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Burnout, career satisfaction, and well-being among US neurologists in 2016

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ABSTRACT

Objective: To study prevalence of and factors that contribute to burnout, career satisfaction, and well-being in US neurologists.

Methods: A total of 4,127 US American Academy of Neurology member neurologists who had finished training were surveyed using validated measures of burnout, career satisfaction, and well-being from January 19 to March 21, 2016.

Results: Response rate was 40.5% (1,671 of 4,127). Average age of participants was 51 years, with 65.3% male and nearly equal representation across US geographic regions. Approximately 60% of respondents had at least one symptom of burnout. Hours worked/week, nights on call/week, number of outpatients seen/week, and amount of clerical work were associated with greater burnout risk. Effective support staff, job autonomy, meaningful work, age, and subspecializing in epilepsy were associated with lower risk. Academic practice (AP) neurologists had a lower burnout rate and higher rates of career satisfaction and quality of life than clinical practice (CP) neurologists. Some factors contributing to burnout were shared between AP and CP, but some risks were unique to practice setting. Factors independently associated with profession satisfaction included meaningfulness of work, job autonomy, effectiveness of support staff, age, practicing sleep medicine (inverse relationship), and percent time in clinical practice (inverse relationship). Burnout was strongly associated with decreased career satisfaction.

Conclusions: Burnout is common in all neurology practice settings and subspecialties. The largest driver of career satisfaction is the meaning neurologists find in their work. The results from this survey will inform approaches needed to reduce burnout and promote career satisfaction and well-being in US neurologists. *Neurology*® 2017;88:1–12

GLOSSARY

AAN = American Academy of Neurology; **AP** = academic practice; **CP** = clinical practice; **MBI-HSS** = Maslach Burnout Inventory–Human Services Survey; **QOL** = quality of life.

Improving patient care and population health while reducing health care costs is critically dependent on timely access to care and optimal performance of health care providers. Physician burnout, career dissatisfaction, and lack of well-being threaten meaningful health care transformation.[1,2]

Well-being is a multidimensional construct that encompasses the complex interplay of an individual's mental, emotional, and physical health including positive aspects such as career satisfaction and negative aspects such as presence of burnout and dissatisfaction with work–life balance.[1,3]

Physician burnout comprises 3 dimensions: emotional exhaustion, feelings of cynicism and detachment (depersonalization), and a sense of ineffectiveness at work (low personal accomplishment).[4] Burned out physicians may have impaired clinical judgment and lack empathy, leading to poor patient care and satisfaction.[3,5,6] The physician workforce may shrink, due to fewer entering and more leaving the field or physicians cutting back their clinical workload.[7–10] Burned

Editorial, page 726

Supplemental data at Neurology.org

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out physicians negatively influence their colleagues and are more likely to have work–life imbalance, work–home conflicts, and health problems including substance abuse, depression, and suicide.[11–17]

Burnout and depression, while sharing some features such as emotional exhaustion, are separate entities.[18] Burnout is situationally-specific while depression is context-free.[18] Six main domains are associated with increased burnout risk: workload, control, reward, community, fairness, and values.[18] Interventions to reduce the risk of and mitigate burnout have mainly centered on personal wellness strategies; however, determinants at the levels of the work unit, organization, and nation play a primary role.[18] Little research has evaluated the efficacy of burnout risk reduction and mitigation efforts.[18]

Burnout is more prevalent among physicians than the general US workforce and is common in all medical and surgical specialties and practice settings.[13,19] Burnout and satisfaction with work–life balance in US physicians worsened between 2011 and 2014, at which time over half of US physicians met burnout criteria.[19]

Burnout rates vary by specialty. Neurology is one of the few specialties with both high rates of burnout and low satisfaction with work–life balance.[13,19,20] In 2013, the American Academy of Neurology (AAN) Workforce Task Force found demand for neurologist services exceeded supply in most states.[21] By 2025, demand for neurologists will be even higher.[21] Given relationships between workload and burnout and burnout and professional work effort,[7–10] the high rate of neurologist burnout may contribute to and be exacerbated by this shortage.

Recognizing this crisis,[20,22] the AAN formed a task force to study neurologist burnout, career satisfaction, and work–life balance; determine associated factors; and develop and disseminate evidence-based resources to mitigate burnout and enhance career satisfaction. We report the results of a national survey of practicing US neurologists characterizing professional burnout, career satisfaction, and well-being.

METHODS

Study population. The population of interest included neurologists and neurology trainees who were current members of the AAN and had a primary address in the United States (n = 17,413). Among the 17,413 members meeting these criteria, 7,852 were excluded because they were missing AAN member record data (postal address, e-mail address, sex, birth date, or subspecialty), received surveys from the AAN within the last 6 months, or were involved with the study, leaving an eligible population of 9,561.

Attempting to yield a margin of error no more than ±3.0% assuming a 20% response rate, a simple random sample of 5,000 members was selected from the eligible population of 9,561. We also oversampled all who had a primary subspecialty of neurohospitalist (n = 41) and endovascular and interventional neurology (n = 24) because of their low numbers and unique practice settings, resulting in 5,065 members in the sample. This sample included neurologists (n = 4,127) as well as residents and fellows (n = 938). The present analysis focuses on the 4,127 neurologists who had completed training.

Sample members were mailed a survey on January 19, 2016, an e-mail with a link to an online survey, and a fax (if available) with 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 mentioned their eligibility in a drawing for 1 of 20 $500 Visa gift cards. All communications and data collection were conducted on behalf of the AAN by Anderson, Niebuhr & Associates, Inc. (Minneapolis, MN), which provided the AAN with de-identified (anonymized) data from those who completed their survey by March 21, 2016.

Standard protocol approvals, registrations, and patient consents. Completing the survey was implied consent to participate in the study. After the anonymized 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 (available at Neurology.org) consisted of 57 questions covering personal and professional characteristics with previously validated instruments to measure burnout and career satisfaction[4,13,19] and included a free text entry area at the end.

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.[4] Using the standard scoring criteria for health care workers, and in keeping with previous studies and convention,[13,19,23] we considered neurologists 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.[13,19,24–26] Questions from the Empowerment at Work[19,27] and Physician Job Satisfaction[28] scales explored meaning in work and professional satisfaction. Two questions were asked about the amount of time spent on clerical tasks directly and indirectly related to patient care.[29]

Statistical analysis. Missing data for 4 demographic variables (ranging from 5% to 8% missing data) were replaced with data from the AAN membership data file (accuracy from 96.5% to 99.6%, based on correct match between nonmissing survey responses and the AAN membership data file): year of birth, sex, state, and career stage (in or out of training).

Standard descriptive statistics were used to characterize responding neurologists. With 1,671 responses to the survey, the percentage estimates were accurate to ±2.2% 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)

Table 1 Personal and practice characteristics for academic practice (AP) vs clinical practice (CP)

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	*p* Value comparison AP to CP[b]
Personal characteristics				
Age, y				
Mean	52	50	53	<0.001
Median	51	48	53	
SD	12	12	12	
Missing, n	0	0	0	
Age % in categories <40	20.2	24.6	17.4[c]	0.001
40–49	25.4	27.4	24.9	
50–59	25.9	24.2	26.9	
60–69	20.5	16.1	23.3[c]	
70+	8.0	7.8	7.5	
Sex, %				0.003
Male	65.3	60.7	68.3[c]	
Female	34.7	39.3	31.7[c]	
Missing, n	0	0	0	
Geographic region,[d] %				
Northeast	23.0	28.7	20.0[c]	0.001
Midwest	24.1	24.4	24.5	
South	30.4	29.7	30.9	
West	21.9	16.8	23.9[c]	
AE, PR, VI	0.7	0.4	0.7	
Missing, n	0	0	0	
Practice characteristics				
Primary work setting,[e] %				
Solo practice	14.3	0.0	23.5	
Neurology group	19.5	0.0	31.9	
Multispecialty group	13.6	0.0	22.3	
Academic-based	33.7	100.0	0.0	
Hospital-based	13.6	0.0	22.3	
Government-based	3.2	0.0	0.0	
Other	2.2	0.0	0.0	
Missing, n	99	0	0	
Years in practice[f]				
Mean	17.3	15.6	18.1	<0.001
Median	16.0	12.5	17.0	
SD	12.1	12.0	11.9	
Missing, n	76	6	7	
% In categories <10	32.7	39.2	29.1[c]	<0.001
10–19	24.1	24.1	24.8	
>20	43.1	36.7	46.1[c]	
Employment status, %				<0.001
Employed at a hospital	41.6	65.1	27.1[c]	
Employed at a practice	22.9	20.1	26.1[c]	
Owner/partner	26.8	0.4	44.1[c]	

Continued

Table 1 Continued

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	p Value comparison AP to CP[b]
Other	8.7	14.4	2.7[c]	
Missing, n	68	2	4	

[a] Includes solo practice, neurology group, multispecialty group, and hospital-based.
[b] Comparisons tested using Kruskal-Wallis for continuous variables and χ^2 for categorical variables.
[c] This paired comparison (z test) was found to be significant at a $p < 0.05$ level.
[d] 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; other: Armed Forces Europe (AE), Armed Forces Pacific, Guam, Puerto Rico (PR), Virgin Islands (VI).
[e] Not compared because this is the variable used to create the 2 groups.
[f] Since completion of residency and fellowship training.

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 (Armonk, NY) SPSS Statistics version 23.

RESULTS **Response rate and representativeness.** Of the 4,127 neurologists surveyed, 1,671 responded (response rate 40.5%). The representativeness of respondents differed from nonrespondents ($p < 0.05$) (table e-1), with overrepresentation from women (+3.7%), midwest region (+3.6%), and child neurologists (+2.0%), and underrepresentation from men (−3.7%), northeast region (−3.2%), other work setting (−3.0%), and subspecialties of vascular neurology and stroke (−2.0%) and other (−3.5%). Respondents and nonrespondents were similar for age ($p = 0.100$). Analysis of early responders (the 53.4% who responded within the first 19 days) to late responders (the 46.6% who responded over the next 41 days) found no significant differences for burnout, sex, age, region, and academic vs clinical practice (all $p > 0.05$). Collectively, there was evidence that the sample was generally representative of US neurologists with respect to demographic characteristics and level of burnout.

Personal and practice characteristics. The median age of all participants was 51 years, 65.3% were men, and they were well-represented across geographic regions (table 1). Compared with neurologists in academic practice (AP), neurologists in clinical practice (CP) were older ($p < 0.001$), more likely to be male ($p = 0.003$), less likely to be in the northeast region, and more likely to be in the west ($p = 0.001$). Respondents practiced neurology a mean of 17.3 years. One-third of neurologists (33.7%) worked in AP. CP neurologists included those in solo practice (14.3%), neurology group (19.5%), multispecialty group (13.6%), and hospital-based (13.6%) settings. Government-based (3.2%) and other (2.2%) practices were excluded from AP vs CP comparisons.

Subspecialty and workload. Almost one-third of responders (table 2) identified themselves as general neurologists (31.9%). The 3 most commonly identified subspecialties were epilepsy (8.4%), child neurology (8.3%), and movement disorders (7.4%). Respondents reported working a mean of 55.7 hours per week, with approximately three-fourths (76.1%; mean 42.4 hours/week) spent in clinical care. The most common method of compensation was salary plus bonus (39.9%), followed by straight salary (32.0%), and pure production-based income (28.1%).

Although AP neurologists worked more hours per week on average (58.1 vs 55.3, $p < 0.001$), they spent a smaller proportion of their time in direct patient care (59.3% vs 87.6%, $p < 0.001$) and devoted more time to research (16.4% vs 1.7%, $p < 0.001$), teaching (11.3% vs 2.8%, $p < 0.001$), and administration (11.9% vs 6.5%, $p < 0.001$). CP neurologists spent more nights per week on call (median 2 vs 1, $p < 0.001$), cared for more outpatients per week (52.3 vs 29.5, $p < 0.001$), and spent more weekends per year rounding in the hospital (11.3 vs 8.1, $p < 0.001$). Compared to CP neurologists, AP neurologists were more likely to get a straight salary (42.9% vs 23.7%, $p < 0.05$) or a salary plus bonus (53.3% vs 32.8%, $p < 0.05$) and rarely received a production-based income (3.8% vs 43.6%, $p < 0.05$).

Career satisfaction and burnout. Table 3 compares burnout, career satisfaction, and well-being among participating neurologists. A majority, 53.4%, of neurologists (850 of 1,591) had high emotional exhaustion, 41.4% (664 of 1,603) high depersonalization, and 21.2% (334 of 1,573) a low personal accomplishment score. Overall, 60.1% (972 of 1,616) of neurologists had at least one symptom of burnout (high emotional exhaustion or high depersonalization). CP neurologists had a higher burnout rate than AP neurologists (63.3% vs 55.7%, $p = 0.004$), resulting from

Table 2 Subspecialty and workload for academic practice (AP) vs clinical practice (CP)

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	*p* Value comparison AP to CP[b]
Subspecialty				
Primary focus, %[c]				<0.001
General neurology	31.9	7.6	45.8[d]	
Other	9.8	12.0	7.4[d]	
Epilepsy	8.4	14.8	4.7[d]	
Child neurology	8.3	9.6	7.7	
Movement disorders	7.4	13.3	3.6[d]	
Vascular neurology and stroke	6.6	8.5	5.6	
Neuromuscular medicine	5.6	10.0	3.3[d]	
Headache medicine	3.9	4.4	3.8	
Neurohospitalist	3.5	1.3	4.9[d]	
Sleep medicine	3.4	2.8	3.7	
Behavioral neurology and neuropsychiatry	3.0	5.0	1.8[d]	
Clinical neurophysiology	3.0	2.6	3.5	
Neuroimmunology and multiple sclerosis	3.0	4.1	2.6	
Neurocritical care	2.3	3.7	1.5[d]	
Missing, n	344	71	178	
Compensation method, %				<0.001
Straight salary	32.0	42.9	23.7[d]	
Salary plus bonus	39.9	53.3	32.8[d]	
Production-based income	28.1	3.8	43.6[d]	
Missing, n	73	4	13	
Workload				
Hours worked per week				<0.001
Mean	55.7	58.1	55.3	
Median	55.0	60.0	55.0	
SD	16.3	14.4	16.9	
Missing, n	65	4	13	
% Time devoted to clinical practice				<0.001
Mean	76.1	59.3	87.6	
Median	85.0	60.0	90.0	
SD	24.8	23.9	15.2	
Missing, n	52	0	3	
% Time devoted to research				<0.001
Mean	7.4	16.4	1.7	
Median	0.0	10.0	0.0	
SD	16.2	20.6	5.8	
Missing, n	52	0	3	
% Time devoted to teaching				<0.001
Mean	5.9	11.3	2.8	
Median	3.0	10.0	0.0	
SD	8.9	11.1	5.4	
Missing, n	52	0	3	

Continued

Table 2 Continued

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	p Value comparison AP to CP[b]
% Time devoted to administration				<0.001
Mean	8.8	11.9	6.5	
Median	5.0	10.0	4.0	
SD	12.6	13.6	9.9	
Missing, n	52	0	3	
% Time devoted to other				0.592
Mean	1.8	1.1	1.3	
Median	0.0	0.0	0.0	
SD	9.5	5.9	6.0	
Missing, n	52	0	3	
Median nights on call/week	1	1	2	<0.001
Missing, n	83	13	17	
Mean no. outpatients in clinic per week	42.7	29.5	52.3	<0.001
Missing, n	69	5	10	
Mean no. inpatients on average hospital day	6.3	7.2	6.1	<0.001
Missing, n	72	8	10	
Mean no. weekends rounded in hospital	9.9	8.1	11.3	<0.001
Missing, n	66	5	7	

[a] Includes solo practice, neurology group, multispecialty group, and hospital-based.
[b] Comparisons tested using Kruskal-Wallis for continuous variables and χ^2 for categorical variables.
[c] Primary foci with fewer than 30 cases (including endovascular and interventional neurology) were added to the other category.
[d] This paired comparison (z test) was found to be significant at a $p < 0.05$ level.

higher scores in both emotional exhaustion ($p = 0.008$) and depersonalization ($p = 0.014$). Personal accomplishment scores were similar in AP and CP groups ($p = 0.764$). Demographic and practice characteristics associated with burnout on univariate analysis are reported in tables e-2 and e-3.

With respect to career satisfaction, 61.3% (995 of 1,622) of neurologists would choose to become a physician again while 67.2% (1,096 of 1,631) would choose to become a neurologist again. Career satisfaction scores differed between CP and AP neurologists, with more AP neurologists indicating they would choose to be both a physician ($p < 0.001$) and a neurologist ($p < 0.001$) again. Overall, 67.0% of neurologists were satisfied with their job, with no differences between AP and CP ($p = 0.434$).

Median overall quality of life (QOL) of neurologists was 7 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 clinically meaningful[30]: 34.2% of our respondents reported scores less than 6. Only 1 in 3 neurologists (32.3%: 523 of 1,620) indicated their work schedule left enough time for personal/family life. AP neurologists scored higher for QOL ($p = 0.033$), but there was no difference (all $p > 0.05$) in fatigue or work–life balance between AP and CP neurologists.

A majority of neurologists (59.9%) reported that they have significant autonomy in determining how they do their job. Most neurologists (87.6%) reported that their work is meaningful to them. There were no differences between AP and CP in these 2 measures ($p = 0.326$ and $p = 0.517$, respectively).

A minority of neurologists indicated the amount of time spent on clerical tasks was reasonable, both directly (23.0%: 369 of 1,607) and indirectly (15.9%: 255 of 1,605) related to patient care. A majority of neurologists (56.3%: 900 of 1,598) indicated that they had too little support staff to assist them in their work. Satisfaction with clerical tasks was lower for AP compared to CP neurologists in direct ($p = 0.004$) and indirect ($p = 0.010$) patient care tasks. AP neurologists were more likely to indicate that they lacked sufficient support staff ($p < 0.001$).

Factors associated with burnout. Multivariable analyses identified factors associated with burnout (table 4). In

Table 3 Burnout and career satisfaction: academic practice (AP) vs clinical practice (CP)

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	*p* Value comparison AP to CP[b]
Burnout indices[c]				
Emotional exhaustion[d]				
Median	28.0	26.5	29.0	0.008
% Low score	27.3	30.2	24.2[e]	0.023
% Intermediate score	19.3	19.8	19.1	
% High score	53.4	50.0	56.7[e]	
Missing, n	80	3	32	
Depersonalization[d]				
Median	8.0	7.0	8.0	0.014
% Low score	36.6	39.1	34.2	0.018
% Intermediate score	22.0	24.1	21.4	
% High score	41.4	36.8	44.4[e]	
Missing, n	68	2	18	
Personal accomplishment[d]				
Median	40.0	40.0	40.0	0.764
% High score	52.8	53.4	52.1	0.895
% Intermediate score	26.0	25.8	26.3	
% Low score[e]	21.2	20.8	21.6	
Missing, n	98	10	36	
% Burned out[f]	60.1	55.7	63.3	0.004
Missing, n	55	1	11	
Career satisfaction				
Would become physician again (career choice), % yes	61.3	67.4	57.5	<0.001
Missing, n	49	1	10	
Would become neurologist again (specialty choice), % yes	67.2	74.5	63.2	<0.001
Missing, n	40	0	2	
Overall, I am satisfied with my job, % agree	67.0	67.9	65.9	0.434
Missing, n	51	0	7	
Quality of life, fatigue, and work-life integration				
Overall quality of life,[g] mean (SD)	6.2 (2.2)	6.3 (2.1)	6.1 (2.2)	
Median	7.0	7.0	6.0	0.033
Missing, n	5	1	2	
Level of fatigue,[g] mean (SD)	5.2 (2.4)	5.2 (2.3)	5.2 (2.4)	
Median	5.0	5.0	5.0	0.586
Missing, n	9	2	3	
Work schedule leaves enough time for personal/family life, % agree	32.3	30.9	32.1	0.626
Missing, n	51	1	12	
Autonomy and meaning in work				
I have significant autonomy in determining how I do my job, % agree	59.9	58.0	60.6	0.326
Missing, n	46	1	3	

Continued

Table 3 Continued

	All (n = 1,671)	AP (n = 529)	CP[a] (n = 959)	p Value comparison AP to CP[b]
The work I do is meaningful to me, % agree	87.6	88.3	87.1	0.517
Missing, n	47	0	4	
Clerical tasks and support staff				
The amount of time I spend on clerical tasks directly[h] related to patient care is reasonable, % agree	23.0	18.3	24.8	0.004
Missing, n	64	4	5	
The amount of time I spend on clerical tasks indirectly[i] related to patient care is reasonable, % agree	15.9	12.2	17.2	0.010
Missing, n	66	4	7	
How much effective support staff do you have to assist you in your work? % Too little	56.3	67.9	49.1	<0.001
Missing, n	73	0	25	

[a] Includes solo practice, neurology group, multispecialty group, and hospital-based.
[b] Comparisons tested using Kruskal-Wallis for continuous variables and χ^2 for categorical variables.
[c] As assessed using the full Maslach Burnout Inventory.
[d] 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 scores ≤33 on the personal accomplishment subscale are considered to have a high degree of burnout in that dimension.
[e] Low scores on the Personal Accomplishment sub-scale are less favorable.
[f] High score on emotional exhaustion or depersonalization subscales of the Maslach Burnout Inventory (see Methods).
[g] Scale of 0 = As bad as it can be to 10 = As good as it can be.
[h] For example, order entry, dictation, laboratory results review, communicating with patients via a patient portal.
[i] For example, correspondence, completion of forms, answering phone calls.

addition to a model for all neurologists, separate models were developed for AP and CP neurologists because of substantial differences in personal and professional characteristics of these groups. For all neurologists, increased hours worked per week ($p = 0.003$), nights on call per week ($p = 0.013$), and number of outpatients ($p = 0.024$) were associated with higher burnout risk. Greater job autonomy ($p < 0.001$), meaningful work ($p < 0.001$), reasonable amount of direct clerical tasks ($p < 0.001$), effective support staff ($p = 0.001$), older age of the neurologist ($p < 0.001$), and reporting a subspecialty in epilepsy compared to general neurology ($p = 0.032$) were associated with lower burnout risk.

Risk profiles differed by practice setting. For AP neurologists, burnout was associated with more hours worked per week ($p = 0.006$) and higher percentage of clinical time ($p = 0.043$), while greater job autonomy ($p < 0.001$) was associated with lower burnout risk. For CP neurologists, burnout was associated with increased number of outpatients seen per week ($p = 0.004$), while greater job autonomy ($p < 0.001$), meaning in work ($p = 0.001$), reasonable amount of direct clerical tasks ($p = 0.002$), effective support staff ($p = 0.001$), older age ($p < 0.001$), and epilepsy subspecialization compared to general neurology ($p = 0.05$) were associated with lower burnout risk.

Factors associated with profession satisfaction. Multivariable analyses identified factors associated with profession satisfaction (table 5). Neurologists were 3 times more likely to be satisfied in their profession if they indicated that their work was meaningful ($p < 0.001$) and 2 times more likely to have profession satisfaction if they reported job autonomy ($p < 0.001$). Effective support staff ($p = 0.020$) and older age ($p < 0.001$) were also associated with profession satisfaction. Respondents meeting criteria for burnout were 64.3% less likely to have profession satisfaction ($p < 0.001$). Practicing sleep medicine was associated with 70% less profession satisfaction compared to general neurology ($p = 0.002$). Each one-unit increase of percent time in clinical practice was associated with 1% less profession satisfaction ($p = 0.005$).

DISCUSSION Our study evaluating burnout, career satisfaction, and well-being of US neurologists used instruments previously validated in studies of other medical specialties. At the time of our survey, approximately 60% of neurologists had at least one symptom of burnout, confirming earlier studies of smaller numbers of neurologists.[13,19]

Previous studies showed that burnout prevalence, career dissatisfaction, and work–life imbalance are higher among neurologists than physicians in most other specialties.[13,19] Our study confirms these findings

Table 4 Factors associated with burnout using multivariable analyses

Group	Predictor	95% CI			p Value
		OR	Lower	Upper	
All neurologists[a–d]	Autonomy in job (Q9a) (0 = disagree/neutral, 1 = agree)	0.325	0.237	0.446	<0.001
	Meaningful work (Q9b) (0 = disagree/neutral, 1 = agree)	0.334	0.188	0.593	<0.001
	Reasonable amount of direct clerical tasks (Q10a) (0 = disagree/neutral, 1 = agree)	0.498	0.340	0.731	<0.001
	Effective support staff (Q11) (0 = too little, 1 = about right)	0.593	0.440	0.801	0.001
	Hours worked per week (Q12)	1.016	1.005	1.027	0.003
	Nights on call per week (Q14)	1.092	1.019	1.171	0.013
	No. of outpatients (Q15)	1.007	1.001	1.013	0.024
	Age (Q19)	0.973	0.960	0.985	<0.001
	Epilepsy (Q24) (compared to general neurology)	0.536	0.303	0.947	0.032
Academic practice[a,b,e,f]	Autonomy in job (Q9a) (0 = disagree/neutral, 1 = agree)	0.332	0.193	0.573	<0.001
	Hours worked per week (Q12)	1.030	1.009	1.051	0.006
	% Clinical time (Q13_1)	1.016	1.000	1.032	0.043
Clinical practice[a,b,g,h]	Autonomy in job (Q9a) (0 = disagree/neutral, 1 = agree)	0.299	0.195	0.457	<0.001
	Meaningful work (Q9b) (0 = disagree/neutral, 1 = agree)	0.264	0.124	0.566	0.001
	Reasonable amount of direct clerical tasks (Q10a) (0 = disagree/neutral, 1 = agree)	0.469	0.289	0.761	0.002
	Effective support staff (Q11) (0 = too little, 1 = about right)	0.513	0.347	0.758	0.001
	No. of outpatients (Q15)	1.011	1.003	1.018	0.004
	Age (Q19)	0.958	0.941	0.975	<0.001
	Epilepsy (Q24) (compared to general neurology)	0.408	0.166	0.999	0.050

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 neurologists. Given substantial differences in professional characteristics, separate models were also created for academic practice neurologists and clinical practice neurologists.
[a] Personal characteristics in all models: age, sex, region.
[b] Professional characteristics in all models: autonomy, meaningful work, direct clerical tasks, indirect clerical tasks, effective support staff, hours per week, nights on call, number of outpatients, number of inpatients, number of weekends hospital rounding, subspecialty.
[c] Additional professional characteristics all neurologist model: % clinical time, academic vs clinical work setting, employment status, compensation method.
[d] Results 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: % clinical time, region, and behavioral neurology.
[e] Additional professional characteristics academic practice model: % professional time in (clinical, research, teaching, administration, other), compensation method (salary vs salary plus bonus).
[f] Results 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: direct and indirect clerical tasks, nights on call, region, child neurology, epilepsy, and sleep medicine.
[g] Additional professional characteristics clinical practice model: % clinical time, practice setting (solo, neurology group, multispecialty group, hospital), employment status, compensation method.
[h] Results shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise). One additional variable was significant in 2 of the methods: nights on call.

and points towards some potential explanations. Although epilepsy subspecialization was associated with lower burnout risk and sleep subspecialization was associated with less profession satisfaction, neurologists are experiencing greater struggles with drivers experienced by all physicians.[13,19] Neurologists work 55 median hours per week compared to 50 for all US physicians. Only 32.3% of neurologists indicated their work schedule leaves enough time for personal/family life compared to 40.9% of all physicians, a rate lower than every other medical specialty.[19] Only 23.0% of neurologists were satisfied with time spent on clerical tasks directly related to patient care compared to 37.2% of all physicians, a rate lower than every other medical specialty except family practice.[29] Similarly, only 15.9% of neurologists were satisfied with time spent on clerical tasks indirectly related to patient care, compared to 25.6% of all physicians.[29] Neurologists' mean overall QOL score was 6.2 with 34% scoring <6 compared to a mean of 7.4 with 28% scoring <6 for all physicians (personal communication, 2016, Tait Shanafelt).

Neurologists' profession satisfaction was also lower than that of physicians in other specialties.[19] Overall,

Table 5 Factors associated with profession satisfaction using multivariable analyses

	95% CI			
Predictor[a–c]	OR	Lower	Upper	*p* Value
Burnout[d]	0.357	0.253	0.505	<0.001
Autonomy in job (Q9a) (0 = disagree/neutral, 1 = agree)	2.113	1.543	2.893	<0.001
Meaningful work (Q9b) (0 = disagree/neutral, 1 = agree)	3.068	2.027	4.644	<0.001
Effective support staff (Q11) (0 = too little, 1 = about right)	1.464	1.062	2.019	0.020
% Time in clinical practice (Q13_1)	0.988	0.979	0.996	0.005
Age (Q19)	1.027	1.012	1.041	<0.001
Sleep medicine (Q24) (compared to general neurology)	0.300	0.138	0.650	0.002

Abbreviations: CI = confidence interval; OR = odds ratio.
Multivariable analyses were conducted to identify personal and professional factors associated with becoming a neurologist again.
[a] Results shown when variable was significant in all 3 variable entry methods (all at once, forward stepwise, and backward stepwise).
[b] Personal characteristics: age, sex, region, burnout.
[c] Professional characteristics: autonomy, meaningful work, direct clerical tasks, indirect clerical tasks, effective support staff, hours per week, nights on call, number of outpatients, number of inpatients, number of weekends hospital rounding, subspecialty, % clinical time, academic vs clinical work setting, employment status, compensation method.
[d] High score on Emotional exhaustion or depersonalization subscales of the Maslach Burnout Inventory (see Methods).

61.3% of neurologists would become a physician again, compared to 67% of all physicians. If they could revisit their specialty choice, 67.2% would become a neurologist again, compared to 70.8% of all physicians. Neurologists' lower career and specialty satisfaction is consistent with their higher burnout rate and lower work–life balance; however, this pattern is not observed in other specialties. For example, medical oncologists have markedly higher rates of career and specialty satisfaction than neurologists but have average burnout rates and very low rates of satisfaction with work–life balance.[26,31]

Engagement, a persistent positive state of fulfillment characterized by vigor, dedication, and absorption, is the inverse of burnout.[18,32–35] Promoting engagement may lower burnout risk. Individual, work unit, organization, and national factors can influence burnout and engagement.[8,29] Strategies to mitigate burnout and increase engagement can be aimed at each of these levels.[8,29]

Our study is subject to several limitations. Although our response rate of ~40% is consistent with[36] or higher[19,37] than physician surveys in general, and we found no significant differences among early responders compared to late responders with respect to age, sex, practice setting, geographic region, or burnout, response bias remains possible. Because the survey was cross-sectional, we were unable to determine causality or potential direction of effect for the associations observed. Distinctions between AP and CP settings may have been blurred because AP and CP definitions were ambiguous, given the wide variety of current AP models. Some respondents working in academic settings may have designated themselves as CP.

Our study has important strengths. Our mixed-methods survey design led to a high participation rate relative to other national studies of physicians. The neurologists in the sample were drawn from the AAN member database, a list comprising most US neurologists. The survey included neurologists with a wide range of personal and practice characteristics. The extensive information collected on these characteristics enabled detailed insights into relationships among these factors and burnout, career satisfaction, and well-being for most neurologists.

Our results provide a high-level overview of factors associated with increased burnout, decreased career satisfaction, and well-being in neurologists and why neurology fares poorly compared to other specialties, but are insufficient to determine all the underlying reasons. One can speculate that personality traits of those who choose neurology[3]; the time-consuming and meticulous nature of neurologic assessment; and the intellectual, emotional, and physical devastation associated with many neurologic illnesses may play important roles,[20–22] but additional studies are needed to assess these hypotheses. Qualitative analysis of the free text comments many respondents contributed to our survey may provide some insights.

Excessive workload (i.e., hours and patient volume), loss of autonomy, clerical burden, and inadequate support staff are associated with the high prevalence of burnout and low rates of satisfaction with career and work–life integration among US neurologists. Effective approaches to address these issues and

cultivate meaning and engagement in neurology practice could include efforts within the work unit and organization to improve efficiency, optimize workload, decrease clerical burden, provide greater flexibility and control over work, and enhance support staff.[38] Physician-friendly national policies that decrease regulatory burden and mandated clerical tasks would also enhance neurologists' engagement in the practice of neurology.[22,39] Studies testing strategies to achieve these goals will likely foster more rapid dissemination of best practices.[40]

AUTHOR CONTRIBUTIONS

Neil A. Busis: 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, drafting and 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. Kerry H. Levin: design of the study, interpretation of the data, revising the manuscript for intellectual content. Heidi B. Schwarz: design of the study, drafting and revising the manuscript for intellectual content. Jennifer R. Molano: design of the study, drafting and revising the manuscript for intellectual content. Thomas R. Vidic: design of the study, drafting and revising the manuscript for intellectual content. Joseph S. Kass: drafting the manuscript for intellectual content. Janis M. Miyasaki: drafting 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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