Comprehensive Characterization of the General Surgery Residency Learning Environment and the Association With Resident Burnout

Ryan J. Ellis, MD, MS,† Joseph D. Nicolas, BS,* Elaine Cheung, PhD,‡ Lindsey Zhang, MD, MS,*†§ Meixi Ma, MD, MS,*†¶ Patricia Turner, MD,†§ Michael S. Nussbaum, MD,|| Chandrakanth Are, MD,** Douglas S. Smink, MD, MPH,†† Caryn Etkin, PhD,* Karl Y. Bilimoria, MD, MS,*† and Yue-Yung Hu, MD, MPH*✉*

Objectives: To characterize the learning environment (ie, workload, program efficiency, social support, organizational culture, meaning in work, and mistreatment) and evaluate associations with burnout in general surgery residents.

Background Summary Data: Burnout remains high among general surgery residents and has been linked to workplace exposures such as workload, discrimination, abuse, and harassment. Associations between other measures of the learning environment are poorly understood.

Methods: Following the 2019 American Board of Surgery In-Training Examination, a cross-sectional survey was administered to all US general surgery residents. The learning environment was characterized using an adapted Areas of Worklife survey instrument, and burnout was measured using an abbreviated Maslach Burnout Inventory. Associations between burnout and measures of the learning environment were assessed using multivariable logistic regression.

Results: Analysis included 5277 general surgery residents at 301 programs (85.6% response rate). Residents reported dissatisfaction with workload (n = 784, 14.9%), program efficiency and resources (n = 1392, 26.4%), social support and community (n = 1250, 23.7%), organizational culture and values (n = 853, 16.2%), meaning in work (n = 1253, 23.7%), and workplace mistreatment (n = 2661, 50.4%). The overall burnout rate was 43.0%, and residents were more likely to report burnout if they also identified problems with residency workload [adjusted odds ratio (aOR) 1.60, 95% confidence interval (CI) 1.31–1.94], efficiency (aOR 1.74; 95% CI 1.49–2.03), social support (aOR 1.37, 95% CI 1.15–1.64), organizational culture (aOR 1.64; 95% CI 1.39–1.93), meaning in work (aOR 1.87; 95% CI 1.56–2.25), or experienced workplace mistreatment (aOR 2.49; 95% CI 2.13–2.90). Substantial program-level variation was observed for all measures of the learning environment.

Conclusions: Resident burnout is independently associated with multiple aspects of the learning environment, including workload, social support, meaning in work, and mistreatment. Efforts to help programs identify and address weaknesses in a targeted fashion may improve trainee burnout.

Keywords: areas of worklife, burnout, residency, wellness

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Clinician burnout has been linked to multiple adverse outcomes, including self-reported medical errors, attrition, and physician suicidality.[1–3] Rates of burnout are high in all physicians, and thought to be higher in certain surgical subspecialties, among females, and among trainees.[4,5] Due to these concerns, the Accreditation Council for Graduate Medical Education officially laid out a provision in Common Program Requirements addressing trainee well-being, though the extent of programmatic responsibility is largely undefined.[6]

Substantial research has examined methods for reducing physician burnout. A range of potentially effective interventions have been studied, with the majority focusing on coping strategies such as mindfulness training, stress relief tactics, and small group discussion of stressful events.[7] However, these interventions have been criticized for focusing on burnout as a problem of individual resiliency, while largely ignoring the aspects of organizational culture that may contribute to burnout.[8,9] Specifically for trainees, studies have shown that difficult working conditions, unfair treatment, and challenging hours can contribute to poor resident wellness.[5,10–14] Significant program-level variation exists, indicating that these predisposing factors are not inherent to the training environment and may be modifiable.[15]

Despite evidence of the role of the learning environment in development of trainee burnout, a comprehensive assessment of the learning environment has not been completed at a national level. Moreover, the relative association between different learning environment domains and trainee burnout is poorly understood. Thorough understanding of these nuances of the surgical learning environment could inform trainee wellness interventions, and assist in identifying residents and programs at high risk for burnout. The objectives of this comprehensive national survey were to (1) assess resident satisfaction with multiple aspects of the learning environment using a modified Areas of Worklife survey, (2) evaluate the association between these measures of the workplace environment and trainee burnout,

From the *Surgical Outcomes and Quality Improvement Center (SOQIC), Department of Surgery and Center for Healthcare Studies, Feinberg School of Medicine, Northwestern University, Chicago, Illinois; †American College of Surgeons, Chicago, Illinois; ‡Department of Medical Social Sciences, Feinberg School of Medicine, Northwestern University, Chicago, Illinois; §Department of Surgery, University of Chicago, Chicago, Illinois; ¶Department of Surgery, University of Alabama Birmingham, Birmingham, Alabama; ||Department of Surgery, Virginia Tech Carilion School of Medicine, Roanoke, Virginia; **Department of Surgery, University of Nebraska School of Medicine, Omaha, Nebraska; and ††Department of Surgery, Brigham and Women's Hospital, Boston, Massachusetts.

✉yueyunghu@luriechildrens.org.

Author Contributions: Study Conception and Design: Ellis, Nicolas, Cheung, Zhang, Ma, Turner, Nussbaum, Are, Smink, Etkin, Bilimoria, Hu.
Acquisition of Data: Ellis, Nicolas, Zhang, Ma, Bilimoria, Hu.
Analysis and Interpretation of Data: Ellis, Nicolas, Cheung, Zhang, Ma, Bilimoria, Hu
Drafting of Manuscript: Ellis, Nicolas, Bilimoria, Hu.
Critical Revision: Ellis, Nicolas, Cheung, Zhang, Ma, Turner, Nussbaum, Are, Smink, Etkin, Bilimoria, Hu.
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and (3) quantify program-level variation in measures of the learning environment.

METHODS

Study Design and Participants

A voluntary, multiple-choice survey was administered to general surgery residents following the January 2019 American Board of Surgery In-Training Examination. The study population included only clinically active residents, and responses were de-identified before analysis. The Northwestern University Institutional Review Board office determined that this study constitutes non-human subjects research.

Resident Survey Development

The survey instrument included content related to resident burnout and measures of workplace stressors.[16] Survey items were adapted from previously published and validated surveys[17–21]; content that was deemed relevant but not addressed by an existing instrument was developed.[16] Pretest cognitive interviews were conducted with general surgery residents to evaluate survey coherence and clarity. The survey subsequently underwent iterative revisions and retesting before dissemination.[22]

Resident and Program Characteristics

Resident characteristics collected included sex, race, post-graduate year (categorized as 1, 2/3, or 4/5), and relationship status (categorized as married or in a relationship, not in a relationship, or divorced/widowed). Program characteristics collected included program size (total number of residents broken into quartiles: <24, 24–34, 35–49, ≥50), program type (academic or community/military), and program location (Northeast, Southeast, Midwest, Southwest, West).

Resident Learning Environment

Residents were queried regarding the number of months in the current academic year in which they had violated the Accreditation Council for Graduate Medical Education duty hour restrictions, specifically the 80-hour workweek, 1 day off in 7, and no more than one 24 hour call in 3 days, averaged over 4 weeks. Responses of 3 or more months (ie, more than half of the present academic year) were coded as "frequent" violations for the purposes of subsequent analyses.

Additional survey items related to the learning environment were adapted from the Areas of Worklife Survey.[23] Developed as a way to integrate various organizational qualities into a single model of the workplace environment, the Areas of Worklife framework defines 6 domains of organizational culture: workload, control, reward, community, fairness, and values. These domains encompass many proposed workplace mediators of burnout symptoms, such as duty hours, parenting or family tensions, camaraderie, and mentorship. Such a framework offers a validated mechanism to quantify workplace exposures.[24,25]

Selected questions were modified to provide more specificity to the residency learning environment (eg, "boss" replaced with "attending surgeon"). All survey items were assessed on a 5-point Likert scale. Responses were considered "negative" when the trainee either disagreed or strongly disagreed with the question stem. Additional context-specific questions were crafted to assess aspects of the environment that are pertinent and specific to surgical residents (eg, operative and clinical endpoints). Questions on trainee mistreatment (bullying, sexual harassment, discrimination based on sex or sexual orientation, discrimination based on sex, and discrimination based on race or religion) were included based on results of previous studies.[5] Trainee responses to these items were considered "frequent" if the behavior was reported a few times per month or more.

Survey items overall fell into 6 learning environment domains, modified from the Areas of Worklife Survey and drivers of burnout previously identified by Shanafelt et al: Workload and Job Demands, Efficiency and Resources, Social Support and Community, Organizational Culture and Values, Meaning in Work, and Workplace Mistreatment.[8] Relevant survey items can be found in Appendix Methods.

Resident Burnout

Symptoms of burnout were assessed using a modified, abbreviated Maslach Burnout Inventory Human Services Survey for Medical Personnel.[26–28] The instrument assessed emotional exhaustion and depersonalization with 3 questions for each domain. To facilitate data interpretation and presentation of the 2 burnout subscales, subscale scores were dichotomized into 2 groups. Burnout was defined as reporting symptoms of either emotional exhaustion or depersonalization at least weekly.[5,15,29]

Statistical Analysis

Multivariable logistic regression models adjusting for resident clustering within programs were constructed to examine the association between learning environment domains and resident burnout. Level of significance was set to 0.05. Data analyses were performed at Northwestern University. Statistical analyses were performed using STATA 15.1 (StataCorp LP, College Station, TX).

RESULTS

Of 8129 clinically active general surgery residents at 301 Accreditation Council for Graduate Medical Education-accredited training programs, 6956 completed the 2019 post-American Board of Surgery In-Training Examination survey (85.6% response rate). Residents with incomplete burnout responses (n = 916, 13.1%) and incomplete learning environment assessments (n = 763, 10.9%) were excluded, yielding 5277 responses at 300 programs for analysis. Overall, 2142 (40.6%) were female and 3256 (61.7%) were non-Hispanic White. Additional demographics of the study population are shown in Table 1.

Resident Assessment of Learning Environment Domains

Problems with workload and job demands were reported by 784 residents (14.9%), mostly due to frequent violations of the 80-hour work week (n = 679, 12.9%). Dissatisfaction with efficiency and resources were reported by 1392 residents (26.4%), with ineffective use of support staff being the most common negative response (n = 939, 17.8%). Nearly one-fourth of residents noted dissatisfaction with social support and community (n = 1250, 23.7%), citing lack of close friends within training (n = 636, 12.1%) and lack of mentorship (n = 640, 12.1%). A similar number of residents were dissatisfied with organizational culture and values (n = 1253, 23.7%), often noting failure to provide avenues for residents to cope with adverse events (n = 1002, 19.0%). Fewer residents cited dissatisfaction with Meaning in Work (n = 853, 16.2%), with dissatisfaction most commonly due to lack of time in the operating room (n = 429, 8.1%) or lack of operative autonomy (n = 481, 9.1%). Workplace mistreatment was reported by 2661 residents (50.4%), most commonly due to discrimination based on sex, sex identity, or sexual orientation (n = 1880, 35.6%). More detailed response data are available in Table 2.

Associations Between Learning Environment Domains and Resident Burnout

Burnout was reported by 2269 (43.0%) residents. In multivariable modeling, residents were less likely to report burnout if

TABLE 1. Characteristics of Residents From 301 Surgical Residency Programs

	Overall n (%)
Total Number of Residents	**N = 5277**
Sex	
Male	3016 (57.2)
Female	2142 (40.6)
Unknown	119 (2.3)
Race/ethnicity	
Non-Hispanic White	3256 (61.7)
Non-Hispanic Black	214 (4.1)
Hispanic	441 (8.4)
Asian	890 (16.9)
Other/unknown	476 (9.0)
Clinical post graduate year (PGY)	
1	1235 (23.4)
2/3	2124 (40.3)
4/5	1918 (36.3)
Relationship status	
Married/relationship	3955 (75.0)
No relationship	1202 (22.8)
Divorced/widowed	101 (1.9)
Unknown	19 (0.3)
Program size (total number of residents)	
Quartile 1 (<24)	1384 (23.2)
Quartile 2 (24–34)	1320 (25.0)
Quartile 3 (35–49)	1367 (25.9)
Quartile 4 (≥50)	1206 (22.9)
Program type	
Academic	3040 (57.6)
Independent/military	2237 (42.4)
Program location	
Northeast	1713 (32.5)
Southeast	1064 (20.2)
Midwest	1188 (22.5)
Southwest	598 (11.3)
West	714 (13.5)

Hispanic [adjusted odds ratio (aOR) 0.64, 95% confidence interval (CI) 0.50–0.81; $P < 0.001$] or Asian (aOR 0.68, 95% CI 0.57–0.83; $P < 0.001$). Poor performance on each learning environment domain was independently associated with higher odds of resident burnout. Residents were more likely to report burnout if they were dissatisfied with workload and job demands (aOR 1.60, 95% CI 1.31–1.94), efficiency and resources (aOR 1.74; 95% CI 1.49–2.03), social support and community (aOR 1.37, 95% CI 1.15–1.64), organizational culture and values (aOR 1.64; 95% CI 1.39–1.93), meaning in work (aOR 1.87; 95% CI 1.56–2.25), or reported workplace mistreatment (aOR 2.49; 95% CI 2.13–2.90; Table 3). There were no statistically significant interactions between Areas of Worklife domains.

Program-level Variation in Learning Environment

Program-level variation was observed for each individual item included in the analysis (Table 4). Similar variation was observed when aggregating into domains, including dissatisfaction with workload and job demands [median 12.5%, interquartile range (IQR): 5.9%–20%, range 0%–61.5%], efficiency and Resources (median 21.6%, IQR: 10.0%–35.7%, range 0%–84.6%), social support and community (median 22.2%, IQR: 14.3%–31.7%, range 0%–75.0%), organizational culture and values (median 21.1%, IQR: 12.5%–32.8%, range 0%–92.3%), meaning in work (median 12.9%, IQR: 7.1%–21.1%, range 0%–61.1%), and workplace mistreatment (median 50.0%, IQR: 38.5%–61.2%, range 0%–100%; Fig. 1).

TABLE 2. Measures of Workload, Social Support, and Meaning in Work in General Surgery Residency*

	n (%)
Total Number of Residents	**N = 5277**
Workload and job demands*	
Frequent violations of 80 h work week	679 (12.9)
Frequently with less than 1 d off in 7	227 (4.3)
Frequently with more than 1 call in 3 d	137 (2.6)
Efficiency and resources	
I do not have adequate time for patient care	496 (9.4)
My program does not effectively use support staff (eg, Advance Practice Providers)	939 (17.8)
My program does not protect educational time	672 (12.7)
Social support and community	
Residents in my do not cooperate	158 (3.0)
Co-residents are not among my closest friends	636 (12.1)
Co-residents do not appreciate my work	206 (3.9)
Attending surgeons do not appreciate my work	381 (7.2)
I do not have a mentor that genuinely cares	640 (12.1)
Organizational culture and values	
My program is not responsive to resident concerns	390 (7.4)
My program does not take wellness seriously	430 (8.2)
My program does not help decompress, debrief, or cope after adverse events	1002 (19.0)
My program does not emphasize learning versus blame after adverse events	464 (8.8)
Meaning in work	
I do not spend enough time in the operating room	429 (8.1)
I do not have an appropriate amount of operative autonomy	481 (9.1)
I do not have an appropriate amount of clinical autonomy	230 (4.4)
Dissatisfied with decision to become a surgeon	260 (4.9)
Workplace mistreatment	
Reported frequent bullying in workplace	899 (17.0)
Reported frequent sexual harassment in workplace	743 (14.1)
Reported frequent discrimination based on sex or sexual orientation	1880 (35.6)
Reported frequent discrimination based on race/ethnicity	758 (14.4)
Domain aggregates†	
Workload and job demands	784 (14.9)
Efficiency and resources	1392 (26.4)
Social support and community	1250 (23.7)
Organizational culture and values	1253 (23.7)
Meaning in work	853 (16.2)
Workplace mistreatment	2661 (50.4)

*Frequent defined as ≥3 violations in the last 6 mo.

†Calculated as number of individuals answering with a negative response to any question within the domain.

DISCUSSION

The results of this national survey of general surgery residents provide the most comprehensive characterization to date of multiple facets of the residency learning environment and the relationship of that environment to burnout. Residents frequently cited dissatisfaction with aspects of the learning environment. Deficiencies in each measured domain of training culture – workload and job demands, efficiency and resources, social support and community, organizational culture and values, meaning in work, and workplace mistreatment – were independently associated with resident burnout. Finally, there was notable program-level variation in each measured domain. These results offer a comprehensive framework from which to design national improvement efforts.

National work on physician and trainee wellness has focused on workload and work-life integration as drivers of burnout. However, research from the Flexibility In Duty Hour Requirements for

TABLE 3. Association Between Burnout and Workload, Social Support, and Meaning in Work (n = 5139)

	Rate		
Overall	**43.0%**	**OR (95% CI)[†]**	***P*-value**
General characteristics			
Sex			
Male	39.0%	1.0	REF
Female	48.6%	0.87 (0.75–1.01)	0.063
Race/ethnicity			
Non-Hispanic White	45.6%	1.0	REF
Non-Hispanic Black	46.3%	0.90 (0.64–1.26)	0.525
Hispanic	36.1%	0.64 (0.50–0.81)	<0.001
Asian	37.9%	0.68 (0.57–0.83)	<0.001
Other/unknown	39.9%	0.65 (0.52–0.81)	<0.001
Clinical post graduate year			
1	46.7%	1.0	REF
2/3	42.3%	1.18 (0.98–1.42)	0.078
4/5	41.4%	0.96 (0.83–1.11)	0.559
Relationship status			
Married/relationship	43.0%	1.0	REF
No relationship	42.9%	0.88 (0.75–1.03)	0.107
Divorced/widowed	43.6%	0.97 (0.64–1.49)	0.897
Program size			
Quartile 1 (<26)	38.6%	1.0	REF
Quartile 2 (26–36)	41.4%	1.05 (0.84–1.29)	0.682
Quartile 3 (37–50)	46.5%	1.23 (0.97–1.56)	0.084
Quartile 4 (>50)	45.9%	1.15 (0.88–1.49)	0.318
Program type			
Academic	45.3%	1.0	REF
Independent/military	39.8%	0.91 (0.75–1.11)	0.338
Program location			
Northeast	41.9%	1.0	REF
Southeast	43.4%	1.16 (0.94–1.42)	0.176
Midwest	41.8%	1.10 (0.90–1.35)	0.343
Southwest	41.3%	0.99 (0.77–1.28)	0.966
West	48.5%	1.38 (1.05–1.81)	0.020
Workload and job demands			
No negative responses	39.3%	1.0	REF
≥1 negative response	64.3%	1.60 (1.31–1.94)	<0.001
Efficiency and resources			
No negative responses	35.0%	1.0	REF
≥1 negative response	65.2%	1.74 (1.49–2.03)	<0.001
Social support and community			
No negative responses	37.0%	1.0	REF
≥1 negative response	62.2%	1.37 (1.15–1.64)	<0.001
Organizational culture and values			
No negative responses	35.6%	1.0	REF
≥1 negative response	66.9%	1.64 (1.39–1.93)	<0.001
Meaning in work			
No negative responses	37.8%	1.0	REF
≥1 negative response	69.9%	1.87 (1.56–2.25)	<0.001
Workplace mistreatment			
No negative responses	29.3%	1.0	REF
≥1 negative response	56.5%	2.49 (2.13–2.90)	<0.001

CI indicates confidence interval; OR, odds ratio.

TABLE 4. Program-level Variation in Negative Responses to Individual Measures of Workload, Social Support, and Meaning in Work (N = 300)

	Median (IQR)
Workload and job demands	
Frequent violations of 80 h work week	10.2% (4.2%–18.3%)
Frequently with less than 1 d off in 7	0% (0%–7.7%)
Frequently with more than 1 call in 3 d	0% (0%–4.3%)
Efficiency and resources	
I do not have adequate time for patient care	7.3% (0%–14.3%)
My program does not effectively use support staff (eg, APNs)	12.5% (3.8%–25.0%)
My program does not protect educational time	7.9% (0%–16.7%)
Social support and community	
Residents in my do not cooperate	0% (0%–5.6%)
Co-residents are not among my closest friends	10.4% (4.5%–17.6%)
Co-residents do not appreciate my work	0% (0%–6.9%)
Attending surgeons do not appreciate my work	5.6% (0%–10.8%)
I do not have a mentor that genuinely cares	10.3% (3.9%–16.5%)
Organizational culture and values	
My program is not responsive to resident concerns	5.2% (0%–12.0%)
My program does not take wellness seriously	5.9% (0%–12.5%)
My program does not help decompress, debrief, or cope after adverse events	17.0% (9.1%–27.2%)
My program does not emphasize learning vs blame after adverse events	6.6% (0%–12.7%)
Meaning in work	
I do not spend enough time in the operating room	4.5% (0%–11.7%)
I do not have an appropriate amount of operative autonomy	5.9% (0%–13.4%)
I do not have an appropriate amount of clinical autonomy	0% (0%–7.1%)
Dissatisfied with decision to become a surgeon	3.2% (0%–8.3%)
Workplace mistreatment	
Reported frequent bullying in workplace	16.7% (9.1%–24.8%)
Reported frequent sexual harassment in workplace	13.0% (6.4%–20.0%)
Reported frequent discrimination based on sex or sexual orientation	36.4% (25.0%–42.6%)
Reported frequent discrimination based on race/ethnicity	13.3% (6.9%–20.0%)

IQR indicates interquartile range.

Surgical Trainees trial highlighted that, at least among surgical residents, workload and work-life integration do not seem sufficient to explain evaluation of the work environment.[22] Surgical residents preferred flexible duty hour policies that allowed them to work longer hours when needed to provide patient care or seek educational opportunities. Moreover, surgical resident wellness is worsening, independent of assignment to either flexible or traditional duty hours regulations.[30] This work indicates that other aspects of the learning environment have substantial and previously unmeasured effects on resident well-being.

Workplace mistreatment was the most cited exposure in the residency environment and demonstrated the strongest association with resident burnout. This finding is in line with previous research on similar datasets, but with a notable increase in reporting of sex discrimination, sexual harassment, and racial discrimination.[5] Unlike in previous iterations of this national survey,[31] specific behaviors were queried and aggregated to define the rate of mistreatment. This approach has been shown to increase reporting rates;[32] thus, rates that are higher than those previously reported could reflect prior underestimation by the use of global questions rather than substantial worsening of the underlying behaviors.

While previous research on resident burnout has largely focused on the role of trainee resilience, mistreatment, and workload,[5,22,33–36] this study highlights several other potential mediators of resident wellness. Approximately 1 in 4 surgical trainees were dissatisfied with workplace efficiency, social support, and organizational culture, and 1 in 6 cited a lack of meaning in their work. While undoubtedly interconnected in complex ways, these domains as defined were each independently associated with burnout symptoms,

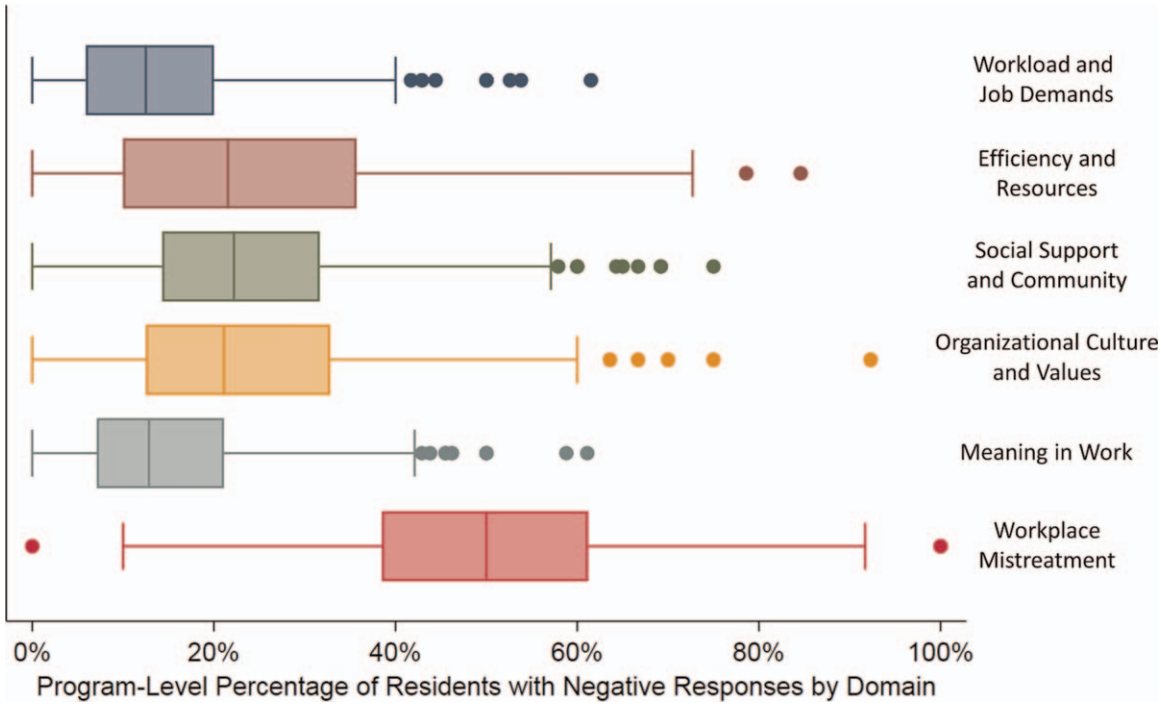

FIGURE 1. Program-level rates. Program-level rates of negative responses by area of worklife domain among all residents included in the analysis. Boxes encompass 25th percentile to 75th percentile, with vertical bar within representing median. Whiskers are ±2.5 IQR, and outlier programs identified with additional points. IQR indicates interquartile range.

implying compounding risk of burnout in trainees that are dissatisfied with multiple aspects of the workplace environment. While similar results have been noted in other populations,[37] this study is the most comprehensive assessment of the surgical training environment to date and the first to define the independent associations between multiple workplace exposures and trainee burnout.

Beyond simply describing additional workplace exposures that may drive burnout, these results are granular enough to provide real and actionable targets for improvement. Survey questions were deliberately structured to ascertain not just satisfaction with an aspect of the workplace, but to infer satisfaction based on responses to detailed questions grounded in common workplace exposures. For example, dissatisfaction in efficiency and resources was derived largely from failures to protect educational time and utilize support staff. Similarly, shortcomings in meaning in work were defined by dissatisfaction with time in the operating room and trainee autonomy. The results of the multivariable model imply that strengths in one area may mitigate weaknesses in other areas (and vice versa), which provide unique and valuable insight into tangible steps that may be taken by individual surgical programs to improve their trainees' wellness.

The possibility of targeted improvement is supported by the program-level variation in survey results indicates significant opportunities for improvement. The median of many exposures was 0% at the program level, implying that many training environments around the country have developed mechanisms to mediate these problems. National efforts to disseminate best practices, such as the ongoing Surgical Education Culture Optimization Through Targeted Interventions Based on National Comparative Data Trial, may help programs improve in weak areas by implementing policies and identifying/providing resources that have been successful at other institutions. In aggregate, these results provide the most comprehensive framework to date for understanding trainee burnout and designing interventions to improve the wellness of surgical trainees.

These results must be interpreted in the context of the study limitations. Cross-sectional data cannot discern causality or directionality of associations, and therefore results should be considered hypothesis-generating. Second, the timing of the survey (immediately after a stressful examination) may bias results in either direction due to the stress of the exam itself or post-exam relief. The advantages of the high response rate likely outweigh any disadvantages associated with survey timing. Administration at different times of the year could be considered in the future, recognizing that doing so introduces additional layers of complexity in interpretation, as other stressors that are not shared by the entire population become more prominent. Third, the timing of the survey requires residents to recall events from the somewhat distant past, which may introduce some level of recall bias. Fourth, while the administered survey items were adapted from validated instruments and/or rigorously developed to address gaps in existing validated instruments, there may be relevant parts of the learning environment that went unexamined (eg, difficulty in obtaining studies, time spent negotiating with insurance, the greater institutional context) that could be considered in future work. Finally, program-level covariation in Areas of Worklife domains may reveal interesting and actionable trends but were beyond the scope of this study.

CONCLUSIONS

Surgical residents frequently report dissatisfaction with workload and job demands, efficiency and resources, social support and community, organizational culture and values, meaning in work, and workplace mistreatment, and each is independently associated with trainee burnout. Substantial variation in resident satisfaction at the program level implies that targeted efforts to help programs identify and address weaknesses may improve trainee burnout.

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