



The Profession

Burnout Evaluation of Radiation Residents Nationwide: Results of a Survey of United States Residents

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Summary

A survey of US radiation oncology residents incorporating the Maslach Burnout Index—Human Services Survey assessed symptoms of burnout and resident/program-specific factors associated with burnout. Completed surveys were available for 205 residents and revealed a 33.1% rate of burnout. This burnout rate is consistent with previous surveys conducted among oncology practicing physicians and residents. Further studies and interventions targeting burnout among

Purpose: To assess rates of burnout among US radiation oncology residents and evaluate program/resident factors associated with burnout.

Methods and Materials: A nationwide survey was distributed to residents in all US radiation oncology programs. The survey included the Maslach Burnout Index—Human Services Survey (MBI-HSS) as well as demographic and program-specific questions tailored to radiation oncology residents. Primary endpoints included rates of emotional exhaustion, depersonalization, and personal accomplishment from MBI-HSS subscale scores. Binomial logistic models determined associations between various residency/resident characteristics and high burnout levels.

Results: Overall, 232 of 733 residents (31.2%) responded, with 205 of 733 (27.9%) completing the MBI-HSS. High levels of emotional exhaustion and depersonalization were reported in 28.3% and 17.1%, respectively; 33.1% experienced a high burnout level on at least 1 of these 2 MBI-HSS subscales. Low rates of personal accomplishment occurred in 12% of residents. Twelve residents (5.9%) reported feeling “at the end of my rope” on a weekly basis or more. On multivariable analysis there was a statistically significant inverse association between perceived adequacy of work-life balance (odds ratio 0.37; 95% confidence interval 0.17–0.83) and burnout.

Conclusions: Approximately one-third of radiation oncology residents have high levels of burnout symptoms, consistent with previous oncology literature, but lower levels than those among physicians and residents of other specialties. Particularly

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radiation oncology residents may reduce downstream consequences.

concerning was that more than 1 in 20 felt “at the end of my rope” on a weekly basis or more. Targeted interventions to identify symptoms of burnout among radiation oncology residents may help to prevent the negative downstream consequences of this syndrome. © 2017 Elsevier Inc. All rights reserved.

Introduction

Physicians have almost twice the rate of burnout and less satisfaction with work-life balance compared with the general population, with the disparity growing recently (1). Provider burnout represents a reaction to chronic stress associated with emotional exhaustion (EE), depersonalization ([DP]—a pattern of behavior in which patients are treated as objects rather than individuals), and a decreased sense of personal accomplishment (PA) (2, 3). Physician burnout is associated with a host of negative outcomes, including medical errors (4, 5), decreased satisfaction with chosen specialty (6), increased likelihood of converting to a part-time position (7) or leaving one’s position entirely (8), alcohol abuse/dependence (2, 9), and suicidal ideation (10, 11).

For residents, burnout and depression rates are also significantly higher than age-matched comparisons from the general population. Burnout seems to be higher in residency than during medical school or the early years of a physician’s practice (12). Burnout in residents or medical students has been associated with increased medical errors (13), decreased medical knowledge equivalent to 1 full year of training (14), and suicidal ideation (15, 16). Studies have shown wide variations in burnout among different specialties, although oncology residents/fellows were often excluded from these studies (17, 18). A variety of factors may contribute to burnout, including inadequate sleep, interference of work with home life, lack of control, and time demands (18). Recognizing the extent of the problem, the Accreditation Council for Graduate Medical Education instituted an annual symposium on physician well-being in 2015 and has worked on a variety of methods to address this issue (19).

Among oncologists specifically, rates of burnout remain relatively high (20-23). It has been suggested that constantly dealing with dying patients and the stress of orchestrating complicated care may contribute to burnout among oncologists (21, 24). However, there is some evidence that burnout rates may be lower among practicing radiation oncologists in the United States (25-27). Studies in France, New Zealand, and Australia have shown rates of burnout above 45% among radiation oncology residents (28, 29); however, to our knowledge, similar studies examining radiation oncology residents in the United States have not been published. This benchmark study was conducted to create a cross-sectional review of burnout among US radiation oncology residents and to document any program- or resident-specific factors correlated with burnout.

Methods and Materials

In September 2016, after approval by the local institutional review board, links to surveys were emailed to all 88 US radiation oncology program coordinators and program directors, using e-mail addresses published in the *Association of Residents in Radiation Oncology Directory* (30). Study data were collected and managed using REDCap electronic data capture tools hosted at the sponsoring university hospital (31). Two reminder e-mails were sent to encourage additional participation. The first 100 participants were given \$5 Amazon gift cards as an incentive to participate.

All participants had to certify that they had not previously completed the survey. Additionally, participants were asked to provide e-mail addresses for forwarding of the Amazon gift card, and any surveys from repeated e-mail addresses would have been removed (no repeated e-mail addresses found). To maintain anonymity, e-mail addresses were unlinked from responses before any analysis. This survey was limited to postgraduate year (PGY) 2 through 5 residents at US programs; thus, fellows were not included.

Resident-specific and program-specific questions

The survey consisted of 46 questions, with 9 questions related to demographics/personality characteristics of residents, 15 questions on program-specific factors, and 22 questions representing the full Maslach Burnout Inventory—Human Services Survey (MBI-HSS). Demographic questions included PGY status, gender, relationship status, self-described personality characteristics, and indebtedness. Program-specific questions addressed perceived adequacy of support staff, work-life balance, satisfaction with the residency program, on-call responsibilities, and average hours worked per week. A copy of the questions designed specifically for this study is available as Figure E1 (available online at www.redjournal.org). Reproduction of MBI-HSS survey questions for publication is not allowed by the publisher (Mind Garden, Menlo Park, CA) (3).

Maslach Burnout Inventory—Human Services Survey

The MBI-HSS is a validated and widely used 22-question survey for measuring burnout in individuals who work in human services and includes 3 subscales related to burnout—EE (9 questions), DP (5 questions), and PA (8 questions) (3). Each subscale is categorized as high,

moderate, or low according to scoring instructions included with the MBI-HSS. High scores on EE and DP are interpreted as negative outcomes, whereas high scores on the PA subscale are interpreted as positive outcomes. For this study the definition of “burnout” was a high score on either the EE or DP subscales, as previously published (20, 22, 32). Previous studies have shown that the EE and DP subscales correlate best with actual negative outcomes associated with burnout (33, 34). Scores from each individual subscale are also presented as discrete variables, given the spectrum of burnout symptoms in individual providers and the lack of a single established consensus for reporting burnout as a dichotomous variable (3, 32).

Statistical analyses

Logistic models were used to determine whether certain radiation oncology program- or resident-specific characteristics were associated with burnout. “Burnout” was given a value of 1 if participants had a high score on either the EE or DP subscale and 0 otherwise. Results of univariable and multivariable logistic regression are reported as odds ratios (ORs) with 95% confidence intervals (CIs). A *P* value of <.05 was considered significant. Factors in univariable analysis (UVA) with *P*<.10 were retained for multivariable analysis (MVA). All analyses utilized the R statistical software package version 3.3.1 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Overall, 232 residents responded, representing 31.7% of the 733 radiation oncology residents nationwide in 2016 (35). The MBI-HSS was not completed by 27 residents, and these responses were excluded, leaving 205 surveys available for analysis. Of the respondents completing the survey, 31.2% were women (Table 1). The proportion of completed surveys by PGY was 26.3% PGY-2, 26.8% PGY-3, 21.5% PGY-4, and 25.4% PGY-5. Most were married (55.1%), whereas 42.0% were single. Among those who were married, the majority (53.1%) had a spouse in health care. Educational debt less than \$50,000 was reported by 42.9%, whereas approximately one-third (32.7%) had more than \$200,000 of debt.

High levels of EE and DP were reported in 28.3% and 17.1%, respectively (Fig. 1); 33.2% experienced high burnout levels on 1 of these subscales, meeting the predetermined criteria for “burnout.” Furthermore, 12.2% had low rates of perceived PA. Mean scores on each subscale were 20.5, 7.1, and 39.4 for the EE, DP, and PA subscales, respectively. Nine residents (4.4%) had high EE, high DP, and low PA scores. Twelve residents (5.9%) reported feeling “at the end of my rope” on a weekly basis or more.

When broken down by training level, 22.2% of PGY-2s, 36.4% of PGY-3s, 31.8% of PGY-4s, and 42.3% of PGY-5s had high burnout (Fig. 2). Rates were similar between men

Table 1 Personal characteristics of residents responding to the survey

Characteristic	All respondents (N=205)	
	Number	Percentage
Gender		
Male	141	68.8
Female	64	31.2
Postgraduate year		
2	54	26.3
3	55	26.8
4	44	21.5
5	52	25.4
Relationship status		
Single	86	42.0
Married	113	55.1
Divorced/separated	4	2.0
Widowed	1	0.5
No response	1	0.5
Spouse also works in health care		
Yes	60	29.3
No	53	25.9
Unmarried	92	44.8
Agree/strongly agree with below descriptions of themselves		
Perfectionist	133	53.1
Very empathetic	184	65.9
Indecisive	61	29.8
Idealistic	113	55.1
Educational debt (\$)		
0-49,999	88	42.9
50,000-99,999	20	9.8
100,000-199,999	29	14.1
200,000-299,999	43	21.0
>300,000	24	11.7
No response	1	0.5

and women, with 32.6% and 34.4% rates of burnout, respectively. Program factors associated with decreased risk of burnout on UVA (Table 2) included adequate work-life balance (OR 0.22, 95% CI 0.11-0.42), perception that the

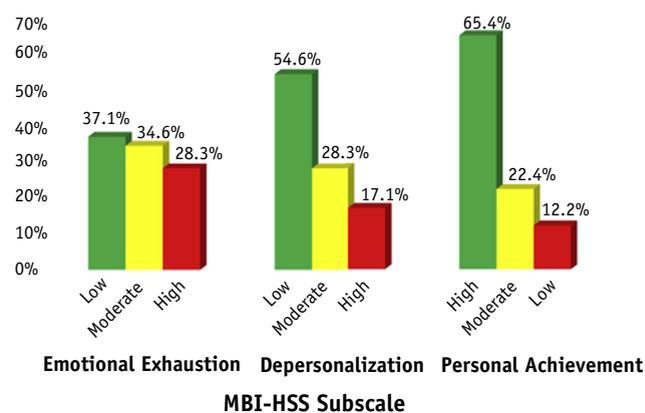


Fig. 1. Maslach Burnout Inventory-Human Services Survey (MBI-HSS) subscale results for all completed resident surveys.

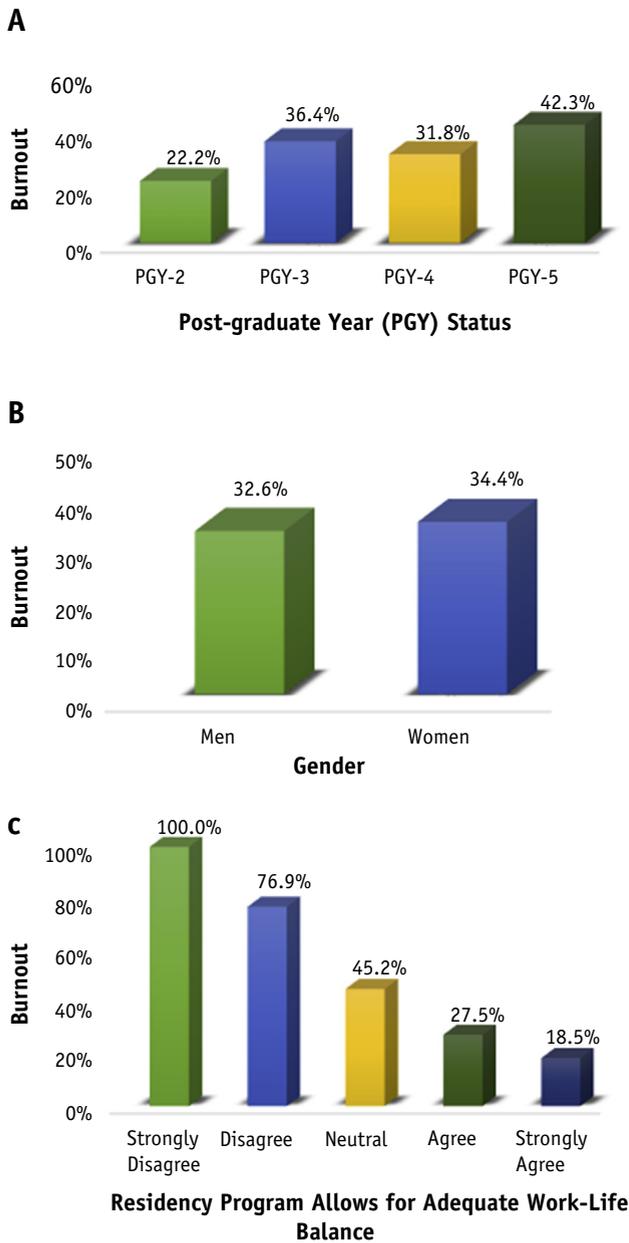


Fig. 2. Burnout by selected resident and residency program characteristics. (A) Burnout by postgraduate year (PGY), (B) burnout by gender, (C) burnout by resident perception of work-life balance at residency program.

program is invested in resident education (OR 0.31, 95% CI 0.16-0.59), residents’ belief that they would choose the same program again (OR 0.28, 95% CI 0.15-0.52), perception that the faculty/staff work well together (OR 0.31, 95% CI 0.15-0.64), and adequate social worker support (OR 0.55, 95% CI 0.30-0.99). Program factors associated with significantly higher levels of burnout on UVA included more than 60 hours spent weekly at work (OR 2.21, 95% CI 1.18-4.12) and need to come in 1 or more days during the weekend per call week (OR 2.12, 95% CI 1.07-4.40). The only resident characteristic significantly

associated with burnout risk on UVA was resident self-description of “indecisive,” with residents demonstrating an OR of 2.54 for burnout (95% CI 1.36-4.77). On MVA there was a statistically significant inverse association with adequate work-life balance (OR 0.38, 95% CI 0.17-0.85) and burnout (Table 3).

Discussion

To our knowledge this is the first study to explore burnout among US radiation oncology residents using a validated assessment tool and is the largest such assessment of radiation oncology residents worldwide. Overall, approximately one-third of radiation oncology residents exhibited signs of burnout, defined as high EE or DP. On MVA, the only factor significantly correlated with high rates of burnout was whether residents felt their program allowed for adequate work-life balance. Gender and PGY status did not correlate with rates of burnout. Interestingly, increased time at work or increased call responsibilities were not significantly associated with burnout on MVA. Two findings were particularly concerning. First, a small subset of residents reported high EE, high DP, and low PA. Furthermore, 12 residents reported feeling, “I’m at the end of my rope,” on a weekly basis or more.

Burnout in medicine

Extensive evidence has documented that burnout among both practicing physicians and residents is associated with a variety of negative consequences. A recent study found that US physician burnout increased relative to the general workforce between 2011 and 2014. After adjustment in MVA, physicians were still almost twice as likely to have burnout and reported less satisfaction with work-life balance (1). Using a 1-question assessment of burnout, another survey found that physician burnout increased from 40% in 2013 to 51% in 2017. Although oncology was in the lower third of specialties in burnout percentage (46%), oncologists were in the top 3 specialties in severity of burnout, with a 4.5 score on a 7-point scale (range among specialties, 3.9-4.6) (36). A previous study of residents among 8 different specialties showed that 50% met burnout criteria; however, burnout varied widely among specialties, ranging from 27% in family medicine to 75% in obstetrics/gynecology residents. Factors associated with burnout included being in the first year of residency, having significant personal stress, feeling dissatisfied with faculty, and being single. No radiation oncology residents were included in that study (17).

A variety of negative consequences has been noted in physicians with burnout symptoms. According to the American College of Radiology, burnout can adversely affect “professionalism, academic and clinical performance, patient safety, interpersonal relationships, personnel retention, and patient satisfaction” while also leading to

Table 2 Univariable analysis of factors associated with burnout

Characteristic	Odds ratio for burnout* (95% CI)	P
Resident characteristics/self-descriptions		
Male gender	0.92 (0.50-0.74)	.81
Postgraduate year 4 or 5	1.44 (0.81-2.60)	.38
Married	0.96 (0.53-1.72)	.88
Educational debt >\$200,000	1.32 (0.71-2.42)	.38
Idealistic	1.05 (0.58-1.89)	.87
Perfectionist	0.62 (0.34-1.12)	.11
Indecisive	2.54 (1.36-4.77)	.003
Empathetic	0.79 (0.31-2.08)	.61
Program factors		
Having adequate work-life balance	0.22 (0.11-0.42)	<.001
Residency program is invested in resident educational success (agree or strongly agree)	0.31 (0.16-0.59)	<.001
Would choose residency program again (agree or strongly agree)	0.28 (0.15-0.52)	<.001
Staff works well together (agree or strongly agree)	0.31 (0.15-0.64)	.001
Residency program uses resident feedback constructively (agree or strongly agree)	0.38 (0.21-0.68)	.001
>60 hours spent at work weekly	2.21 (1.18-4.12)	.013
Call assignment of ≥ 7 wk per year	1.36 (0.76-2.46)	.3
Average staying late ≥ 3 weeknights during call week	1.13 (0.59-2.15)	.7
Average coming in ≥ 1 weekend day during call week	2.12 (1.07-4.40)	.04
Average ≥ 4 or more consultations seen outside of clinic during call week	1.68 (0.91-3.11)	.1
Having adequate social worker support	0.55 (0.30-0.99)	.047
Having adequate nursing support	0.56 (0.31-1.02)	.061
Having adequate physics support	0.81 (0.29-2.49)	.7
Having adequate dosimetry support	1.13 (0.48-2.90)	.78

Abbreviation: CI = confidence interval.

* Burnout defined as high emotional exhaustion or depersonalization score.

“absenteeism from work, problematic alcohol consumption, disruptive behavior, and early retirement” (37). In addition, among internal medicine residents, those reporting feeling burnt out on a daily basis performed worse on their in-training examination than peers not experiencing burnout. Notably, this score difference was greater than that between first- and second-year residents (14). Another study of internal medicine residents showed that high EE, high DP, and low PA on the MBI-HSS were each associated with a higher rate of self-reported medical errors (13). In a

longitudinal study of US medical students over 1 year, 11% reported suicidal ideation over the year, with baseline burnout associated with a more than 2-fold higher risk of suicidal ideation (15).

Burnout in oncology

Multiple studies have explored burnout among medical or surgical oncologists. A study of medical oncologists found

Table 3 Multivariable analysis of factors associated with burnout

Characteristic	Odds ratio for burnout* (95% CI)	P
Resident characteristics/self-descriptions		
Indecisive	1.87 (0.90-3.86)	.09
Program factors		
Having adequate work-life balance	0.38 (0.17-0.85)	.018
Residency program is invested in resident educational success (agree or strongly agree)	0.66 (0.28-1.58)	.34
Would choose residency program again (agree or strongly agree)	0.55 (0.25-1.24)	.15
Staff works well together (agree or strongly agree)	0.73 (0.30-1.82)	.49
Residency program uses resident feedback constructively (agree or strongly agree)	0.67 (0.31-1.47)	.31
>60 hours spent at work weekly	1.51 (0.71-3.14)	.28
Average coming in ≥ 1 weekend day during call week	1.76 (0.80-4.06)	.17
Average ≥ 4 or more consultations seen outside of clinic during call week	1.38 (0.67-2.87)	.38
Having adequate social worker support	0.79 (0.38-1.68)	.54
Having adequate nursing support	1.17 (0.53-2.65)	.71

Abbreviation as in Table 2.

* Burnout defined as high emotional exhaustion or depersonalization score.

that 45% showed burnout (20), whereas another study found that 36% of surgical oncologists had burnout (22). A meta-analysis of studies on burnout in oncology providers found that high EE varied from 23% to 48%, with an average of 32%. Additionally, 27% to 34% suffered from depression (21). The rates of burnout found in our study coincide with this literature, although burnout rates among radiation oncology residents were slightly lower.

Several international studies have evaluated rates of burnout among radiation oncologists. In a survey of radiation oncologists in Australia and New Zealand, 28.1% had high levels of EE, and 19.2% had high levels of DP (38). A French study conducted among medical oncology, hematology, and radiation oncology residents found that 44% had some symptoms of burnout, with no significant differences among specialties. Individuals with symptoms of burnout had a lower perception of their health status and expressed desires to either change specialty or leave medicine entirely. Furthermore, 20% were taking anxiolytic medications—88% of which were self-prescribed (29). Studies conducted among young radiation oncologists in Italy and radiation oncology trainees in Australia and New Zealand found burnout rates of 35% and 49.5%, respectively (28, 39). Burnout rates among radiation oncology providers internationally seem to be similar to those reported among other oncology specialties in the United States.

At least 3 previous studies have investigated rates of burnout among US radiation oncologists, although none has specifically addressed resident burnout. A workforce study conducted by the American Society for Radiation Oncology found that approximately 15% of practicing radiation oncologists reported “burnout feelings” often or always, with an increase in burnout correlating with the number of consults seen annually. Although this study included residents, it did not specify the rates of burnout feelings among residents and did not use a validated instrument to assess burnout (27). Radiation oncology chairs

were surveyed on burnout, with 25% having high EE, 10% high DP, and 15% low PA, with none having the combination of all 3 of these unfavorable characteristics. Chairs with higher EE were more likely to consider stepping down over the next year (25). A separate survey of US radiation oncology program directors showed proportionally higher scores on each subscale, with 28%, 15%, and 32% having high EE, high DP, and low PA, respectively. High burnout scores were inversely correlated with job satisfaction (26). These rates of burnout among US radiation oncologists seem somewhat lower than those reported among other oncology professionals and among radiation oncologists internationally.

In the present study the rates of high EE (28.3%) and DP (17.1%) were numerically higher than those reported by US department chairs but similar to those reported by program directors (Table 4). Additionally, 12.2% of residents had low PA, similar to rates reported among medical oncologists, surgical oncologists, and US radiation oncology department chairs but lower than rates described among US radiation oncology program directors.

Institutional factors associated with burnout

Multiple work environment factors have been implicated in oncologist burnout, with increased time spent at work and higher administrative workload commonly cited. The American Medical Association reports that the 4 most important factors contributing to burnout are chaotic environments, time pressure, a sense of loss of control in the workplace, and misalignment of values between providers and leaders (2). According to a study of medical oncologists, amount of time spent in direct patient care was the strongest predictor for burnout. Furthermore, each additional hour spent working from home was associated with increased burnout (20). Another study found that the 3 most highly rated contributors to burnout among oncologists

Table 4 Comparison of MBI-HSS results among selected studies of physicians

Group surveyed (reference)	Emotional exhaustion, Depersonalization, Personal accomplishment,			Burned out (definition 1)*	Burned out (definition 2)†
	median/mean/% scoring high	median/mean/% scoring high	median/mean/% scoring low		
All physicians (1)	25/NR/46.9%	7/NR/34.6%	41/NR/16.3%	54.4%	NR
All residents (12)	24/NR/44.4%	10/NR/50.7%	39/NR/22.0%	60.3%	NR
Medical oncologists (20)	22/NR/38.3%	5/NR/24.9%	42/NR/13.2%	44.7%	NR
Surgical oncologists (22)	20/21.4/31.6%	4/5.9/19.8%	43/41.1/11.6%	36.1%	NR
RO program directors (26)	21/21.53/28%	5.5/7.0/15%	38/35.8/32%	NR	6%
RO department chairs (25)	19/21.0/25%	3/5.3/10%	39/38.5/15%	NR	0%
French RO residents (29)	NR/NR/25%	NR/NR/41%	NR/NR/NR	46%	NR
Australia and New Zealand RO residents (28)	NR/23.6/NR	NR/7.8/NR	NR/35.2/NR	49.5%	13.1%
Present study	20/20.5/28.3%	5/7.1/17.1%	41/39.4/12.2%	33.2%	4.4%

Abbreviations: MBI-HSS = Maslach Burnout Inventory—Human Services Survey; NR = not reported; RO = radiation oncology.

* High score on either emotional exhaustion or depersonalization subscale.

† High score on emotional exhaustion subscale, high score on depersonalization subscale, and low score on personal accomplishment subscale.

were “too many bureaucratic tasks,” “spending too many hours at work,” and “increasing computerization of practice” (36). Young Italian radiation oncologists with burnout reported more issues in cooperation with superiors/colleagues, concerns about future job possibilities, and fewer professional development opportunities (39). On MVA in the present study, only feeling that the residency program did not allow for adequate work-life balance was associated with increased burnout. Increased hours at work, frustrations with the adequacy of support from staff, and perceptions that faculty were not invested in a resident’s educational success were not associated with burnout. The perception that work-life balance was inadequate may be a surrogate for other characteristics of the residency program not specifically addressed in this survey, such as time spent with family or time spent working from home.

Interventions to reduce burnout

Studies specifically assessing interventions to address physician burnout are limited. Unfortunately, work-hour restrictions or debriefing sessions have not alleviated symptoms of burnout among internal medicine residents (40, 41). An ongoing study is assessing the ability of resident-led peer support sessions to reduce burnout (42). One report on second-year US oncology fellows found that those who reported better teaching on end-of-life issues and direct observation of their “goals-of-care” discussions had lower rates of EE and DP (43). Leadership also likely plays a significant role in burnout, with a Mayo Clinic study showing significant reductions in burnout among physicians who rated their immediate supervisor more favorably. The authors suggested that developing new strategies to better identify and develop potential leaders could lower physician burnout (44).

To reduce burnout, the American College of Radiology recommends ensuring adequate staffing, reducing prolonged stress, restoring lifestyle balance, reducing call obligations, and restoring a sense of control (37). The American Medical Association developed an online “STEPS forward” module, which proposed making wellness a quality indicator, choosing leaders to oversee the wellness effort, conducting surveys to assess wellness, implementing improvement interventions, and intermittently evaluating success in promoting wellness. Suggested “workflow redesigns” to address burnout included improving previsit planning/labs, testing a “cap and trade program” that allows providers to take on additional call for more compensation, delegating tasks to non-physician staff, and keeping physicians paired with the same nurses/medical assistants (2). Similar interventions were identified in a study that involved site visits to “high-performing” primary care practices to assess how they were mitigating burnout (45).

Study limitations

A limitation of this study is the response rate of just over 30%. A larger response rate would have allowed more

power to detect additional demographic or program-specific factors associated with burnout. Response rates of previous surveys of US radiation oncology chairs (25) and program directors (26) were higher. Unfortunately, resident e-mail addresses are not universally publicly available; therefore, we had to rely on published contact information for residency program directors and program coordinators as a means to distribute the surveys. This likely contributed to the lower response rate in our study. However, a comparison with demographic data from the Accreditation Council for Graduate Medical Education shows that our respondents were similar to residents nationwide, at least in terms of gender and PGY status (35). For instance, 28.5% of residents nationwide are female, compared with 31.2% in our survey. Furthermore, 26.1%, 25.8%, 23.3%, and 24.8% are PGY-2, -3, -4, and -5, respectively, compared with 26.3%, 26.8%, 21.5%, and 25.4% in our survey.

Additionally, several of the questions included in the UVA and MVA were on resident perceptions of their programs, and it is difficult to know whether differences in burnout are actually due to characteristics of the program or whether resident perceptions were influenced by their pre-existing burnout. Additionally, the effect of hours spent at work may not be universal, because time spent working on direct patient care, education, or research may be rewarding and contribute to a sense of personal achievement, whereas work that is perceived to be simply bureaucratic may be more highly associated with burnout. However, these differences are difficult to assess without a more in-depth study.

Other questions that might impact burnout rates but were not addressed in this study include program size, type of internship performed (particularly for PGY-2 residents), childcare responsibilities (46), concerns about job prospects (47), and pre-existing mental health diagnoses. Despite these limitations, this study represents the only published survey of US radiation oncology residents focusing on burnout and the largest such study among radiation oncology residents worldwide. The use of the MBI-HSS, a validated burnout assessment, represents another strength because it allows comparison with previous literature and stratification of risk categories known to correlate with a variety of negative effects (48).

Conclusions

Overall, burnout rates among US radiation oncology residents seem to be consistent with rates among other US oncologists, international radiation oncologists, and practicing US radiation oncologists. In general, radiation oncology resident burnout rates in this study were lower than rates reported among several studies with a more diverse sample of physicians or residents. However, burnout among one-third of residents should be considered too high given the established association between burnout and medical errors, desire to leave the profession,

decreased medical knowledge, and even suicidal ideation. Given these findings, efforts should focus on identifying and mitigating risk factors for burnout to prevent the variety of negative sequelae associated with this syndrome. Future studies should track the evolution of burnout among US radiation oncology residents, using this study as a baseline.

References

- Shanafelt TD, Hasan O, Dyrbye LN, et al. Changes in burnout and satisfaction with work-life balance in physicians and the general US working population between 2011 and 2014. *Mayo Clin Proc* 2015;90:1600-1613.
- Linzer M, Guzman-Corrales L, Poplau S. Preventing physician burnout. Available at: www.stepsforward.org/modules/physician-burnout#section-steps; 2015. Accessed February 27, 2017.
- Maslach C, Jackson SE, Leiter MP, et al. *Maslach Burnout Inventory Manual*. 4th ed. Menlo Park, CA: Mind Garden; 2016.
- Shanafelt TD, Balch CM, Bechamps G, et al. Burnout and medical errors among American surgeons. *Ann Surg* 2010;251:995-1000.
- Hall LH, Johnson J, Watt I, et al. Healthcare staff wellbeing, burnout, and patient safety: A systematic review. *PLoS One* 2016;11:e0159015.
- Dyrbye LN, Shanafelt TD, Balch CM, et al. Relationship between work-home conflicts and burnout among American surgeons: A comparison by sex. *Arch Surg* 2011;146:211-217.
- Shanafelt TD, Mungo M, Schmitgen J, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work effort. *Mayo Clin Proc* 2016;91:422-431.
- Shanafelt TD, Raymond M, Kosty M, et al. Satisfaction with work-life balance and the career and retirement plans of US oncologists. *J Clin Oncol* 2014;32:1127-1135.
- Oreskovich MR, Shanafelt T, Dyrbye LN, et al. The prevalence of substance use disorders in American physicians. *Am J Addict* 2015;24:30-38.
- Wall M, Schenck-Gustafsson K, Minucci D, et al. Suicidal ideation among surgeons in Italy and Sweden—a cross-sectional study. *BMC Psychol* 2014;2:53.
- Shanafelt TD, Balch CM, Dyrbye L, et al. Special report: Suicidal ideation among American surgeons. *Arch Surg* 2011;146:54-62.
- Dyrbye LN, West CP, Satele D, et al. Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. *Acad Med* 2014;89:443-451.
- West CP, Tan AD, Habermann TM, et al. Association of resident fatigue and distress with perceived medical errors. *JAMA* 2009;302:1294-1300.
- West CP, Shanafelt TD, Kolars JC. Quality of life, burnout, educational debt, and medical knowledge among internal medicine residents. *JAMA* 2011;306:952-960.
- Dyrbye LN, Thomas MR, Massie FS, et al. Burnout and suicidal ideation among U.S. medical students. *Ann Intern Med* 2008;149:334-341.
- Muller D, Kathryn. *N Engl J Med* 2017;376:1101-1103.
- Martini S, Arfken CL, Churchill A, et al. Burnout comparison among residents in different medical specialties. *Acad Psychiatry* 2004;28:240-242.
- Ishak WW, Lederer S, Mandili C, et al. Burnout during residency training: A literature review. *J Grad Med Educ* 2009;1:236-242.
- Accreditation Council for Graduate Medical Education. *Physician well-being*. Available at: www.acgme.org/What-We-Do/Initiatives/Physician-Well-Being. Accessed February 22, 2017.
- Shanafelt TD, Gradishar WJ, Kosty M, et al. Burnout and career satisfaction among US oncologists. *J Clin Oncol* 2014;32:678-686.
- Medisauskaitė A, Kamau C. Prevalence of oncologists in distress: Systematic review and meta-analysis. *Psychooncology* 2017. <http://dx.doi.org/10.1002/pon.4382>. [Epub ahead of print].
- Balch CM, Shanafelt TD, Sloan J, et al. Burnout and career satisfaction among surgical oncologists compared with other surgical specialties. *Ann Surg Oncol* 2011;18:16-25.
- Eelen S, Bauwens S, Baillon C, et al. The prevalence of burnout among oncology professionals: Oncologists are at risk of developing burnout. *Psychooncology* 2014;23:1415-1422.
- Shanafelt T, Dyrbye L. Oncologist burnout: Causes, consequences, and responses. *J Clin Oncol* 2012;30:1235-1241.
- Kusano AS, Thomas CR Jr., Bonner JA, et al. Burnout in United States academic chairs of radiation oncology programs. *Int J Radiat Oncol Biol Phys* 2014;88:363-368.
- Aggarwal S, Kusano AS, Carter JN, et al. Stress and burnout among residency program directors in United States radiation oncology programs. *Int J Radiat Oncol Biol Phys* 2015;93:746-753.
- Pohar S, Fung CY, Hopkins S, et al. American Society for Radiation Oncology (ASTRO) 2012 Workforce Study: The radiation oncologists' and residents' perspectives. *Int J Radiat Oncol Biol Phys* 2013;87:1135-1140.
- Leung J, Riaseco P. Burnout, stress and satisfaction among Australian and New Zealand radiation oncology trainees. *J Med Imaging Radiat Oncol* 2017;61:146-155.
- Blanchard P, Truchot D, Albiges-Sauvin L, et al. Prevalence and causes of burnout amongst oncology residents: A comprehensive nationwide cross-sectional study. *Eur J Cancer* 2010;46:2708-2715.
- Association of Residents in Radiation Oncology Association of Residents in Radiation Oncology Directory. Available at: www.astro.org/uploadedFiles/Affiliates/ARRO/ARRO_Directory.pdf; 2015. Accessed September 7, 2016.
- Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-381.
- Dyrbye LN, West CP, Shanafelt TD. Defining burnout as a dichotomous variable. *J Gen Intern Med* 2009;24:440. author reply 441.
- Rafferty JP, Lemkau JP, Purdy RR, et al. Validity of the Maslach Burnout Inventory for family practice physicians. *J Clin Psychol* 1986;42:488-492.
- Schaufeli WB, Bakker AB, Hoogduin K, et al. On the clinical validity of the Maslach Burnout Inventory and the Burnout Measure. *Psychol Health* 2001;16:565-582.
- Accreditation Council for Graduate Medical Education. *Data Resource Book Academic Year 2015-2016*. Chicago, IL: ACGME; 2016.
- Peckham C. *Medscape lifestyle report 2017: Race and ethnicity, bias and burnout*. Available at: <http://www.medscape.com/features/slide-show/lifestyle/2017/overview>; 2017. Accessed February 26, 2017.
- Harolds JA, Parikh JR, Bluth EI, et al. Burnout of radiologists: Frequency, risk factors, and remedies: A report of the ACR Commission on Human Resources. *J Am Coll Radiol* 2016;13:411-416.
- Leung J, Riaseco P, Munro P. Stress, satisfaction and burnout amongst Australian and New Zealand radiation oncologists. *J Med Imaging Radiat Oncol* 2015;59:115-124.
- Ciammella P, De Bari B, Fiorentino A, et al. The "BUONGIORNO" project: Burnout syndrome among young Italian radiation oncologists. *Cancer Invest* 2013;31:522-528.
- Ripp JA, Bellini L, Fallar R, et al. The impact of duty hours restrictions on job burnout in internal medicine residents: A three-institution comparison study. *Acad Med* 2015;90:494-499.
- Gunasingam N, Burns K, Edwards J, et al. Reducing stress and burnout in junior doctors: The impact of debriefing sessions. *Postgrad Med J* 2015;91:182-187.
- Abrams MP. Improving resident well-being and burnout: The role of peer support. *J Grad Med Educ* 2017;9:264.
- Mougalian SS, Lessen DS, Levine RL, et al. Palliative care training and associations with burnout in oncology fellows. *J Support Oncol* 2013;11:95-102.

44. Shanafelt TD, Gorringer G, Menaker R, et al. Impact of organizational leadership on physician burnout and satisfaction. *Mayo Clin Proc* 2015;90:432-440.
45. Sinsky CA, Willard-Grace R, Schutzbank AM, et al. In search of joy in practice: A report of 23 high-functioning primary care practices. *Ann Fam Med* 2013;11:272-278.
46. Holliday EB, Ahmed AA, Jagsi R, et al. Pregnancy and Parenthood in Radiation Oncology, Views and Experiences Survey (PROVES): Results of a blinded prospective trainee parenting and career development assessment. *Int J Radiat Oncol Biol Phys* 2015;92:516-524.
47. Burt LM, Trifiletti DM, Nabavizadeh N, et al. Supply and demand for radiation oncology in the United States: A resident perspective. *Int J Radiat Oncol Biol Phys* 2017;97:225-227.
48. Shanafelt TD, Dyrbye LN. Reply to P. Blanchard et al. *J Clin Oncol* 2012;30:3030.