

ANESTHESIOLOGY

Repeated Cross-sectional Surveys of Burnout, Distress, and Depression among Anesthesiology Residents and First-year Graduates

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EDITOR'S PERSPECTIVE

What We Already Know about This Topic

- Burnout has been identified in approximately 50% of residents and practicing physicians

What This Article Tells Us That Is New

- Based on survey data from 2013 to 2016, the prevalence of burnout, distress, and depression in anesthesiology residents and first-year graduates was 51%, 32%, and 12%, respectively
- More hours worked and student debt were associated with a higher risk of distress and depression, but not burnout
- Perceived institutional and social support and work–life balance were associated with a lower risk of burnout, distress, and depression

Physician burnout is a work-related syndrome that includes emotional exhaustion, depersonalization, and a sense of reduced personal accomplishment.^{1,2} It may be associated with physician distress and depression. National studies of practicing physicians and physicians-in-training have documented symptoms of burnout in approximately 50% of those studied, leading to a call for further study and intervention from the National Academy of Medicine.³

ABSTRACT

Background: This repeated cross-sectional survey study was conducted to determine the prevalence of, and factors associated with, burnout, distress, and depression among anesthesiology residents and first-year graduates. We hypothesized that heavy workload and student debt burden were associated with a higher risk of physician burnout, distress, and depression, and that perception of having adequate workplace resources, work–life balance, and social support were associated with a lower risk.

Methods: Physicians beginning U.S. anesthesiology residency between 2013 and 2016 were invited to take online surveys annually from their clinical anesthesia year 1 to 1 yr after residency graduation. The Maslach Burnout Inventory, the Physician Well-Being Index, and the Harvard Department of Psychiatry/National Depression Screening Day Scale were used to measure burnout, distress, and depression, respectively. Logistic regression analyses were conducted to examine whether self-reported demographics, personal, and professional factors were associated with the risk of burnout, distress, and depression.

Results: The response rate was 36% (5,295 of 14,529). The prevalence of burnout, distress, and depression was 51% (2,531 of 4,966), 32% (1,575 of 4,941), and 12% (565 of 4,840), respectively. Factors associated with a lower risk of all three outcomes included respondents' perceived workplace resource availability, (odds ratio = 0.51 [95% CI, 0.45 to 0.57] for burnout; 0.51 [95% CI, 0.45 to 0.56] for distress; 0.52 [95% CI, 0.45 to 0.60] for depression) and perceived ability to maintain work–life balance (0.61 [95% CI, 0.56 to 0.67] for burnout; 0.50 [95% CI, 0.46 to 0.55] for distress; 0.58 [95% CI, 0.51 to 0.65] for depression). A greater number of hours worked per week and a higher amount of student debt were associated with a higher risk of distress and depression, but not burnout.

Conclusions: Burnout, distress, and depression are notable among anesthesiology residents. Perceived institutional support, work–life balance, strength of social support, workload, and student debt impact physician well-being.

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Physician trainees in anesthesiology must acquire a large body of knowledge and proficiency in a multitude of cognitive and technical skills, while at the same time developing clinical acumen, integrating themselves into efficient perioperative teams, and establishing their professional reputation. The resulting intellectual, physical, and psychologic challenges presented as they make the transition from novice to independent practitioner may lead to acute occupational stress and adverse mental health consequences.^{4,5}

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As the certifying body for anesthesiologists, the American Board of Anesthesiology (Raleigh, North Carolina) interacts with anesthesiology residents and practicing anesthesiologists at multiple points throughout their careers. This ongoing relationship presents serial opportunities to study areas of interest. The American Board of Anesthesiology Survey Project was established in 2013 and gathers data relating to physician demographics, well-being, career plans, and perception of the specialty through annual voluntary surveys among anesthesiologists-in-training and first-year graduates of Accreditation Council for Graduate Medical Education (Chicago, Illinois)-accredited residency programs.

The goal of this repeated cross-sectional survey study was to measure the prevalence of burnout, distress, and depression in anesthesiology residents and first-year graduates from 2013 to 2016, and identify their associated factors. We hypothesized that an onerous clinical workload and owing large amounts of student debt were associated with a higher risk of burnout, distress, and depression, and that being in a committed relationship, the availability of adequate workplace resources, maintaining work-life balance, and having strong social support were associated with a lower risk.

Materials and Methods

This study was deemed exempt from review by the Mayo Clinic Institutional Review Board (Rochester, Minnesota) in April 2018.

Participants

Anesthesiology residents who started their first year of Clinical Anesthesiology training (CA-1) from 2013 to 2016 and had an email address on file with the American Board of Anesthesiology were invited to participate *via* email in sequential self-administered surveys at an online survey platform, QuestionPro (QuestionPro Inc., USA). Invitations emphasized that survey participation was anonymous, confidential, and voluntary, and took about 10 to 15 min. All residents included in this study were in the American Board of Anesthesiology's staged system for primary certification, which consists of the BASIC (first offered at the end of the CA-1 year), ADVANCED, and APPLIED (offered after the completion of residency training) examinations.

Resident cohorts were defined by the starting year of their CA-1 training. The first cohort surveyed was the group of entering CA-1 residents of 2013, which was also the first cohort that entered the American Board of Anesthesiology's staged system. This cohort was surveyed annually thereafter including the first year after graduation from their residency program, their Post-Graduate Year 5 (PGY-5). There were two versions of the PGY-5 survey—one for those who entered subspecialty fellowship training and the other for those who started their first year of independent practice. The residents who started their CA-1 training in each year between 2014 and 2016 were also surveyed at their CA-1

year and followed up annually thereafter. As a result, a total of 11 surveys were completed—5 surveys for the 2013 cohort (including two versions of the PGY-5 survey), 3 surveys for the 2014 cohort, 2 surveys for the 2015 cohort, and 1 survey for the 2016 cohort. Once a survey was sent, it was open for 4 weeks, with two reminder emails sent, at 2 weeks and at 3 days before survey closure.

In this repeated cross-sectional survey study of sequential anesthesiology resident cohorts, to maintain anonymity, participants were not identifiable, and thus it was not possible to track the responses of individuals over time. Participants were not required to have previously responded to surveys at lower training levels to take the current-year survey.

Survey Questionnaire

The survey questionnaires were specific to each training level, and included 29 to 46 questions querying demographic information, career planning, residency life, professional experiences, and respondents' opinions on the future of the profession of anesthesiology. For example, questions related to medical and other professional training before residency were asked only in the CA-1 resident survey, and questions related to postresidency employment plans were asked only in the CA-3 resident survey. A core set of questions that included measures of burnout, distress, and depression was asked each year to all training levels surveyed. Skip logics were used to guide respondents to applicable questions; questions within the same survey were not randomized. In an effort to decrease possible response bias the survey invitation letters indicated, in general terms, the broad range of topics to be addressed, including—but not highlighting—physician well-being.

Validated survey tools were used to measure burnout, distress, and depression. The degree of burnout was measured by a 12-question, shortened version of the original 22-question Maslach Burnout Inventory-Human Services Survey.¹ These 12 questions were identified by Gabbe *et al.* using factor analysis,⁶ reflecting each of the three subscales in the original burnout inventory questionnaire with 5 questions relating to emotional exhaustion, 4 questions concerning low personal accomplishment, and 3 questions on depersonalization. Based on the projection to the full scale using the proportional scoring method, each subscale was scored as low, moderate, or high. A participant with a high degree of burnout was defined as one who had moderate or high scores in two or more of the subscales.^{6,7} This shortened version reduces the response burden for participants and facilitates comparison with previously published data on anesthesiology residents.⁸

The seven-question Physician Well-Being Index was used to identify physicians in distress based on their experience over the past month. This instrument is designed to assess for the presence of indicators of distress across multiple dimensions (fatigue, burnout, stress, depression, and low mental quality of life). A threshold of four or more

affirmative answers to the seven questions was used to indicate a physician in distress.⁹

The 10-question Harvard Department of Psychiatry/National Depression Screening Day Scale was used to identify whether the physicians were likely to have a major depressive disorder over the previous 2 weeks. The scale of “none or little of the time,” “some of the time,” “most of the time,” and “all of the time” was coded as 0, 1, 2, and 3, respectively. A total score of 9 or more across the 10 questions indicates that the presence of a major depressive disorder is likely and further diagnostic evaluation is recommended.¹⁰

Additional questions sought demographic data including sex, medical school country, birth year, and information regarding the physicians’ personal and professional lives to explore potential risk factors for burnout, distress, and depression. Other questions asked the number of hours worked per week, number of nights on call per month, physicians’ perception of whether residency programs and institutions provided them with adequate resources to address burnout/depression and whether the respondents were comfortable using them, whether the physicians were in a committed relationship and if they had children, language spoken at home, the amount of student loan debt, their perceived ability to maintain work–life balance, and the perceived strength of their social support system.

Statistical Analysis

A survey was deemed to be a “response” and included in the analysis if at least 20 questions were answered. As part of the data cleaning process, we removed duplicates if gender, birth year, medical school, medical school graduation year, and amount of student loan debt were the same. Descriptive statistics of physician characteristics were provided using frequencies for nominal or ordinal variables and mean/median, SD, and range for interval variables. The prevalence of burnout, distress, and depression was reported for all respondents as well as for each cohort-year.

The Pearson chi-square test was used to test whether there were statistically significant differences in the rates of burnout, distress, and depression between males and females and between American medical school graduates and international medical school graduates.

Logistic regression analyses were conducted to examine whether factors in the anesthesiologists’ professional and personal lives, in addition to demographic variables, were associated with each of the three outcomes of burnout, distress, and depression (*i.e.*, three separate models). To make the logistic regression model as comparable as possible for these three outcomes, three demographic variables (sex, medical school country, and age) were included in the model regardless of their statistical significance, and other factors were built into the model using the forward selection method with a selection criterion of *P* value less than 0.01. To validate the selection of variables, the step-wise selection

procedure was repeated in 1,000 bootstrap samples, and the frequency with which each variable was selected into the model was evaluated.

Pearson correlational analysis was conducted to examine the correlations of the subscales of the burnout inventory, the well-being index, and the depression screening scale; biserial correlational analysis was conducted to evaluate the correlation of each factor with risk of burnout, distress, and depression for each cohort-year.

The analysis was based on all the data available; no *a priori* statistical power calculation was conducted. *P* values were based on two-tailed statistical testing, and a *P* value of less than 0.01 was considered to indicate statistical significance. All statistical analyses were performed in SPSS version 22.0 (IBM, USA).

Results

A total of 14,529 invitations were sent for the 11 surveys, and 5,295 physicians (anesthesiology residents, anesthesiologists participating in fellowship programs, or practicing anesthesiologists) responded, for an overall response rate of 36%. The response rate varied from 29% (254 of 890 PGY-5 practicing anesthesiologists of the 2013 cohort responded) to 46% (334 of 728 PGY-5 fellows of the 2013 cohort responded) among the cohort-years (Supplemental Digital Content, table 1, <http://links.lww.com/ALN/B957>). For the CA-2, CA-3, and PGY-5 surveys, approximately half to two thirds of respondents indicated that they had responded to previous surveys at an earlier training level.

Physician Characteristics

Approximately 37% (1,857 of 5,010) respondents were females and 12% (604 of 5,212) were international medical school graduates. The distribution of age and night calls per month was slightly right skewed and that of hours worked per week was slightly left skewed. The mean and median physician age was 32 and 31 yr, respectively; the mean and median numbers of hours worked per week were 61 and 60, respectively; the mean and median night calls/night shifts per month were 5 and 4, respectively. Eighty-two percent (4,124 of 5,026) of the respondents were in a committed relationship, and approximately 30% (1,438 of 4,880) had at least one child. Seven percent (360 of 4,938) spoke a language other than English at home. Overall, 78% (3,762 of 4,796) of the respondents reported having student loan debt, with a median of \$220,000 owed among those with student loan debt (table 1).

Approximately three quarters (3,654 of 5,000) of the respondents agreed that they maintained a balance between their personal and professional lives, while 11% (562 of 5,000) disagreed. A large majority (approximately 9 of 10) indicated that they had a strong social support system. Five out of every 6 physicians thought that their residency program/institution had sufficient resources to address

Table 1. Descriptive Statistics of Respondent Characteristics

Characteristics	No. of Respondents	Descriptive Statistics
Sex	5,010	Males: 3,153 (63%) Females: 1,857 (37%)
Medical school country	5,212	AMGs: 4,608 (88%) IMGs: 604 (12%)
Age (yr)	4,929	Median: 31 Mean \pm SD: 32 \pm 3 Range: 23–55
Hours worked per week	5,179	Median: 60 Mean \pm SD: 61 \pm 9 Range: 0–120
Night calls per month	5,160	Median: 4 Mean \pm SD: 5 \pm 3 Range: 0–30
Enough resources provided in working place and comfortable to use (3-point scale)	3,635	No: 617 (17%) Yes, not comfortable to use: 573 (16%) Yes, comfortable to use: 2,445 (67%)
Committed relationship	5,026	No: 902 (18%) Yes: 4,124 (82%)
Number of children	4,880	None: 71% 1 child: 14% 2 children: 10% 3 children: 4% 4 children: 2% 5 or 6 children: <1%
Speaking a home language other than English	4,938	No: 4,578 (93%) Yes: 360 (7%)
Maintaining work–life balance (5-point scale)	5,000	Strongly agree: 1,641 (33%) Agree: 2,013 (40%) Neutral: 784 (16%) Disagree: 445 (9%) Strongly disagree: 117 (2%)
Having a strong social system (5-point scale)	4,995	Strongly agree: 3,031 (61%) Agree: 1,500 (30%) Neutral: 313 (6%) Disagree: 115 (2%) Strongly disagree: 36 (1%)
Student loan debt	4,796	78% had student loan debt: Median: \$220,000 Mean \pm SD: \$227,111 \pm \$115,596 Range: \$9–\$700,000

AMG, American medical school graduate; IMG, international medical school graduate.

physician burnout and/or depression, and 4 out of 5 physicians who believed that resources were adequate stated that they would be comfortable using those resources.

Prevalence of Burnout, Distress, and Depression

Overall, 51% (2,531 of 4,966) of the anesthesiology residents and first-year graduates were identified as having a high degree of burnout, 32% (1,575 of 4,941) were in distress, and 12% (565 of 4,840) screened positive for depression. Among the cohort-years, the prevalence of burnout varied from 37% (91 of 248 PGY-5 practicing anesthesiologists of the 2013 cohort) to 57% (315 of 550 CA-3 residents of the 2014 cohort; fig. 1A), that of distress varied

from 17% (41 of 240 PGY-5 practicing anesthesiologists of the 2013 cohort) to 37% (203 of 549 CA-3 residents of the 2014 cohort; fig. 1B), and that of depression varied from 9% (22 of 243 CA-1 residents of the 2014 cohort; fig. 1C) to 15% (85 of 571 CA-2 residents of the 2015 cohort; Supplemental Digital Content, tables 2a, 2b, and 2c, <http://links.lww.com/ALN/B957>).

Compared to the 2013 CA-1 residents (43%), the 2015 CA-1 residents (51%) had a higher prevalence of burnout by 7.9% (95% CI, 1.0 to 14.8%), and 2016 CA-1 residents (52%) had a higher prevalence of burnout by 8.6% (95% CI, 1.8 to 15.4%); compared to the 2014 CA-1 residents (24%), the 2015 CA-1 residents (34%) had a higher prevalence of distress by 9.4% (95% CI, 2.6 to 16.2%), and 2016 CA-1 residents (34%) had a higher prevalence of distress by 9.6% (95% CI, 2.9 to 16.3%). Across the 2013 to 2016 cohorts, the frequency of a high degree burnout increased from the CA-1 year (49%) to the CA-2 (55%, 5.9% difference from the CA-1 year [95% CI, 2.3 to 9.3%]) and CA-3 year (54%, 5.5% difference from the CA-1 year [95% CI, 1.8 to 9.2%]), and then dropped in the PGY-5 year (42% for fellows, –12.8% difference from the CA-3 year [95% CI, –18.9% to –6.7%]) and 37% for practicing anesthesiologists, –17.7% difference from the CA-3 year [95% CI, –24.4% to –11.0%]). Compared to the CA-3 residents (34%), the prevalence of distress of residency graduates also dropped in their PGY-5 year (26% for fellows, –8.2% difference [95% CI, –13.7% to –2.6%]); 17% for practicing anesthesiologists, –17.2% difference [95% CI, –22.7% to –11.7%]). There was no statistically significant difference in the prevalence of depression among physicians at their different training levels and after graduation (11% for CA-1, CA-3, and PGY-5, and 13% for CA-2).

Across the cohort-years, females were more likely than males to suffer from burnout (54% *vs.* 49%, difference of 4.5% [95% CI, 1.6 to 7.5%], chi-square test, $P = 0.002$), to be in distress (40% *vs.* 27%, difference of 12.5% [95% CI, 9.7 to 15.3%], chi-square test, $P < 0.001$), or to screen positive for depression (15% *vs.* 10%, difference of 4.8% [95% CI, 2.8 to 6.7%], chi-square test, $P < 0.001$). International medical school graduates were less likely to have a high degree of burnout (40% *vs.* 52%, difference of –11.8% [95% CI, –16.2% to –7.4%], chi-square test, $P < 0.001$) and less likely to screen positive for depression (8% *vs.* 12%, difference of –3.8% [95% CI, –6.4% to –1.3%], chi-square test, $P = 0.009$) than American medical school graduates. Although a lower percentage of international medical school graduates were identified as being in distress compared to American medical school graduates, the chi-square test of independence found no statistically significant difference between the two groups (28% *vs.* 32%, chi-square test, $P = 0.056$).

There were high correlations between the well-being index and the depression screening scale (Pearson correlation $r = 0.61$ to 0.71 , $P < 0.001$) and the subscale of Emotional Exhaustion of the burnout inventory with the

well-being index (Pearson correlation $r = 0.60$ to 0.68 , $P < 0.001$) and the depression screening scale (Pearson correlation $r = 0.60$ to 0.67 , $P < 0.001$) within each cohort-year (Supplemental Digital Content, table 3, <http://links.lww.com/ALN/B957>).

Factors Associated with Burnout, Distress, and Depression

No outliers (*i.e.*, cases with studentized residuals greater than 3) were identified from the logistic regression analyses. Controlling for other variables in the model, females were 1.58 (95% CI, 1.33 to 1.89) times more likely to be in distress than males; international medical school graduates were 41% less likely to have burnout (odds ratio = 0.59 [95% CI, 0.45 to 0.77]), 39% less likely to be in distress (odds ratio = 0.61 [95% CI, 0.45 to 0.82]), and 45% less likely to screen positive for depression (odds ratio = 0.55 [95% CI, 0.35 to 0.87]). In addition, for each year older a physician was, they were 9% less likely to suffer from burnout (odds ratio = 0.91 [95% CI, 0.88 to 0.93], table 2).

Working more hours per week was statistically significantly associated with a higher risk of distress and depression, with a 3% higher risk for both distress (odds ratio = 1.03 [95% CI, 1.02 to 1.05]) and depression (odds ratio = 1.03 [95% CI, 1.01 to 1.05]) for each additional hour worked. Owing student loans was also statistically significantly associated with a higher risk for distress and depression, with a 1% higher risk for each additional \$10,000 owed (odds ratio = 1.01 [95% CI, 1.01 to 1.02]). Taking night calls, being in a committed relationship, number of children, or speaking a home language other than English were not found to be associated with the likelihood of burnout, distress, or depression.

There were two factors consistently associated with a lower risk of all three outcomes: the physician's perception

of whether the workplace provided sufficient resources to address burnout/depression and whether the physician felt comfortable using them (odds ratio = 0.51 [95% CI, 0.45 to 0.57] for burnout; odds ratio = 0.51 [95% CI, 0.45 to 0.56] for distress; odds ratio = 0.52 [95% CI, 0.45 to 0.60] for depression), and whether the physician perceived that they maintained a balance between their personal and professional lives (odds ratio = 0.61 [95% CI, 0.56 to 0.67] for burnout; odds ratio = 0.50 [95% CI, 0.46 to 0.55] for distress; odds ratio = 0.58 [95% CI, 0.51 to 0.65] for depression). Having a strong social support system was associated with a lower risk of burnout (odds ratio = 0.83 [95% CI, 0.73 to 0.94]) and depression (odds ratio = 0.68 [95% CI, 0.59 to 0.79]).

With 1,000 bootstrap samples, all the variables that had a greater than 50% chance of being selected for inclusion in the logistic regression models were significant predictors while all the variables with a less than 50% chance of being selected were not found to be significant predictors, as reported above. The Supplemental Digital Content, tables 4–6 (<http://links.lww.com/ALN/B957>), present the physician characteristics and their biserial correlations with burnout, distress, and depression by cohort-year in detail.

Discussion

This repeated cross-sectional survey study found that, during the course of their residency and first year after residency, approximately half of the anesthesiologists who entered training from 2013 to 2016 experienced burnout, one third were in distress, and one in eight screened positive for depression. The data suggest that residents at higher training levels had a higher prevalence of burnout and distress, reaching a peak in the CA-3 year. During their CA-1 year, later cohorts (2015 and 2016) were more likely

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Table 2. Factors Independently Associated with Burnout, Distress, and Depression in the Logistic Regression Model

	Burnout (N = 3,188)			Distress (N = 3,198)			Depression (N = 3,176)		
	Odds Ratio	P Value	95% CI	Odds Ratio	P Value	95% CI	Odds Ratio	P Value	95% CI
Demographics									
Sex (ref = male)	1.07	0.429	0.91–1.25	1.58	< 0.001	1.33–1.89	1.30	0.035	1.02–1.66
Medical school country (ref = AMGs)	0.59	< 0.001	0.45–0.77	0.61	0.001	0.45–0.82	0.55	0.010	0.35–0.87
Age (each additional year older)	0.91	< 0.001	0.88–0.93	1.00	0.718	0.97–1.02	0.96	0.020	0.92–0.99
Associated factors									
Hours worked per week				1.03	< 0.001	1.02–1.05	1.03	< 0.001	1.01–1.05
Enough resources provided in working place and physicians comfortable to use (3-point scale)	0.51	< 0.001	0.45–0.57	0.51	< 0.001	0.45–0.56	0.52	< 0.001	0.45–0.60
Maintaining work–life balance (5-point scale)	0.61	< 0.001	0.56–0.67	0.50	< 0.001	0.46–0.55	0.58	< 0.001	0.51–0.65
Having a strong social system (5-point scale)	0.83	0.004	0.73–0.94				0.68	< 0.001	0.59–0.79
Student loan (per \$10,000)				1.01	< 0.001	1.01–1.02	1.01	0.004	1.00–1.02

AMG, American medical school graduate; ref, reference group.

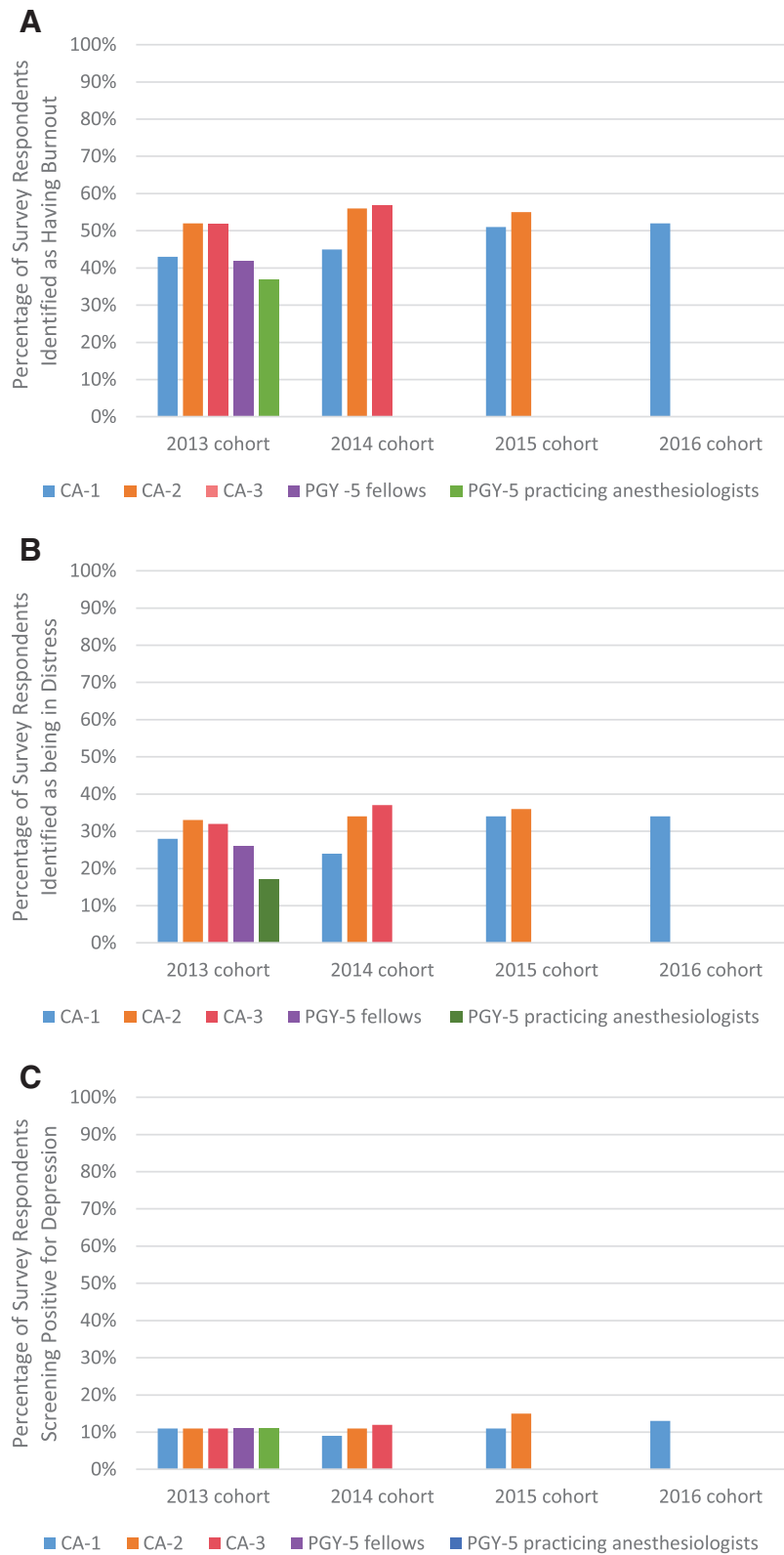


Fig. 1. (A) Percentage of survey respondents identified as having burnout by the Maslach Burnout Inventory by cohort-year. (B) Percentage of survey respondents identified as being in distress by the Physician Well-Being Index by cohort-year. (C) Percentage of survey respondents screening positive for depression by the Harvard Department of Psychiatry/National Depression Screening Day Scale by cohort-year. CA, Clinical Anesthesiology training year; PGY, Post-Graduate Year.

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to experience burnout and distress than the earlier cohorts (2013 and 2014, respectively).

Practicing physicians have been documented to have higher burnout rates than those of the general U.S. working population, individuals in other careers, and other health-care workers. In a 2010 large, national, multispecialty study of U.S. physicians and the general U.S. population, physicians had an overall burnout rate of 37.9%, which was 10.1% higher than the general U.S. working population; among the specialties studied, anesthesiology had a higher rate of burnout (approximately 48%) than the all-physician average (approximately 46%) and was seventh on the specialty-specific list of burnout prevalence, with emergency medicine, general internal medicine, neurology, and family medicine having the highest rates of burnout.¹¹ In a more recent national, multispecialty study of PGY-2 physicians, anesthesiologists had a burnout prevalence rate of 42.5%. Although burnout was not more prevalent than in internal medicine residents, anesthesiology residents were more likely to regret their career choice.¹² Further, in the same medical unit, physicians, especially residents, were at a higher risk of burnout than other healthcare workers such as nurses and nurse anesthetists.¹³

Physicians in training are at the highest risk for burnout, distress, and depression. Among U.S. medical students, residents, and early career physicians, residents/fellows had the highest prevalence of burnout (60.3%), compared with 55.9% and 51.4% for medical students and early career physicians, respectively.¹⁴ For anesthesiology trainees, de Oliveira *et al.* reported in 2013 that 41% of 1,508 resident respondents had high burnout risk and 22% screened positive for depression.⁸ Moreover, emotional stress during residency was found to be correlated with future emotional distress, emotional exhaustion, and depersonalization in professional practice 10 yr later.¹⁵ The data in our study are based on a larger sample, and suggest a higher percentage of residents at risk of burnout (52%) but a lower percentage of residents who screened positive for depression (12%). In addition, de Oliveira *et al.* reported that 23% of those who screened positive for depression thought about or wanted to commit suicide at least some of the time, and our figure of 25% confirmed this. These data suggest that approximately 3% of U.S. anesthesiology residents have thought about committing suicide.

The problem is not limited to the United States. For example, the Royal College of Anaesthetists (London, United Kingdom) found that 85% of anaesthetists training in the U.K. had an Oldenburg Burnout Inventory score suggestive of high risk of burnout.¹⁶ A survey of 382 cardiac anesthesiologists from 71 centers in Italy found that 34%, 54%, and 66% of respondents scored “high” or “moderate-high” in the subscales of burnout inventory—emotional exhaustion, depersonalization, and (low) personal accomplishment, respectively.¹⁷ In China, a survey of 2,873 anesthesiologists from 211 hospitals estimated the

prevalence of high emotional exhaustion, high depersonalization, and low personal accomplishment to be 57%, 49%, and 57%, respectively.¹⁸

Female physicians have been found to be at increased risk for burnout and/or depression in some studies,^{8,12,19} but not in others.²⁰ Our data show that female anesthesiologists-in-training were more likely than their male counterparts to be at risk of burnout, be in distress, or screen positive for depression. When adjusted for other factors, being female was associated with a higher risk of being in distress but not with a higher risk of burnout or depression. In a study of eight occupations, Innstrand *et al.* reported higher levels of exhaustion in females overall, but occupation-specific gender differences were heterogeneous.²¹ We speculate that, in addition to occupational differences, the inconsistency of sex as an independent factor may be due to adjustment of different sets of confounding variables in different studies.

Previous studies have commonly reported that the risk of burnout varies as a function of age, with younger physicians being at a higher risk of burnout.^{2,8,20} Our survey data confirmed these findings even within this group of relatively young physicians, documenting that for each year older a physician was, they were 9% less likely to suffer from burnout. Better emotional regulation strategies that develop with increasing age may ameliorate burnout.²² Similar age-related patterns have been seen for mental health disorders in a large study of U.S. attorneys.²³

The diversity of the anesthesiology workforce allowed us to evaluate the possible cultural influence on physician well-being. Twelve percent of the respondents in this study were international medical school graduates, and being an international medical school graduate was associated with a lower risk: international medical school graduates were 42% less likely to be burnt out, 40% less likely to be in distress, and 45% less likely to screen positive for depression compared to American medical school graduates, despite the fact that international medical school graduates worked longer hours (2h more per week) and were less likely to have a strong social support system. International medical school graduates were older (2 yr older), had less debt (~\$30,000 less), and were less likely to be emotionally exhausted and depersonalized than American medical school graduates, although the sense of personal accomplishment was comparable between these two groups. One could speculate that the arduous process that international medical school graduates need to go through to gain entry to a U.S. residency program and/or possible previous training in anesthesiology may have resulted in a selection bias.

The empirical evidence of how burnout, distress, and depression are correlated or overlap is not well established.²⁴ Each may be linked with disruptive behavior in the workplace, physician impairment (including alcohol abuse), and increased risk of suicidal ideation,^{25,26} and can result in suboptimal patient care, medical errors, and an increased

likelihood of leaving the medical workforce.^{27–30} In this study, the emotional exhaustion component of the burnout inventory, the well-being index, and the depression screening scale had moderate to high correlations with each other. In addition, a high burnout score, being in distress, and screening positive for depression increased the risk of suicidal thoughts from 1% to 6%, from 1% to 9%, and from 1% to 25%, respectively.

Understanding the prevalence and associated factors of physician burnout, distress, and depression may have important implications for prevention and intervention strategies. Karp and Levine recently described one model of mental health services for medical students that might be applied to residents and fellows.³¹ A holistic approach to physician support considers the importance of physician family and social support in addition to work-related factors and access to institutional resources. Consistent with previous findings,^{2,8,20,32} longer working hours and having student loan debt take a toll on physicians' mental health. More important, those who believed they maintained an appropriate balance between personal and professional lives and who were satisfied with the level, accessibility, and acceptability of workplace resources were much less likely to suffer from burnout, distress, and depression. It is noteworthy that five out of six respondents in our cohort (83% of 3,635 physicians) felt that their training program and/or institution provided sufficient resources to support them in times of distress, but one in five of those physicians were not comfortable using those resources. Overall, one third of the respondents essentially perceive that they lack institutional support for their well-being. Nationally imposed restrictions in duty hours have evolved in an effort to decrease resident fatigue and improve well-being, while attempting to optimize the quality of training and patient care.³³ We agree with West *et al.* that both individual-focused and organizational or structural strategies to reduce physician burnout need to be explored.³⁴ Furthermore, the development of resilience is essential for physician well-being.³⁵

As with any voluntary survey project, our study has several limitations. First, although the response rates are in keeping with the typical response rate for physician surveys,³⁶ those responding to the survey may have been more likely to screen positive for burnout, distress, and depression. The surveys, however, were not solely focused on these issues, and the invitation letters indicated, in general terms, the broad range of topics to be addressed. Second, it was not possible to track individual responses over time (which could have provided more useful information of individual trajectories over the training years), and the impact of overlap of respondents in sequential years was unknown. We opted to preserve anonymity in the surveys in the hopes of increasing the response rate and because of the ethical and practical dilemmas posed by identifying a physician who screened positive for depression.

In conclusion, this repeated cross-sectional survey study estimated that approximately half of anesthesiology residents and first-year graduates were at high risk of burnout, one third were in distress, and one in eight screened positive for depression. Burnout and distress were most prevalent among the CA-3 residents and seemed to be more prevalent in the more recent residency classes. Demographics, workload, perceived institutional support, work-life balance, strength of social support, and student loan debt all impact physician well-being.

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Competing Interests

Drs. Sun and Zhou are staff members of the American Board of Anesthesiology (Raleigh, North Carolina); Drs. Culley, Keegan, Macario, and Warner are American Board of Anesthesiology Directors and receive a stipend for their participation in American Board of Anesthesiology activities.

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