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High Prevalence of Burnout Among U.S. Emergency Medicine Residents: Results from the 2017 National Emergency Medicine Wellness Survey --Manuscript Draft--

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**High prevalence of burnout among U.S. emergency medicine residents: Results from the
2017 National Emergency Medicine Wellness Survey**

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This study was an initiative launched by the Academic Life in Emergency Medicine (ALiEM) Wellness Think Tank organization. All the authors, who are Think Tank members, provided substantial contributions in conceiving the study and study design, iteratively drafting the manuscript, and provided final confirmatory approval of this final manuscript version per ICJME authorship criteria. Additionally, MM and ML obtained sponsors to purchase the gift cards and rewards for survey respondents. MM obtained institutional review board approval. MM, NB, SM, AC, and ML coordinated data collection, social media awareness of the survey, response monitoring, confirmation of the residents, and distribution of the gift cards via email. MM, DR, and ML coordinated discussions with statisticians and performed the analyses. ML takes responsibility for the paper as a whole.

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ABSTRACT

1
2 OBJECTIVE: Prior work shows that emergency medicine (EM) attendings have higher-than-
3
4 average rates of burnout. Preliminary data suggests that EM residents are also at risk for
5
6 burnout. National assessments of burnout among U.S. EM resident burnout are lacking.
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12 METHODS: This prospective 2017 National Emergency Medicine Resident Wellness Survey
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14 study was conducted through the Wellness Think Tank whereby EM residents from 247
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16 residencies across the United States were invited to participate in a national survey. The
17
18 primary measure of burnout was the Maslach Burnout Inventory-Human Services Survey
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20 (MBI-HSS). As per others' work, "burnout" was defined as a dichotomous variable
21
22 represented by high levels of emotional exhaustion or depersonalization. Due to interpretative
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24 variability with the MBI-HSS tool, we also calculated burnout rates using a more restrictive
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26 definition and more inclusive definition that have been reported in the literature.
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34 RESULTS: Surveys were completed by 1,522 residents (21.1% of all U.S. EM residents),
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36 representing 193 of 247 (78.1%) U.S. EM residency programs. Within this sample, the
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38 prevalence of burnout residents was 76.1% [95% CI 74.0-78.3%]. Applying alternative
39
40 definitions, burnout prevalence rates for this same sample was 18.2% [16.3-20.1%] using the
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42 more restrictive definition and 80.9% [78.9-82.9%] using the more inclusive definition.
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49 CONCLUSIONS: The majority of U.S. EM residents responding to this survey reported
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51 symptoms consistent with burnout, highlighting that physician burnout in the EM profession
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53 seems to begin as early as residency training. These findings may provide a baseline against
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55 which future work can be compared.
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INTRODUCTION

Background

Physician burnout has been defined as a complex, multidimensional, psychological syndrome resulting from long-term stress during one's career. The 22-item Maslach Burnout Inventory-Human Services Survey (MBI-HSS) is the most widely-used validated tool to measure burnout in healthcare professionals. It assesses three subscale domains: emotional exhaustion (EE), which means being emotionally depleted at work; depersonalization (DP), which means a lack of feelings or negative, cynical feelings towards others; and personal accomplishment (PA), which is a positive sense of self-evaluation and success at work. The authors of the MBI-HSS suggest that high EE, high DP, and low PA scores are correlated with burnout.^{1,2}

The MBI-HSS authors originally designed the tool with burnout subscale scores reported as a continuum. They subsequently proposed that, if a dichotomous definition is used (such as for clinically relevant reporting), a more restrictive approach should be taken to avoid overestimation. Specifically, burnout exists if all three criteria of a high EE, high DP, and low PA score are present. They validated definitions of low, moderate, and high scores for each of the subscales.¹ Despite this recommendation and because there is no gold standard definition for burnout, many study authors defined burnout as a dichotomous variable (burned out or not burned out) and applied their own definitions for burnout using the MBI-HSS subscales.³⁻⁵ This has since muddied the burnout research literature with at least 47 distinctly different definitions reported.⁶⁻¹⁴

Regardless of how burnout is defined, emergency medicine (EM) physicians appear particularly vulnerable to burnout compared to those in other specialties with reported rates of over 60%, and prior literature suggests burnout may start earlier during residency

1 training.^{7,8,11,14-23} Prior research in EM physician burnout have been restricted to a small
2 subset of physicians from a single program, single gender, geographic region, a mix of
3 independently practicing and resident trainee physicians, and licensure, in addition to
4 implementing a variety of burnout survey tools.^{15,16,24,25} This limits generalizability to the EM
5 and broader graduate medical education community as a whole.
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11 **Importance**

12 Physician burnout negatively impacts not only physicians but also their colleagues and
13 patients. It has been associated with perceptions of providing suboptimal patient care,^{16,24}
14 lack of empathy,²⁶⁻²⁸ perceived and self-reported medical errors,^{9,17,26} intent to leave the
15 profession,^{1,29} poor job satisfaction,^{8,24} and lack of professionalism.³⁰⁻³²
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29 **Goals of this Investigation**

30 We aimed to evaluate the current state of burnout in U.S. EM residents by launching the 2017
31 National EM Resident Wellness Survey, which incorporated the MBI-HSS tool. Our study is
32 the first national-level assessment of burnout rates for EM residents. We hypothesized that
33 there is a high prevalence rate during EM residency training prior to them becoming
34 independently practicing emergency physicians.
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48 **METHODS**

49 **Study design**

50 In this prospective survey study, U.S. EM residents completed a self-administered,
51 incentivized online questionnaire, conducted by the Academic Life in Emergency Medicine's
52 (ALiEM) Wellness Think Tank volunteer organization, during the 12-day period of March
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1 20-31, 2017. ALiEM is a not-for-profit, health professions education organization focused on
2 social media technologies and community-building. The Wellness Think Tank is a virtual
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4 community of more than 100 EM residents and 12 EM supervising faculty from across North
5
6 America who are interested in physician wellness. This study was granted expedited approval
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8 by the Institutional Review Board of New York-Presbyterian Brooklyn Methodist Hospital.
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11 12 13 14 **Survey instrument** 15

16 The 2017 National EM Resident Wellness Survey included demographic questions, the MBI-
17
18 HSS tool, an inventory of active residency program wellness initiatives, and the Life
19
20 Orientation Test-Revised (LOT-R) tool. The initial survey design was created by one
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22 investigator (M.M.), and subsequent iterative refinements for clarity and brevity were
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24 completed by the remaining investigators. This study focuses solely on the MBI-HSS tool,
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26 which can be licensed from MindGarden.com.
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33 The validated, 22-item MBI-HSS tool scores each item on a 7-point Likert scale. Items are
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35 categorized into one of three subscales (EE, DP, PA), each of which can be classified as low,
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37 moderate, or high, based on cutoff ranges (Table 1). These ranges were derived from
38
39 normative data originally studied and validated by Maslach et al. based on 1,104 physicians.¹
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46 Table 1: Cutoff ranges for each MBI-HSS subscale
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48 Subscale	49 Low	50 Moderate	51 High
52 Emotional Exhaustion (EE)	53 ≤ 18	54 19-26	55 ≥ 27
56 Depersonalization (DP)	57 ≤ 5	58 6-9	59 ≥ 10
60 Personal Accomplishment (PA)	61 ≤ 33	62 34-39	63 ≥ 40

1 For our study, we defined burnout as an individual with a high EE or high DP score to mirror
2 other landmark burnout studies by Dyrbye et al.,⁷ Shanafelt et al.,⁸ and other burnout
3 researchers in the graduate medical education domain.^{10–13,21–23}
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9 **Participants and survey administration**

10 U.S. EM residents were informed of the online survey through multiple online channels.
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12 These included announcements on the ALiEM blog website (<https://www.aliem.com>) on
13 March 20, 2017; Twitter and Facebook led by members of ALiEM and the Wellness Think
14 Tank teams; the Council of EM Residency Directors organizational listserv; and the EM
15 Residents' Association organization listserv. The complete survey was hosted online using
16 REDCap (Research Electronic Data Capture; Version 8.1.4), a secure web application for
17 building and managing online surveys and databases.³³ All participants were provided a five-
18 dollar Starbucks gift card and coupon codes to meal delivery services. Furthermore, programs
19 with more than 90% survey completion rates were entered into a lottery for a free pizza party
20 and access to live-streamed recordings from a national EM education conference.
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39 Participant status as a current U.S. EM resident was verified by the Wellness Think Tank
40 members by obtaining and cross-referencing resident rosters from program directors,
41 residency coordinators, or chief residents of accredited EM residency programs. Submissions
42 were reviewed against program rosters to ensure resident status and that each resident
43 responded only once. Submissions made by unconfirmed participants, duplicate submissions,
44 and residents from dual or triple residency programs, such as combined EM/Internal
45 Medicine programs were excluded. Although demographic information was collected on the
46 participants, all data was anonymized prior to analysis.
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Outcomes

The primary outcome measure was the proportion of burned out EM residents, using the definition of having a high EE (≥ 27) or high DP (≥ 10) subscale score on the MBI-HSS tool. Because the definition of burnout using the MBI-HSS tool varies in the literature across medical specialties and in graduate medical education,⁷⁻²⁵ we also calculated burnout rates using two alternative formulas that have been reported in the literature. The more restrictive definition, which was originally proposed by the MBI-HSS tool authors, is a high EE (≥ 27) and high DP (≥ 10) and low PA (≤ 33);¹ the more inclusive definition is a high EE (≥ 27) or high DP (≥ 10) or low PA (≤ 33). Secondary outcomes included differences in burnout rates by geographic region and post-graduate year (PGY) of residency training.

Analysis

Survey data collected on REDCap were exported to Microsoft Excel spreadsheets and analyzed utilizing R version 3.4.2.³⁴ Burnout was defined as a dichotomized yes/no variable. Standard descriptive statistics were used to report burnout rates (with 95% confidence intervals calculated using Taylor approximation series) and demographic characteristics.

Sensitivity analyses were performed using inverse probability weighting to calculate adjusted estimates that would account for non-response in residents potentially underrepresented in the sample, based on the best-available evidence for the age, gender, PGY class, and geographic region for the national population of EM residents. We used logistic regression to explore the relationships between the reported burnout rate (using primary outcome definition) and training years and geographic region. These variables were selected a priori as relationships of interest based on a review of the existing literature and assessed individually with a likelihood ratio tests against the null hypothesis of no association. We also analyzed early and

late survey responders during the 12-day survey period, comparing the first 50% versus last 50%, as well as the first 25% versus last 25% of responders.

RESULTS

Characteristics of study subjects

A total of 1,522 of 7,186 (21.2%) independently-verified U.S. EM residents representing 193 of 247 (78.1%) residency programs participated in the survey, after excluding 394 respondents (5.5%). A range of 1-44 residents (median 6, mean 8.8) per program participated in the survey. The participants were geographically distributed in similar fashion to the locations of EM residency programs based on demographic data from 2016-17 ACGME reports of U.S. EM PGY-1 residents and Association of American Medical Colleges Workforce Reports.³⁵⁻³⁷ Demographic data of the study participants are listed in Table 2.

Table 2. Demographic data of survey participants (n=1,522)

	Criteria	Number (%)
Gender	Female	643 (42.2%)
	Male	879 (57.8%)
Age (years)	20-29	739 (48.6%)
	30-39	753 (49.5%)
	40-49	21 (1.3%)
	50-59	1 (0.07%)
	Not provided	8 (0.53%)
Postgraduate Year (PGY) of Training	PGY-1	523 (34.4%)
	PGY-2	437 (28.7%)
	PGY-3+	562 (36.9%)
Number of Unique Residency Programs Represented by Geographic Region	Midwest	58 of 69 (84.1%)
	Northeast	55 of 70 (78.6%)

	South	58 of 76 (76.3%)
	West	22 of 32 (68.8%)

Main results

The prevalence of burnout among EM residents responding to our survey was 76.1% [95% CI 74.0-78.3%], as defined by a high EE (≥ 27) or high DP (≥ 10) score on the MBI-HSS tool. Based on the best-available evidence for the age, gender, PGY class, and geographic region for the national population of EM residents, we recalculated burnout rates using inverse probability weighting and report an adjusted burnout rate of 75.1% [95% CI 71.3-78.9%], which is similar to the unadjusted burnout rate of 76.1%.

Applying the alternative, more restrictive and more inclusive definitions for burnout, we report a 18.2% [95% CI 16.3-20.1%] and 80.9% [95% CI 78.9-82.9%] burnout rate, respectively, amongst our survey participants. Figure 1 summarizes these findings, and Table 3 reports the raw data on a more granular level with each MBI-HSS subscale reported individually and stratified by PGY class.

Figure 1: Prevalence of EM resident burnout, based on three different definitions of burnout in the literature, stratified by residency training year (raw data in Appendix Table): A) More inclusive definition. B) Study definition. C) More restrictive definition. The vertical brackets denote 95% confidence intervals. (emotional exhaustion, EE; depersonalization, DP; personal accomplishment, PA; postgraduate year, PGY)

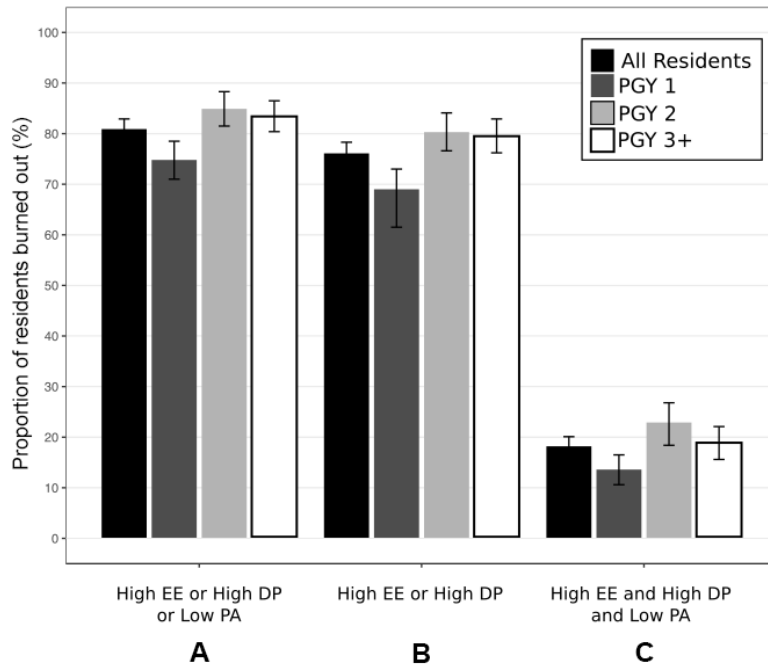


Table 3: MBI-HSS subscale scores for emotional exhaustion, depersonalization, and personal accomplishment stratified by residency postgraduate year (PGY). The denominator used to calculate percentages is the number of residents (n) in that PGY class. The gray boxes suggest a person is at high risk for burnout per MBI-HSS definitions.

	Burnout Severity	PGY 1 (n=523)	PGY 2 (n=437)	PGY 3+ (n=562)	All Residents (n=1,522)
Emotional Exhaustion	Low (≤ 18)	169 (32.3%) [28.3-36.3]	98 (22.4%) [18.5-26.4]	140 (24.9%) [21.3-28.5]	407 (26.7%) [24.5-29.0]
	Moderate (19-26)	145 (27.7%) [23.9-31.6]	115 (26.3%) [22.2-30.5]	154 (27.4%) [23.7-31.1]	414 (27.2%) [25.0-29.4]
	High (≥ 27)	209 (40.0%) [37.8-44.2]	224 (51.3%) [46.6-56.0]	268 (47.7%) [43.5-51.8]	701 (46.1%) [43.6-48.6]
Depersonalization	Low (≤ 5)	85 (16.3%) [13.1-19.4]	37 (8.5%) [5.6-11.1]	54 (9.6%) [7.2-12.1]	176 (11.6%) [10.0-13.2]
	Moderate (6-9)	95 (18.2%) [14.9-21.5]	66 (15.1%) [11.7-18.5]	82 (14.6%) [11.7-17.5]	243 (16.0%) [14.1-17.8]
	High (≥ 10)	343 (65.6%) [61.5-69.7]	334 (76.4%) [72.4-80.4]	426 (75.8%) [72.2-79.4]	1,103 (72.5%) [70.2-74.7]
Personal Accomplishment	High (≥ 40)	211 (40.3%) [36.1-44.6]	154 (35.2%) [30.7-39.7]	197 (35.1%) [31.1-39.0]	562 (36.9%) [34.5-39.4]
	Moderate (34-39)	170 (32.5%) [28.5-36.5]	131 (30.0%) [25.7-34.3]	193 (34.3%) [30.4-38.3]	494 (32.5%) [30.1-34.8]
	Low (≤ 33)	142 (27.2%) [23.3-31.0]	152 (34.8%) [30.3-39.3]	172 (30.6%) [26.8-34.4]	466 (30.6%) [28.2-32.9]

Compared to PGY-1 residents, PGY-2 and PGY-3+ residents were more likely to report burnout with adjusted odds ratios for primary burnout of 1.7 [95% CI 1.1-2.8] and 2.0 [95% CI 1.2-3.2], respectively. There was, however, no indication of a difference between the

1 burnout reported in PGY-2 and PGY-3+ residents (80.3 [95% CI 76.6-84.1%] vs 79.5% [95%
2 CI 76.2-82.9%]). When applying the alternative, more restrictive and more liberal definitions
3 of burnout, there was no difference in burnout rates between any of the training years. The
4 burnout rates by geographic region were 69.9% [95% CI 62.3-77.5%], 77.1% [95% CI 71.5-
5 82.7%], 74.1% [95% CI 66.3-81.9%], and 80.5% [95% CI 73.4-87.7%] for the Midwest,
6 Northeast, South, and West, respectively, and did not differ by region (p=0.22).
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17 The internal reliability of the MBI-HSS tool was measured by the Cronbach α and showed
18 that the measurements were not item-specific, but rather a measure of the underlying
19 constructs of burnout. The Cronbach α for EE, DP, and PA was 0.92, 0.81, and 0.85,
20 respectively, which is greater than the general acceptability standard of ≥ 0.70 .
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29 There were no significant differences between the early and late responders, when comparing
30 the first 50% versus last 50% as well as first 25% versus last 25% of responders.
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36 **LIMITATIONS**

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38 Our study had several limitations specifically regarding generalizability, which is a common
39 problem for survey-based research methodologies.³⁸ Our response rate of 21.2% introduces
40 non-response bias and may represent a skewed population, although this mirrors other survey
41 response rates of 19.2%⁸ and 22.5%⁷ in landmark studies for burnout research. Because there
42 is no scientifically proven lower limit for an accepted survey response rate, sensitivity
43 analyses and other approaches, such as early-to-late responder comparisons may help address
44 non-response bias and determine the representativeness of the survey respondents.³⁹ For our
45 study, there were no significant differences between the early and late responders, and
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our inverse probability weighting sampling adjustments resulted in a similar burnout rate.

This suggests that our responders may be a representative sample of U.S. EM residents.

We excluded 394 of 7,186 (5.5%) survey responses because their EM resident status could not be confirmed, they were duplicate entries, or they belonged to dual/triple-residency programs. This may have inadvertently excluded some EM residents resulting in a sampling bias; however, we noted a trend that the email addresses of many of the unconfirmed responders did not include names but rather numbers, symbols, and .net accounts, suggesting spammers potentially wanting to obtain the gift cards.

Some programs had higher rates of respondents than others, which may overly weight the data towards certain residency programs. Generalizability may also be a limitation based on when the survey was conducted. The national survey data was collected during the month of March, which may not be representative of the burnout rates across the entire academic year. In one study, internal medicine residents demonstrated a significant increase in rates of anger, depression, and fatigue over the course of their intern year.²⁸ Although patterns of changes in mood, energy, and wellness have not been studied in EM residents over the course of an academic year, it may be that our reported burnout data in March would differ if collected in a different month.

Incentives for survey research may have introduced additional bias. A five-dollar gift card and entry into a larger lottery-based prize were provided to confirmed U.S. EM residents who completed the entire survey. Because of concerns that respondents may provide more favorable survey questions to obtain the gift card and larger prize, participants were informed that they would receive the gift card regardless of how they answered the questions. Of note,

the literature suggests that such financial incentives may not significantly alter survey responses.^{40,41}

DISCUSSION

Resident burnout prevalence rate

This is the first national EM resident cross-sectional survey on burnout with 1,522 residents enrolled. Among survey respondents, 76.1% met criteria for burnout. Although our national survey study was not designed as a comparative study, EM residents in our study population did seem to have a similarly high burnout rate as prior studies of EM residents and attending physicians (65%-73.9%).^{8,15,16} Studies on resident burnout studies in other medical specialties, when compared to our study findings, suggest that EM residents have among the highest rate of burnout (Table 4).

Table 4: Key U.S. survey-based studies on burnout in graduate medical education outside of emergency medicine using the full 22-item MBI-HSS tool in comparison to our national survey study results of 1,522 EM residents (emergency medicine, EM; emotional exhaustion, EE; depersonalization, DP; personal accomplishment, PA)

Study	Definition of Burnout	Study Population (Sample Size)	Prevalence of Burnout	National Prevalence of EM Resident Burnout, Using Similar Burnout Definition
Dyrbye et al. (2014) ⁷	High EE or High DP	Medical students (4,402), residents/fellows (1,701), and early career (first 5 years) physicians (880) across all specialties	55.9% students, 60.3% residents and fellows 51.4% physicians	76.1%
Pantaleoni et al. (2014) ²¹		Pediatric residents (232)	37-46%	
Guenette and Smith (2017) ¹³		Radiology residents (94)	51%	
Chaukos et al. (2017) ²²		PGY-1 psychiatry residents (68)	28%	
Ramey et al.		Radiation oncology	33.2%	

(2017) ¹²		residents (205)		
Attenello et al. (2018) ¹⁰		Neurological surgery residents (346)	67%	
Kemper et al. (2018) ²³		Pediatric residents (1,758)	56% in 2016; 54% in 2017	
Lebares et al. (2018) ¹¹		Surgery residents (566)	69%	
Williford et al. (2018) ⁹		Surgery residents (92)	75%	
Elmore et al. (2016) ¹⁴	High EE or High DP or Low PA	Surgery residents (665)	69%	80.9%
Garza et al. (2004) ⁴²	High EE and High DP and Low PA	Obstetrics and gynecology residents (136)	17.6%	18.2%

High degree of depersonalization

The underlying etiology for burnout may not be the same for residents and independently practicing physicians. Of note, the majority of residents in our study (72.5%) report a high degree of depersonalization based on a high DP score, versus lower DP scores in other studies of attending emergency physicians (38.9%)¹⁶ and of other specialties (34.6%).⁸ We hypothesize that this more negative and cynical attitude towards patients results from working more clinical hours in the Emergency Department (ED) as a resident; having a greater clerical burden; and interacting more with consultants, admitting services, and ancillary staff as a trainee.^{16,43} This hypothesis is indirectly supported by our identified trend that PGY-1 residents are less burned out than more senior residents. These first-year residents are typically less often working in the ED and instead on off-service rotations. Thus, they presumably have less clinical responsibilities, have fewer interactions with the broader healthcare team, are not responsible for ED throughput despite overcrowding, and do not manage higher acuity patients. Also, they have not yet accumulated years of working in the stressful ED work environment. Future research might study the underlying root cause and

1 potential interventions necessary to minimize depersonalization, while also improving
2 engagement as residents progress through training.
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7 *Defining burnout and reporting burnout rates using the MBI-HSS tool*
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10 The standard definition of burnout used in this study (high EE or high DP) was the only
11 definition to differentiate between burnout status of different PGY classes. Our findings align
12 with the larger field of burnout research, which has expanded beyond the traditional,
13 restrictive definition of burnout. The definition of burnout used in our study may allow
14 identification of practitioners who would be missed by other definitions. For example, those
15 with high DP scores may not necessarily be emotionally exhausted or have a low sense of
16 personal accomplishment. These individuals may still be at risk for negative downstream
17 effects on professionalism, empathy, and patient care. Nonetheless, the more restrictive
18 definition (high EE and high DP and low PA) may still have practical value. Individuals who
19 are more severely burned out likely need closer monitoring and outreach. In our study, we
20 identified that 18.2% of EM residents could be classified into this more concerning category.
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39 A common complaint about the MBI-HSS involves the length of the survey instrument with
40 22 items. This has led to abbreviated versions, such as the a shorter 2-item modified version
41 of the MBI survey used in a 2018 *Journal of American Medical Association* study, which
42 reported a 53.8% burnout prevalence among 301 EM residents.²⁹ While these shorter versions
43 are less cumbersome, we still advocate for the full-length MBI-HSS instrument in burnout
44 research because of the complicated psychosocial phenomenon of physician burnout. A more
45 detailed tool seems better positioned to detect new, subtle, and unpredictable trends.
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Until a consensus is reached about a gold standard definition for burnout, we reported our data in more granular form to allow for external comparative use, regardless of how one defines burnout.⁴⁴ We plan to repeat this study periodically to better track the burnout landscape and inform national residency-based interventions conducted in EM. We concur with prior calls for reporting transparency³ and advocate that future burnout researchers follow a similar reporting construct as our Figure 1 and Table 3 to aid in reporting consistency.

National mandate on improved resident well-being

The high burnout rates for EM residents underscores the importance of the 2017 Accreditation Council for Graduate Medical Education (ACGME) common program requirements mandate focusing on improved resident well-being and wellness education across the health profession specialties.³⁵ Solutions will likely involve a multi-prong and step-wise approach. Wellness and resiliency training initiatives for the individual have been proposed to improve physician burnout but in isolation may not be impactful.^{27,45-47} At best, because wellness programs for physicians seem to have little to modest improvements in burnout metrics,^{47,48} it will likely require concurrent organizational and strategic overhaul efforts for significant improvements to occur. The focus should potentially be less on “blaming the individual” for being burned out and more on changing a traditional, time-honored, and often inefficient culture.^{49,50} Targets for improvement have included fewer administrative and clerical tasks, a more efficient electronic medical records charting experience, more autonomy and flexibility over shift and call scheduling, productivity and reimbursement expectations, and use of scribes.^{31,51} Fortunately, despite high burnout rates among EM residents, they have significantly lower specialty choice regret at 3.3% compared to other specialties.²⁹

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2 *Future research*
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4 This national study demonstrating high EM resident burnout rates provides a springboard for
5 future research. This same MBI-HSS survey can be conducted annually or every few years to
6 trend burnout patterns, especially with the 2017 ACGME wellness mandate and ongoing
7 national initiatives.
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17 *Summary*
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19 This study reports the results of the largest national survey of EM residents to date. Among
20 respondents, 76.1% met criteria for burnout. Burnout within the EM specialty seems to begin
21 as early as residency training, although PGY-1 residents seem less burned out. Our results
22 provide baseline data that can inform and allow objective evaluation of future individual,
23 programmatic, and systems-level burnout prevention interventions.
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Appendix

Appendix Table 1: These values represent the data graphed in Figure 1 reporting the prevalence of EM resident burnout, based on the different definitions of burnout in the literature, stratified by residency training year. The brackets denote 95% confidence intervals. (emotional exhaustion, EE; depersonalization, DP; personal accomplishment, PA; postgraduate year, PGY)

Burnout definition	Description of burnout definition	PGY 1 (n=523)	PGY 2 (n=437)	PGY 3+ (n=562)	All residents (n=1,522)
High EE (≥ 27) or High DP (≥ 10) or Low PA (≤ 33)	More liberal, inclusive definition of burnout	391 (74.8%) [71.0-78.5]	371 (84.9%) [81.5-88.3]	469 (83.4%) [80.4-86.5]	1,231 (80.9%) [78.9-82.9]
High EE (≥ 27) or High DP (≥ 10)	Our study definition of burnout	361 (69.0%) [65.1-73.0]	351 (80.3%) [76.6-84.1]	447 (79.5%) [76.2-82.9]	1,159 (76.1%) [74.0-78.3]
High EE (≥ 27) and High DP (≥ 10) and Low PA (≤ 33)	More conservative, restrictive definition of burnout	71 (13.6%) [10.6-16.5]	100 (22.9%) [18.4-26.8]	106 (18.9%) [15.6-22.1]	277 (18.2%) [16.3-20.1]

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