)	266 (25.7)	
Age categories, n (%)					<0.0001
Missing	10	7	8	11	
50 y or older	1,682 (39.8)	927 (21.9)	559 (13.2)	1,057 (25)	
Younger than 50 y	1,072 (30.7)	987 (28.3)	519 (14.9)	909 (26.1)	
Age, y. median	53.0	49.0	50.0	51.0	<0.0001
Primary method determining compensation, n (%)					<0.0001
Missing	72	20	15	37	
Salaried position no incentive pay	712 (26.4)	397 (20.9)	203 (19)	337 (17.4)	
Salaried with bonus based on billing	782 (29)	631 (33.2)	358 (33.4)	567 (29.2)	
Incentive pay based entirely on billing	834 (31)	746 (39.2)	429 (40.1)	887 (45.7)	
Other	364 (13.5)	127 (6.7)	81 (7.6)	149 (7.7)	
SF-12 mental scale, median	53.6	50.4	51.0	51.0	<0.0001
High mental QOL (55+), n (%)					<0.0001
Missing	133	82	49	90	
Yes	1,147 (43.6)	528 (20.1)	319 (12.1)	636 (24.2)	
No	1,484 (31.2)	1,311 (27.5)	718 (15.1)	1,251 (26.3)	

(continued)

Table 2. Continued

	≤1 Night (n = 2,764)	2 Nights (n = 1,921)	3 Nights (n = 1,086)	>3 Nights (n = 1,977)	p Value
SF-12 physical scale (norm mean 50, SD 10)	55.5	55.9	55.5	55.5	<0.0001
High physical QOL (55+), n (%)					<0.0001
Missing	133	82	49	90	
Yes	1,394 (53)	1,106 (60.1)	565 (54.5)	1,019 (54)	
No	1,237 (47)	733 (39.9)	472 (45.5)	868 (46)	
Depressed, n (%)					<0.0001
Missing	17	11	9	14	
Yes	611 (22.2)	649 (34)	371 (34.4)	689 (35.1)	
No	2,136 (77.8)	1,261 (66)	706 (65.6)	1,274 (64.9)	
Made major medical error in last 3 mos, n (%)					0.0023
Yes	202 (7.3)	194 (10.1)	108 (9.9)	189 (9.6)	
No	2,562 (92.7)	1,727 (89.9)	978 (90.1)	1,788 (90.4)	
Ever gone through a divorce, n (%)					0.0039
Missing	26	18	7	6	
Yes	553 (20.2)	371 (19.5)	265 (24.6)	437 (22.2)	
No	2,185 (79.8)	1,532 (80.5)	814 (75.4)	1,534 (77.8)	
Conflict between work and personal in last 3 wks, n (%)					<0.0001
Missing	14	16	5	18	
Yes	1,159 (42.1)	1,120 (58.8)	618 (57.2)	1,012 (51.7)	
No	1,591 (57.9)	785 (41.2)	463 (42.8)	947 (48.3)	
How resolved last work and personal conflict, n (%)					<0.0001
Missing	126	47	33	65	
Resolved in favor of work	776 (29.4)	766 (40.9)	424 (40.3)	755 (39.5)	
Resolved in favor of personal	358 (13.6)	201 (10.7)	147 (14)	190 (9.9)	
Resolved to meet both responsibilities	1,504 (57)	907 (48.4)	482 (45.8)	967 (50.6)	

QOL, quality of life; SF-12, Medical Outcomes Study Short Form.

compared with 22.2% for those who worked <60 hours/week ($p < 0.0001$; Table 2). Prevalence of suicide ideation did not vary based on work hours ($p = 0.9527$), but did relate to increasing nights on call ($p = 0.0011$).

Medical errors

Surgeons who worked ≥ 80 hours/week were significantly more likely to report that they had made a major medical error in the last 3 months compared with those who worked <60 hours/week (10.7% versus 6.9%; $p < 0.0001$). Similarly, the rate of major medical errors was 7.3% for those surgeons who worked ≤ 1 nights on call/week compared with 9.9% for those who worked ≥ 2 nights on call/week ($p = 0.0023$).

We previously reported that self-report of recent medical errors was strongly correlated with objectively measured burnout.¹⁰ In a subanalysis, those surgeons who reported a major medical error in the last 3 months were asked to subjectively attribute what they believed was the single greatest contributing factor to their most recent major medical error. Large differences in the perceived cause of the error were observed by hours worked. Surgeons work-

ing <60 hours were almost twice as likely as those working >80 hours to report a lapse in judgment as the cause of the error (40.6% versus 22.3%), and those working >80 hours were more than twice as likely to identify burnout as the largest contributing factor (20.1% versus 8.9%) (Table 1).

Work and home conflict

Having experienced a work and home conflict in the last 3 weeks was also more common among surgeons who worked longer hours and/or had more nights on call. Work and home conflicts were reported by 65.7% of surgeons who worked >80 hours/week compared with 35.5% of surgeons working <60 hours/week ($p < 0.0001$; Table 1). Similarly, surgeons who took more call nights reported a higher prevalence of work and home conflict in the last 3 weeks (55.2% for ≥ 2 nights on call/week versus 42% for ≤ 1 nights on call/week; $p < 0.0001$; Table 2). When surgeons were asked how they had resolved their most recent work and home conflict (eg, in favor of work responsibility, in favor of personal responsibility, or in a manner that met both work and personal responsibility), those working >80 hours/week were more likely to report resolving the conflict in

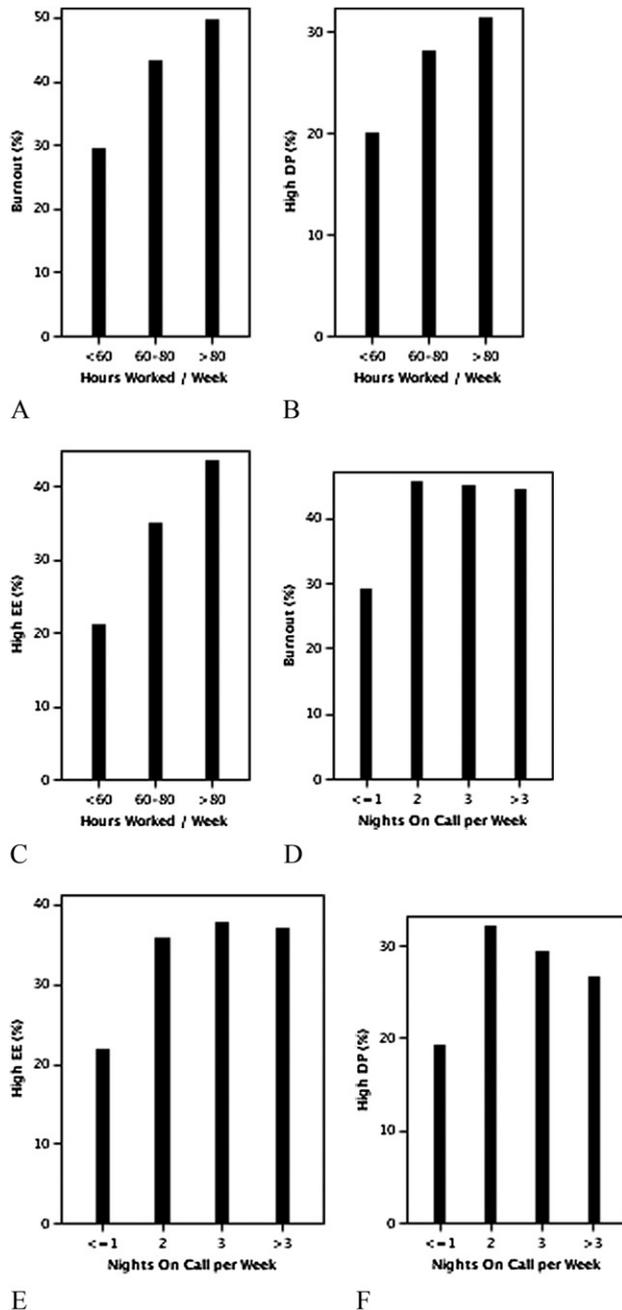


Figure 1. Association of burnout indices with hours worked per week. (A) High depersonalization (DP), (B) emotional exhaustion (EE), and (C) overall burnout rate, and (D, E, F) with nights on call per week. Correlations are all <0.0001 .

favor of work than those who worked <60 hours/week (46.7% versus 28%; $p < 0.0001$, Table 1). A similar trend was observed when comparing surgeons who worked <2 nights on call/week with those who worked ≥ 2 nights on call/week (29% versus 39%; $p < 0.0001$; Table 2).

Career satisfaction

Career satisfaction also varied by workload. When asked whether they would become a surgeon again (specialty choice), surgeons who worked >80 hours/week more often reported that they would “definitely not” or “probably not” choose to become a surgeon again at a higher rate than those who worked <60 hours/week (20.6% versus 13.6%; $p < 0.0001$; Table 3). Similarly, a higher percentage of surgeons working ≥ 2 nights on call/week compared with those who had ≤ 1 nights on call/week replied definitely or probably not (17.7% versus 12.3%; $p < 0.0001$; Table 4). Similar trends were noted when surgeons were asked if they would become a physician again (career choice; $p < 0.0001$; Tables 3 and 4) or if they would recommend their children become a physician or surgeon ($p = 0.0001$; Tables 3 and 4).

Finally, when asked, “Should the American College of Surgeons establish guidelines on hours of work or number of nights on call?” only 32% of surgeons replied favorably. Surgeons who were salaried were more likely to respond favorably to guidelines compared with those whose pay was based on billing (38.2% versus 30.9%; $p < 0.0001$), as well as those in an academic practice relative to those in a private practice (37% versus 30%; $p < 0.0001$). In contrast, there was no relationship between hours and whether or not surgeons supported guidelines (34.6% of those who worked <60 hours supported guidelines compared with 32.9% for those who worked >80 hours/week; $p = 0.1025$). A small negative correlation between number of nights on call per week and support of guidelines was observed (34.1% for those with ≤ 1 nights on call/week supported guidelines compared with 30.5% for those with >3 nights on call/week; $p = 0.0324$). Surgeons with higher distress scores were also more likely to favor the American College of Surgeons establishing guidelines on hours worked per nights on call. A higher percentage of burned-out surgeons (38% versus 29.8%; $p < 0.0001$) and those who screened positive for depression (39% versus 30.6%; $p < 0.0001$) supported guidelines on hours worked per nights on call.

DISCUSSION

This is the first in-depth analysis of the relationship between workload (hours worked and nights on call per week) and surgeon distress. There are 3 major conclusions from this American College of Surgeons survey.

1. There was a highly significant correlation with increasing hours and increasing nights on call associated with a detrimental impact on surgeons in almost every setting, both professionally and personally. These trends were statistically significant in virtually every parameter surveyed: increased burnout rate, decreased quality of life,

Table 3. Professional Satisfaction by Hours Worked per Week

	<60 Hours (n = 2,876)		60–80 Hours (n = 3,587)		>80 Hours (n = 1,336)		p Value
	n	%	n	%	n	%	
Would choose to become a surgeon again							<0.0001
Missing	11		16		5		
Definitely not	99	3.5	145	4.1	104	7.8	
Probably not	290	10.1	409	11.5	170	12.8	
Not sure or neutral	278	9.7	404	11.3	122	9.2	
Probably	641	22.4	914	25.6	310	23.3	
Definitely yes	1,557	54.3	1,699	47.6	625	47	
Would choose to become a physician again							<0.0001
Missing	16		19		6		
Definitely not	102	3.6	142	4	83	6.2	
Probably not	283	9.9	456	12.8	184	13.8	
Not sure or neutral	369	12.9	488	13.7	187	14.1	
Probably	675	23.6	907	25.4	304	22.9	
Definitely yes	1,431	50	1,575	44.1	572	43	
Would recommend to their child to become physician and surgeon							0.0001
Missing	351		454		235		
No	1,303	51.6	1,615	51.5	491	44.6	
Yes	1,222	48.4	1,518	48.5	610	55.4	

decreased career satisfaction, and increased work and home conflict.

- The incidence of various distress parameters showed no threshold based on the number of hours worked (ie, there was a clear gradient effect), while there was a clear threshold of increasing incidences of distress parameters based on surgeons who worked ≥ 2 nights on call/week.
- Although the adverse consequences based on night call were more global, the greatest incidence of distress was observed in the 17% of surgeons who worked >80 hours/week.

It is interesting to note that two thirds of responding surgeons did not want external regulation or boundary limits on hours, including those who reported that they work >80 hours/week or have >3 nights on call/week. Although resident work hours have been restricted since 1993, studies examining the relationship between work hour restriction and resident well-being have been mixed, with 1 study involving surgical residents showing no reduction in burnout symptoms,²⁶ and 3 studies among internal medicine residents demonstrating a reduction in burnout indices and self-reported medical errors with concurrent improvements in career satisfaction.^{4,5,8} As burnout has been shown to be predictive of a subsequent perceived major medical error,^{7,8} and as burnout is associated with medical errors among surgeons,¹⁰ it is imperative to find effective ways to reduce burnout as a quality-improvement initiative. These observations, and our previous publica-

tion showing an association with burnout and medical errors among surgeons, suggest that work hours of >80 hours a week can have an adverse effect on patient care or personal wellness. However, there is no evidence that putting an artificial cap on work hours for practicing surgeons would improve career satisfaction, patient care, or reduce medical errors. More research on this crucial issue is needed.

In this study, surgeons practicing trauma, cardiovascular surgery, transplantation surgery, and urology worked the longest hours and reported the most nights on call. We have previously reported that these surgical subspecialties have a higher overall risk for burnout in a multivariate analysis.¹ It is interesting to note that the burnout rate among younger Australian and New Zealand practicing surgeons was highest among the same surgical specialties, especially cardiothoracic surgery and urology.²⁷ The Australian study also found that younger surgeons who worked >60 hours/week reported significantly higher personal burnout than those who work <60 hours/week ($p < 0.05$).²⁷

Burnout is the single greatest predictor of surgeons' satisfaction with career and specialty choice.^{1,28} Although our previously reported results showed that American surgeons are personally satisfied with a career in surgery overall, only half would recommend their children pursue a career as a physician or surgeon and only one third believed their career left enough time for personal and family life.¹ In the current study, we identified a highly significant and detri-

Table 4. Professional Satisfaction by Nights on Call per Week

	≤1 Call (n = 2,764)		2 Calls (n = 1,921)		3 Calls (n = 1,086)		>3 Calls (n = 1,977)		p Value
	n	%	n	%	n	%	n	%	
Would choose to become a surgeon again									<0.0001
Missing	13		7		5		7		
Definitely not	80	2.9	88	4.6	50	4.6	129	6.5	
Probably not	255	9.3	223	11.7	161	14.9	230	11.7	
Not sure or neutral	215	7.8	225	11.8	120	11.1	237	12	
Probably	641	23.3	518	27.1	273	25.3	410	20.8	
Definitely yes	1,560	56.7	860	44.9	477	44.1	964	48.9	
Would choose to become a physician again									<0.0001
Missing	15		6		6		13		
Definitely not	85	3.1	76	4	55	5.1	111	5.7	
Probably not	270	9.8	234	12.2	147	13.6	268	13.6	
Not sure or neutral	281	10.2	299	15.6	160	14.8	297	15.1	
Probably	623	22.7	489	25.5	276	25.6	481	24.5	
Definitely yes	1,490	54.2	817	42.7	442	40.9	807	41.1	
Recommend your children become physician or surgeon									<0.0001
Missing	361		268		134		271		
Yes	1,393	58	799	48.3	433	45.5	760	44.5	
No	1,010	42	854	51.7	519	54.5	946	55.5	

mental correlation of increased work hours and nights on call with lower career satisfaction. One interpretation of these findings is that although American surgeons generally enjoy the practice of surgery, when their workloads are excessive, there is inadequate time for personal and family pursuits, which can lead to burnout and poor mental QOL. Work-home conflicts appear to be one of the critical contributors to surgeon burnout.²⁸ Strategies to reduce such conflicts or that provide avenues to resolve conflicts in a manner that meets both work and home responsibilities can reduce surgeon burnout and increase career satisfaction. Such strategies can be particularly beneficial for women surgeons, as they appear to encounter work-home conflicts more frequently. Notably, despite the extensive differences in the personal and professional lives of women and men surgeons, the same 3 factors (ie, hours worked per week, work-home conflict last 3 weeks, resolving last work-home conflict in favor of work) accounted for about two thirds of the variation in the experience of burnout for both men and women.²⁸

There was a highly significant correlation of increasing hours and nights on call with work-home conflict incidence and an increased resolution of the conflict in favor of work. Results from the literature also confirm that increased work hours and overtime work are associated with a lower level of work-home balance, especially among women physicians.²⁹ Maintaining career satisfaction is important, not only for maximizing productivity, but for enhancing personal quality of life and avoiding early retire-

ment. A shortage of physicians and surgeons has been projected, and an emigration of surgeons at an early age because of burnout would clearly exacerbate the workforce issues facing us in the coming years.³⁰ Addressing a more optimal work hour schedule and the increasing uncertainties of reimbursement issues might very well affect the rate of early retirement and the choice of young medical school graduates to pursue a career in surgery.^{30,31}

Our study is subject to a number of limitations. First, although similar to national survey studies of the members of physician societies,^{32,33} our response rate of 32% is lower than physician surveys in general.^{34,35} and could introduce a response bias. It is unknown whether distressed physicians are less likely to complete surveys because of apathy or are more likely to complete surveys related to job stress because of greater interest in the topic. Second, the study is cross-sectional and we are unable to determine if the associations between work hours and nights on call with measures of distress (eg, burnout) are causally related or the potential direction of the effects. Third, there are important aspects related to both burnout and career satisfaction that were not measured by our study. No doubt some challenges vary by subspecialty, geography, practice type, and local practice environments—aspects that are difficult to address in a national study. Fourth, lack of congruence between actual working conditions and original expectations of the surgical field or career interest might also be contributing to burnout.^{36,37} On the other hand, our study also has several notable strengths. It is the largest study of

physician burnout conducted to date. The survey included standardized instruments that are validated measures of burnout and QOL and facilitate comparison with earlier studies of physicians and surgeons.

In conclusion, burnout and other measures of surgeon distress correlate directly with increasing work hours and nights on call among American surgeons. A wide range of adverse personal and professional characteristics were related to ≥ 2 nights on call/week and increasing work hours (especially > 80 hours/week). Given that extensive data indicate a relationship between physician burnout and the quality of care they provide patients,¹⁰ these data have important implications for practice, departmental, institutional, and national efforts to promote quality of care, and to mitigate the adverse consequences of burnout.³⁸⁻⁴¹ When physicians are in distress, their performance in delivering care can be suboptimal. However, most indicators of quality patient care do not take into account physician wellness. Physician wellness goes beyond merely the absence of distress and includes being challenged, thriving, and achieving success in various aspects of personal and professional life.^{39,42-45}

Author Contributions

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