

Burnout, career satisfaction, and well-being among US neurology residents and fellows in 2016

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ABSTRACT

Objective: To study prevalence of and factors contributing to burnout, career satisfaction, and well-being in US neurology residents and fellows.

Methods: A total of 938 US American Academy of Neurology member neurology residents and fellows were surveyed using standardized measures of burnout, career satisfaction, and well-being from January 19 to March 21, 2016.

Results: Response rate was 37.7% (354/938); about 2/3 of responders were residents and 1/3 were fellows. Median age of participants was 32 years and 51.1% were female. Seventy-three percent of residents and 55% of fellows had at least one symptom of burnout, the difference largely related to higher scores for depersonalization among residents. For residents, greater satisfaction with work-life balance, meaning in work, and older age were associated with lower risk of burnout; for fellows, greater satisfaction with work-life balance and effective support staff were associated with lower risk of burnout. Trainees experiencing burnout were less likely to report career satisfaction. Career satisfaction was more likely among those reporting meaning in work and more likely for those working in the Midwest compared with the Northeast region.

Conclusions: Burnout is common in neurology residents and fellows. Lack of work-life balance and lack of meaning in work were associated with reduced career satisfaction and increased risk of burnout. These results should inform approaches to reduce burnout and promote career satisfaction and well-being in US neurology trainees. *Neurology*® 2017;89:1-10

GLOSSARY

AAN = American Academy of Neurology; **ACGME** = Accreditation Council for Graduate Medical Education; **MBI-HSS** = Maslach Burnout Inventory-Human Services Survey; **QOL** = quality of life.

Burnout in physicians is a threat to personal well-being, harms patient care, and may reduce the future physician workforce over time.¹⁻⁵ Physicians experiencing burnout are more likely to have work-home conflicts and health problems, including depression and suicide.⁶⁻¹² The 3 dimensions of physician burnout are emotional exhaustion, feelings of cynicism and detachment (depersonalization), and the sense of ineffectiveness at work (low personal accomplishment).¹³

Over 50% of physicians in the United States meet criteria for burnout and the rate of burnout is increasing.¹⁴ Practicing neurologists have one of the highest burnout rates and one of the lowest levels of satisfaction with work-life balance among all medical specialties.^{8,14,15}

Among US physicians, the rate of burnout appears to be even higher in residents and fellows than among those in practice.¹⁶ Resident distress has been linked to occupational body fluid exposures, motor vehicle accidents, medical errors, and poor quality of life.¹⁷⁻²⁰ The Accreditation Council for Graduate Medical Education (ACGME) and the American Medical Association are developing guidelines and wellness programs to help training programs recognize and mitigate burnout and trainee distress.

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Understanding the threats burnout poses to access to and quality of care for patients with neurologic disorders,^{15,21,22} the American Academy of Neurology (AAN) formed a task force to study burnout, career satisfaction, and work–life balance; identify associated drivers; and develop resources to improve burnout and career satisfaction. We report the results of a national survey of neurology residents and fellows assessing burnout, career satisfaction, and well-being.

METHODS Study population. Details of the survey population and study methods were published previously.²³ The aggregate study population ($n = 9,561$) of interest included neurologists ($n = 7,738$) and neurology trainees (1,823 residents and fellows) who were current members of the AAN and had a primary address in the United States.

Assuming a 20% response rate and targeting a margin of error no more than $\pm 3.0\%$, a sample of 5,065 members was selected from the eligible population. The sample included 4,127 neurologists in practice and 938 trainees (residents and fellows). Results for practicing neurologists were previously reported.²³ The present analysis focuses on the 938 neurology trainees.

Individuals in the sample were mailed a paper survey on January 19, 2016, sent an e-mail with a link to an online survey, and faxed (if available) a link to an online survey. Nonrespondents received up to 2 additional mailings and faxes and up to 5 additional e-mail reminders. All communications and data collection were conducted on behalf of the AAN by Anderson, Niebuhr & Associates, Inc., who provided the AAN with deidentified (anonymized) data from those who completed their survey by March 21, 2016. Participants were eligible for a drawing for 1 of 20 \$500 Visa gift cards.

Standard protocol approvals, registrations, and patient consents. Consent to participate in the study was implied by completing the survey. After the deidentified data were provided to the AAN, the study was reviewed and granted exempt status by the University of Pittsburgh Institutional Review Board.

Study measures. The survey consisted of 57 questions covering personal and professional characteristics with standardized instruments to measure burnout and career satisfaction (available at Neurology.org).^{8,13,14}

Burnout was measured using the 22-item Maslach Burnout Inventory–Human Services Survey (MBI-HSS). The MBI-HSS has 3 subscales to evaluate each domain of burnout: emotional exhaustion, depersonalization, and personal accomplishment.¹³ Using the standard scoring criteria for health care workers, and in keeping with previous studies and convention,^{8,14,24} we considered neurology trainees with high scores on the emotional exhaustion (≥ 27) or depersonalization (≥ 10) subscales as having at least one manifestation of professional burnout. Career satisfaction was assessed using 2 questions from previous physician surveys regarding career and specialty choice.^{8,14} Meaning in work and job satisfaction were assessed using questions from the Empowerment at Work^{14,25} and Physician Job Satisfaction²⁶ scales. Two questions were asked about the amount of time spent on clerical tasks directly and indirectly related to patient care.²⁷

Statistical analysis. Standard descriptive statistics were used to characterize responding neurology trainees. With 354 trainee

responses to the survey, the percentage estimates were accurate to 4.7% with 95% confidence. Associations between variables were evaluated using the χ^2 test for categorical variables and the Kruskal-Wallis test for continuous variables. All tests were 2-sided with type I error rates (α) of 0.05. Multivariable analyses to identify demographic and professional characteristics associated with the dependent outcomes were performed using binary logistic regression. All analyses were performed using IBM (Chicago, IL) SPSS Statistics version 23.

Modeling for multivariable analysis was different for trainees and practicing neurologists to more accurately reflect differences in work settings for the 2 groups. Work–life balance and year of training were included only for trainees. Autonomy was excluded in the multivariable analysis for trainees because it was less likely to be a significant independent variable.

RESULTS Response rate and representativeness. Of the 938 neurology trainees surveyed, 354 responded (response rate 37.7%), with 23 respondents reporting a primary focus in child neurology. Responders did not differ significantly from nonrespondents (all $p > 0.05$) (table e-1) with respect to age, sex, region, or stage of training (resident vs fellow). Analysis of early responders (the 49.7% who responded within the first 29 days) vs late responders (the 50.3% who responded over the next 31 days) found no significant differences (all $p > 0.05$) with respect to burnout, sex, age, region, or type of trainee (resident vs fellow). Collectively, there was evidence that the sample was generally representative of US neurology trainees with respect to demographic characteristics and level of burnout.

Personal characteristics. The median age of all participants was 32 years; 51.1% were female. Responders were well-represented across geographic regions. Roughly two-thirds of responders were residents and one-third were fellows (table 1). Residents and fellows were statistically similar in terms of sex and geographic distribution; however, fellows were older than residents ($p < 0.001$).

Professional characteristics. Responders reported working a mean of 64.6 hours per week, with approximately three-quarters (76.9%; mean 49.7 h/wk) (table 2) of the time spent on clinical care. Residents worked more hours per week on average than fellows (67.5 vs 59.1, $p < 0.001$), spent a larger proportion of their time in direct patient care (82.5% vs 67.3%, $p < 0.001$), and devoted less time to research (4.1% vs 19.3%, $p < 0.001$). Residents spent more nights per week on call than fellows (mean 1.39 vs 1.18, $p = 0.003$), cared for more inpatients on hospital days (median 10 vs 1, $p < 0.001$), and spent more weekends per year rounding in the hospital (median 23 vs 4, $p < 0.001$), but cared for fewer outpatients per week (median 6 vs 10, $p = 0.006$).

Career satisfaction and burnout. Table 3 describes burnout, career satisfaction, and well-being among

Table 1 Characteristics of residents and fellows

	All (n = 354)	Residents (n = 212)	Fellows (n = 111)	p Value comparison of residents vs fellows ^a
General				
Age, y				
Mean	33	32	35	<0.001
Median	32	31	34	
SD	4	4	4	
Missing, n	0	0	0	
Sex, %				
Male	48.9	51.4	42.3	0.121
Female	51.1	48.6	57.7	
Missing, n	0	0	0	
Geographic region,^b %				
Northeast	29.7	30.2	30.6	0.227
Midwest	26.3	28.3	22.5	
South	29.7	29.7	27.0	
West	14.4	11.8	19.8	
Missing, n	0	0	0	
Training year, %				
PGY1	0.6	0.9	0.0	NA ^c
PGY2	22.9	34.9	0.0	
PGY3	23.5	35.8	0.0	
PGY4	18.6	28.3	0.0	
Fellowship	34.4	0.0	100.0	
Missing, n	31	0	0	

^a Comparisons tested using Kruskal-Wallis for continuous variables (age) and χ^2 for categorical variables (sex and region).

^b Regional designations: Northeast: Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont; Midwest: Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin; South: Alabama, Arkansas, Washington, DC, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, Wyoming.

^c Not tested because this is the variable used to create the 2 groups.

participating trainees. Over one-half of trainees had high emotional exhaustion (181 of 332; 54.5%) and high depersonalization (178 of 332; 53.6%). A total of 31.9% (106 of 332) had a low personal accomplishment score. Overall, 67.2% (223 of 332) of trainees had at least one symptom of burnout (high emotional exhaustion or high depersonalization). Residents had a higher burnout rate than fellows (73.5% vs 55.0%, $p = 0.001$), due to higher scores in the depersonalization domain ($p = 0.001$). Personal accomplishment scores were worse (lower) for residents than for fellows ($p < 0.001$). Demographic and practice characteristics associated with burnout on bivariate

analysis are shown in tables e-2 and e-3. Men and women had similar burnout rates.

With respect to career satisfaction, 56.9% (189 of 332) of trainees reported they would choose to become a physician again while 75.9% (252 of 332) indicated they would choose to become a neurologist again. Career satisfaction scores in both these domains were similar between residents and fellows ($p > 0.05$).

The median overall quality of life (QOL) score of trainees was 6 on a 0–10 scale, while the median score on the fatigue scale was 5 out of 10. Scores less than 6 on the QOL scale are considered clinically meaningful impairments in QOL,²⁸ and 37.7% of respondents reported scores less than 6. Fewer than 1 in 4 trainees (23.0%; 76 of 331) indicated their work schedule left enough time for personal/family life. There were no differences ($p > 0.05$) between residents and fellows on QOL and fatigue; however, residents scored lower on work–life balance ($p = 0.025$).

One third of trainees (33.5%) reported significant autonomy in determining how they do their job. Most trainees (81.0%) reported their work was meaningful, and 66.5% were satisfied with their job. There were no differences between residents and fellows for measures of autonomy, meaning, and job satisfaction (all $p > 0.05$).

A minority of trainees indicated the amount of time spent on clerical tasks, both directly (28.0%: 92 of 328) and indirectly (15.5%: 51 of 328) related to patient care, was reasonable. A majority of trainees (62.2%: 199 of 320) indicated that they had too little support staff to assist them with their work. There were no differences between residents and fellows on satisfaction with clerical tasks and sufficient amount of support staff (all $p > 0.05$).

Factors associated with burnout. Multivariable analyses were conducted to identify factors associated with burnout (table 4). In addition to a model for all trainees, separate models were developed for residents and fellows because of substantial differences in personal and professional characteristics between these groups. On pooled analysis of all trainees, greater satisfaction with work–life balance ($p = 0.005$), meaning in work ($p = 0.010$), and having effective support staff ($p = 0.017$) were associated with lower burnout risk.

Risk profiles differed by trainee status. For residents, greater satisfaction with work–life balance ($p = 0.020$) and meaning in work ($p = 0.015$) as well as older age ($p = 0.009$) were associated with lower burnout risk. For fellows, greater satisfaction with work–life balance ($p = 0.035$) and having effective support staff ($p = 0.009$) were associated with lower burnout risk.

Table 2 Professional characteristics of residents and fellows

	All (n = 354)	Residents (n = 212)	Fellows (n = 111)	p Value comparison of residents vs fellows ^a
Hours worked per week				<0.001
Mean	64.6	67.5	59.1	
Median	65	70	60	
SD	11.4	9.4	12.8	
Missing, n	26	1	0	
% Time devoted to clinical practice				<0.001
Mean	76.9	82.5	67.3	
Median	80	90	75	
SD	22.0	17.3	25.4	
Missing, n	25	0	0	
% Time devoted to research				<0.001
Mean	9.6	4.1	19.3	
Median	5	0	10	
SD	17.2	7.3	23.3	
Missing, n	25	0	0	
% Time devoted to teaching				0.609
Mean	4.3	4.3	4.3	
Median	2	3	0	
SD	5.1	5.0	5.5	
Missing, n	25	0	0	
% Time devoted to administrative work				0.358
Mean	6.2	6.0	6.4	
Median	0	0	0	
SD	9.5	9.7	9.0	
Missing, n	25	0	0	
% Time devoted to other activities				0.113
Mean	3.0	3.1	2.7	
Median	0	0	0	
SD	8.7	8.2	9.5	
Missing, n	25	0	0	
Nights on call/wk				0.003
Median	1	1	1	
Mean (SD)	1.32 (1.05)	1.39 (0.82)	1.18 (1.38)	
Missing, n	28	1	1	
Median number of outpatients in clinic per week	6	6	10	0.006
Missing, n	28	0	1	
Median number of inpatients on average hospital day	10	10	1	<0.001
Missing, n	31	1	2	
Median number of weekends round in hospital	18	23	4	<0.001
Missing, n	33	3	2	

^a Comparisons tested using Kruskal-Wallis for continuous variables and χ^2 for categorical variables.

Table 3 Burnout and career satisfaction for residents and fellows

	All (n = 354)	Residents (n = 212)	Fellows (n = 111)	p Value comparison of residents vs fellows ^a
Burnout indices^b				
Emotional exhaustion^c				
Median	28	29	25	0.094
% Low score	22.9	20.9	27.9	0.105
% Intermediate score	22.6	20.9	26.1	
% High score	54.5	58.3	45.9	
Missing, n	22	1	0	
Depersonalization^c				
Median	10	11	8	0.001
% Low score	25.3	21.8 ^g	32.4	0.004
% Intermediate score	21.1	18.0	27.0	
% High score	53.6	60.2 ^g	40.5	
Missing, n	22	1	0	
Personal accomplishment^c				
Median	38	37	40	<0.001
% High score	40.7	34.1 ^g	54.1	0.002
% Intermediate score	27.4	29.9	23.4	
% Low score ^d	31.9	36.0 ^g	22.5	
Missing, n	22	1	0	
% Burned out ^e	67.2	73.5	55.0	0.001
Missing, n	22	1	0	
Well-being and career satisfaction				
Would become physician again (career choice), % yes	56.9	55.9	59.5	0.542
Missing, n	22	1	0	
Would become neurologist again (specialty choice), % yes	75.9	76.9	75.7	0.807
Missing, n	22	0	0	
Median overall quality of life ^f	6	6	6	0.361
Missing, n	1	0	0	
Median level of fatigue ^f	5	5	5	0.832
Missing, n	0	0	0	
Work schedule leaves enough time for personal/family life, % agree	23.0	19.0	30.0	0.025
Missing, n	23	1	1	
I have significant autonomy in determining how I do my job, % agree	33.5	29.7	39.6	0.072
Missing, n	23	0	0	
The work I do is meaningful to me, % agree	81.0	78.8	85.6	0.137
Missing, n	23	0	0	
Overall, I am satisfied with my job, % agree	66.5	68.9	63.1	0.292
Missing, n	23	0	0	
The amount of time I spend on clerical tasks directly related to patient care is reasonable, % agree	28.0	26.2	29.7	0.499
Missing, n	26	2	0	

Continued

Table 3 Continued

	All (n = 354)	Residents (n = 212)	Fellows (n = 111)	p Value comparison of residents vs fellows ^a
The amount of time I spend on clerical tasks indirectly related to patient care is reasonable, % agree	15.5	13.8	18.0	0.319
Missing, n	26	2	0	
How much effective support staff do you have to assist you in your work?, % too little	62.2	63.6	60.6	0.596
Missing, n	34	6	2	

^a Comparisons tested using Kruskal-Wallis for continuous variables and χ^2 for categorical variables.

^b As assessed using the full Maslach Burnout Inventory.

^c Per the standard scoring of the Maslach Burnout Inventory for health care workers, physicians with scores on the Emotional Exhaustion subscale ≥ 27 , the Depersonalization subscale ≥ 10 , or the Personal Accomplishment subscale ≤ 33 are considered to have a high degree of burnout in that dimension.

^d Low scores on the Personal Accomplishment subscale are less favorable.

^e High score on Emotional Exhaustion or Depersonalization subscales of the Maslach Burnout Inventory (see Methods).

^f Scale of 0 = As bad as it can be to 10 = As good as it can be.

^g This paired comparison (z test) was found to be significant at a $p < 0.05$ level.

Factors associated with career satisfaction. Multivariable analyses were also conducted to identify factors associated with career satisfaction (table 5). Trainees with burnout were less likely to have career satisfaction ($p = 0.013$). Trainees who reported their work was meaningful were more likely to be satisfied with their career choice ($p < 0.001$). Trainees living in the Midwest were more likely to report career satisfaction than trainees in the Northeast ($p = 0.008$). Personal and professional characteristics were not significantly different (all $p > 0.05$) between the Midwest and Northeast regions (table e-4).

DISCUSSION We assessed burnout, career satisfaction, and well-being among US neurology residents and fellows using standardized instruments.²³ About 73% of residents and 55% of fellows had at least one symptom of burnout. There were too few child neurology trainee respondents to allow for separate analysis of this group.

The 73% burnout rate for neurology residents is similar to rates previously reported in internal medicine residents.^{16,23,29} In a 2001 survey using methodology similar to ours, 76% of internal medicine residents met criteria for burnout.¹⁶ When the survey was repeated in 2004, 1 year after implementation of ACGME work hour restrictions, 68% met criteria for burnout and 80% reported career satisfaction, up from 66%.²⁹ Although the difference in burnout between the 2 studies (2001 and 2004) was reported as statistically significant, the persistent high burnout rate does not indicate a striking effect from work hour limitations. Likewise, in our study, high burnout among residents was evident years after the implementation of duty hour restrictions. For fellows, however, the significantly fewer work hours compared

with residents may have contributed to their lower burnout rate. A study of 150 residents across 13 specialties identified pessimism as a major factor in burnout, among other factors, but poor support staff and too many work demands were not correlated with burnout.³⁰ Lack of support was not specifically associated with burnout for residents in our study, but it was for fellows. Our survey did not explore specific aspects of support, such as outpatient vs inpatient differences, that might explain this finding.

A Dutch study of residents in different specialties found emotional demands at work and work-home interference were main contributors to burnout, similar to our findings.³¹ While not directly comparable with US training program characteristics, a study of neurology residents in Greece identified an 18% burnout rate and linked burnout to reduced professional development but not stage of training or work hours.³² Likewise, our study did not identify work hours as an independent factor in burnout.

We found that career satisfaction was higher in the Midwest region of the United States compared to the Northeast ($p = 0.008$). The professional and personal characteristics we measured were not different between these regions (table e-4), but our survey did not ask about possibly relevant factors such as size of metropolitan area, program size, competitiveness, or collegial milieu.

Residents experienced significantly more burnout, mainly attributable to increased depersonalization. Factors different for residents' work included more weekends and overall hours worked, more nights on call, more direct patient care, and more inpatients. The number and intensity of patient experiences for residents compared with fellows, especially when concentrated in the early years of training, may

Table 4 Factors associated with trainee burnout using multivariable analyses

Group	Predictor	OR	95% CI		p Value
			Lower	Upper	
All trainees ^{a,b,c,d}	Greater satisfaction with work-life balance (Q5) (0 = disagree/neutral, 1 = agree)	0.344	0.165	0.719	0.005
	Greater sense of meaning in work (Q9b) (0 = disagree/neutral, 1 = agree)	0.284	0.109	0.741	0.010
	Effective support staff (Q11) (0 = too little, 1 = about right)	0.472	0.254	0.877	0.017
Residents ^{a,b,e,f}	Greater satisfaction with work-life balance (Q5) (0 = disagree/neutral, 1 = agree)	0.262	0.085	0.811	0.020
	Greater sense of meaning in work (Q9b) (0 = disagree/neutral, 1 = agree)	0.152	0.033	0.693	0.015
	Age (Q19)	0.879	0.798	0.969	0.009
Fellows ^{a,b,g,h}	Greater satisfaction with work-life balance (Q5) (0 = disagree/neutral, 1 = agree)	0.265	0.077	0.910	0.035
	Effective support staff (Q11) (0 = too little, 1 = about right)	0.167	0.043	0.645	0.009

Abbreviations: CI = confidence interval; OR = odds ratio.

Three multivariable analyses were conducted to identify personal and professional factors associated with burnout. The first model included all trainees. Given substantial differences in workload and career satisfaction characteristics, a separate model was created for residents and another for fellows.

^aPersonal characteristics in all models: age, sex, region.

^bProfessional characteristics in all models: work-life balance, meaningful work, direct clerical tasks, indirect clerical tasks, effective support staff, hours per week, % clinical time, nights on call, number of outpatients, number of inpatients, number of weekends have hospital rounding.

^cAdditional personal characteristics in all trainee model: year in training.

^dResults shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise). Some variables were significant in only 1 or 2 of the methods: number of inpatients, South region (compared to the Northeast).

^eAdditional personal characteristics in resident model: year in training.

^fResults shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise). Some variables were significant in only 1 or 2 of the methods: indirect clerical tasks and West region (compared to the Northeast).

^gNo additional variables in the fellow model.

^hResults shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise). Some variables were significant in only 1 or 2 of the methods: age, sex, and South region (compared to the Northeast).

contribute to the disparity in burnout and work-life balance seen between residents and fellows in our study, and may contribute to increased depersonalization. Better work-life balance and meaning in work correlated with older age among residents, perhaps due to less prolonged exposure to intense patient care, fewer days worked, and more supervisory duties. However, age did not significantly correlate with other personal or professional characteristics measured in the survey.

Neurology trainee burnout rate was higher than the previously reported burnout rate among practicing neurologists.²³ In that analysis, the burnout rate among neurologists was about 56% in academic practice and 63% in clinical practice. Hours worked, nights on call, number of outpatients seen, and amount of clerical work were independent factors associated with burnout for practicing neurologists but not for trainees. However, themes were similar for trainees and neurologists, including work-life

balance, the relationship of both meaning in work and need for support with career satisfaction, and the relationship between career satisfaction and burnout.

In our study, neurology fellows had professional characteristics and a burnout rate similar to neurologists in academic practice.²³ In a study of oncology fellows, their burnout rate of 43% was similar to that among practicing oncologists.³³

Our results provide insights into factors associated with increased burnout in neurology trainees. As with practicing neurologists, there may be additional determinants not assessed in our survey. One could ask whether there are personality traits of neurology trainees or higher emotional or intellectual demands placed on trainees by patients with severe neurologic disease that predispose to increased burnout.^{15,21,22} In addition, whereas neurology residents have similar rates of burnout compared with trainees in other specialties, the burnout rate among practicing neurologists is higher

Table 5 Factors associated with trainee career satisfaction using multivariable analyses

Predictor ^{a,b,c}	OR	95% CI		p Value
		Lower	Upper	
Burnout ^d	0.309	0.122	0.782	0.013
Meaningful work (Q9b) (0 = disagree/neutral, 1 = agree)	6.848	3.267	14.351	<0.001
Region (Q21) Midwest vs Northeast	3.658	1.411	9.485	0.008

Abbreviations: CI = confidence interval; OR = odds ratio.

Multivariable analyses were conducted to identify personal and professional factors associated with becoming a neurologist again.

^aResults shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise).

^bPersonal characteristics: age, sex, region, burnout.

^cProfessional characteristics: Work-life balance, meaningful work, direct clerical tasks, indirect clerical tasks, effective support staff, hours per week, % clinical time, nights on call, number of outpatients, number of inpatients, number of weekends have hospital rounding, resident vs fellow.

^dHigh score on Emotional Exhaustion or Depersonalization subscales of the Maslach Burnout Inventory (see Methods).

than in many other specialties.^{16,19,23,29,34} Fewer trainees would choose a career in medicine again than would choose neurology again. This may reflect dissatisfaction with the practice of medicine in general rather than neurology in particular. Additional studies may provide a deeper understanding of these findings, including analysis of the free text comments many responders entered in our survey.

Our study had notable strengths. The survey response rate for trainees was almost 38% (212 residents and 111 fellows). These numbers are similar to other published studies^{16–20,29,30} on US trainees, and we obtained statistically significant findings with our respondent population. Neurology trainees and practicing neurologists completed the same survey, allowing direct comparisons between these groups.

Our study had limitations. Although we found no significant differences between early responders compared to late responders, we cannot exclude the possibility of response bias. Because the survey was cross-sectional, we were unable to determine causality or potential direction of effect for the associations observed. Modeling for multivariable analysis differed in some respects for neurology trainees and neurologists in practice.

Intervening to prevent and mitigate burnout among neurology trainees is critically needed to maintain the health and productivity of our workforce. The ACGME proposed that resident well-being be monitored and addressed in training programs. Short versions of the Maslach Burnout Inventory³⁵ or the more easily administered Mayo Physician Well-Being Index³⁶ may enable program directors to monitor trainees over time for signs of distress and intervene when needed.

Elements of burnout and depression can overlap in affected trainees, particularly emotional exhaustion. However, burnout and depression are not synonymous but rather are complexly interrelated.^{31,37} The combination of depression and burnout in a trainee is especially worrisome,^{16,31} possibly increasing the risk of suicide.

Many have blamed prolonged work hours for eroding trainees' learning milieu and quality of direct patient interactions.²⁹ However, it is now clear that despite mandated and implemented work hour restrictions, the rate of trainee burnout is still too high. Further evidence that regulating work hours is not sufficient is provided by a study of European residents that reported burnout despite a 48-hour work restriction, considerably lower than the work hour restrictions for US residents.³⁸

A recent meta-analysis investigating the effectiveness of interventions to reduce burnout suggests that a combination of strategies focused at the individual, structural, and organizational levels may be required to produce meaningful reductions of burnout rates.³⁹ Programs devoted to improving personal resilience and stress reduction can promote physician well-being. Trainee burnout can also be lessened by increasing engagement and providing increased opportunities for job development and increased autonomy,^{32,40} although additional analysis found that autonomy was not a significant factor for predicting burnout in our results.

Finding meaning in work appears to be a major factor in both career satisfaction and burnout. Our findings that burnout correlates with low satisfaction with work-life balance and meaning in work suggest that organizational changes are necessary. Examples include redesigning neurology training curricula to focus on more meaningful internal medicine experiences in the preliminary year of training (for adult neurology residents), emphasizing professional development, teaching coping skills, and reducing clerical burdens. Alternating less intense with more intense clinical rotations in earlier years of training could decrease depersonalization. Training programs should consider providing additional support staff to enable trainees to focus on learning and practicing the intellectual and procedural aspects of neurology during their work hours, and not be distracted by less meaningful tasks. Longitudinal studies in the future may help determine if implemented changes improve career satisfaction and promote engagement during training and over the course of a career in neurology.

AUTHOR CONTRIBUTIONS

Kerry H. Levin: design of the study, interpretation of the data, drafting and revising the manuscript for intellectual content. Tait D. Shanafelt:

design of the study, interpretation of the data, revising the manuscript for intellectual content. Christopher M. Keran: design of the study, analysis and interpretation of the data, drafting and revising the manuscript for intellectual content. Neil A. Busis: design of the study, interpretation of the data, drafting and revising the manuscript for intellectual content. Laura A. Foster: analysis and interpretation of data, revising the manuscript for intellectual content. Jennifer Rose V. Molano: analysis and interpretation of data, revising the manuscript for intellectual content. Cormac A. O'Donovan: analysis and interpretation of data, revising the manuscript for intellectual content. Jeffrey B. Ratliff: analysis and interpretation of data, revising the manuscript for intellectual content. Heidi B. Schwarz: design of the study, analysis of the data, and revising the manuscript for intellectual content. Jeff A. Sloan: design of the study, interpretation of the data. Terrence L. Cascino: conceptualization of the study, commenting on manuscript for intellectual content.

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