

A narrative review on burnout experienced by medical students and residents

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OBJECTIVE To summarise articles reporting on burnout among medical students and residents (trainees) in a narrative review.

METHODS MEDLINE was searched for peer-reviewed, English language articles published between 1990 and 2015 reporting on burnout among trainees. The search used combinations of Medical Subject Heading terms *medical student, resident, internship and residency, and burnout, professional*. Reference lists of articles were reviewed to identify additional studies. A subset of high-quality studies was selected.

RESULTS Studies suggest a high prevalence of burnout among trainees, with levels higher than in the general population. Burnout can undermine trainees' professional

development, place patients at risk, and contribute to a variety of personal consequences, including suicidal ideation. Factors within the learning and work environment, rather than individual attributes, are the major drivers of burnout. Limited data are available regarding how to best address trainee burnout, but multi-pronged efforts, with attention to culture, the learning and work environment and individual behaviours, are needed to promote trainees' wellness and to help those in distress.

CONCLUSION Medical training is a stressful time. Large, prospective studies are needed to identify cause effect relationships and the best approaches for improving the trainee experience.

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INTRODUCTION

Medical schools and residency programmes are responsible for ensuring that future doctors are well prepared to deliver high-quality patient-centred care, uphold ideals of the profession and be leaders within evolving health care systems. Ideally, trainees should also enter the workforce optimistic about the future of medicine and satisfied with their career choice. Medical educators design and implement curricula to move trainees toward these goals. Some components of training and acculturation, however, have an unintended and detrimental impact on trainees' mental health. A high proportion of medical students, residents and fellows (trainees) experience severe work-related stress and burnout.^{1,2} Burnout is a multifaceted construct characterised by various degrees of emotional exhaustion, depersonalisation (i.e. feeling detached from or callous toward patients) and a low sense of personal accomplishment.³ Burnout can undermine trainees' professional development, place patients at risk and contribute to a variety of personal consequences, including suicidal ideation and substance abuse.⁴⁻⁸ Given its prevalence and the serious nature of the consequences, action is needed to prevent burnout among doctors in training and help those who are struggling get the necessary care. In this narrative review, we present an overview regarding the extent of trainee burnout, professional and personal consequences of burnout, why trainees commonly experience burnout, and how to best address trainee burnout. We also discuss and identify critical areas that need further research to better inform intervention strategies.

Search strategy and selection criteria

We searched MEDLINE for peer-reviewed, English language articles published between 1990 and 2015 with use of the search terms *medical student* OR *resident* OR *'internship and residency'* AND *burnout, professional*. We identified additional studies from the reference lists of these articles. Each article was critically reviewed and included as appropriate based on reporting primary data, validity of the methods used, clarity of the results and reliance on an established tool to measure burnout. We included a subset of high-quality studies that we thought most pertinent and insightful. This paper is informed by our narrative review and experience.

WHAT IS THE EXTENT OF TRAINEE BURNOUT AND HOW DOES IT VARY ACROSS DIFFERENT STAGES OF TRAINING?

Studies consistently find that a high proportion of medical students and residents across all residency specialties and throughout the world experience severe work-related stress and burnout.^{1,2,8-15} In our national or multi-institutional studies we found that 35-45% of medical students had high emotional exhaustion, 26-38% had high depersonalisation and 45-56% had symptoms suggestive of burnout (Table 1).^{1,4,5,16-19} Limited cross-sectional data suggest the prevalence of burnout is higher for students in more advanced years of training.^{12,17,19,20} Most of this increase appears to stem from an increase in the experience of depersonalisation.^{17,20} This is particularly concerning because depersonalisation, an aspect of burnout primarily manifested as being callous or detached toward patients, is most strongly associated with negative effects on professionalism.^{4,8}

Residency programme directors are likely to inherit medical school graduates with a substantial burden of burnout symptoms.²¹ In a pooled analysis of responses to the 22-item Maslach Burnout Inventory (MBI) completed by 1428 fourth-year medical students attending five to seven US medical schools just prior to graduation, the mean emotional exhaustion score was 23.8, the mean depersonalisation score was 9.3 and the overall prevalence of burnout of 49%.²¹ These findings suggest that the burden of burnout symptoms continues during the transitional period from medical school into residency. One longitudinal study that followed medical students as they transitioned from the Karolinska Institute Medical School into residency found that a high degree of worry about the future during the final year of medical school predicted postgraduate exhaustion (as measured by the Oldenburg Burnout Inventory, [OLBI])²² 6-10 months after graduation.²³ This study suggests that students who are anxious about workload, long hours, volume of information to learn and ability to meet future responsibilities may be more vulnerable to a spike in their burnout level as they start residency.

Once in residency the prevalence of high emotional exhaustion continues at about the same level found during medical school (44-50%).^{1,8,15} The prevalence of high depersonalisation (32-38%) and overall burnout (60%), however, increases.^{1,10} Some

Table 1 Select large, multicentre or national studies using 22-item Maslach Burnout Inventory

Citation	Year of study	No. trainees	Response rate (%)	No. schools/institutions	EE* (mean)	High EE* (%)	DP† (mean)	High DP† (%)	Overall burnout‡ (%)
Medical students									
Dyrbye <i>et al.</i> ¹⁷	2004	545	50	3 US	21.8	35	6.4	26	45
Dyrbye <i>et al.</i> ¹⁶	2006	1701	55	5 US	23.3	37	6.8	28	47
Dyrbye ⁵	2007	2248	52	7 US	24.0	40	7.3	32	50
Dyrbye ⁴¹	2009	2682	61	7 US	24.4	42	8.0	36	53
Paro ¹⁹	2011–12	1350	82	22 Brazil	25.7 (men); 27.7 (women)		9.2 (men); 8.0 (women)		
Dyrbye ¹	2012	4402	35	US national study	25.0	45	7.0	38	56
Dyrbye ¹⁸	2012	873 (second–fourth year)	36	6 US	24.8	42	7.8	34	53
Residents									
Golub ²⁶	2005	684	50	US national study of otolaryngology residents	22.4	33	10.7	53	
Blanchard ¹¹	2009	204	60	French national study of oncology residents		23		35	44
Takayesu (2014)	2011	218	75	8 US emergency medicine programmes		33		59	
Dyrbye ¹	2012	1701	23	US national study, all specialties	24.0	44	10.0	51	60

* EE, emotional exhaustion; high EE defined as a score of 27 or higher.

† DP, depersonalisation; high DP defined as a score of 10 or higher.

‡ Burnout, defined as having high EE (≥ 27) or DP (≥ 10)¹⁵.

multicentre cross-sectional studies¹⁰ and small longitudinal studies suggest the prevalence of burnout increases with each year of residency,^{24,25} with others finding an equivalent prevalence across years of residency²⁶ or a lower risk of developing burnout after the intern year.^{13,27}

It is unknown whether the prevalence of burnout varies by specialty during residency training; a recent national study of US doctors, however, suggests rather large variations in the prevalence of burnout among practising US doctors by specialty,

with the highest rate among those working in disciplines at the front line of access to medical care (emergency medicine, general internal medicine, neurology and family medicine).²⁸ The extent to which this can be extrapolated to the residency training environment is uncertain.

In addition to potential differences by specialty, the prevalence of burnout may also vary by country of training and the trainee's country of origin. Although some of the stressors are likely to be different there are also bound to be similarities

(e.g. suffering, death and dying, medical error, workload, etc.). Direct comparisons between studies from around the world are problematic due to the wide variations in medical training and methodological differences. Two recent large studies reported that burnout was less common among international medical graduates than among US medical graduates training in the US.^{6,29} Whether this finding is due to the extreme process of selection that international medical graduates must go through before arriving in the US or is due to other factors merits further exploration. Regardless, studies indicate that burnout among trainees is a global phenomenon^{2,9,11} and often persists into practice.^{28,30}

IS THE PREVALENCE OF BURNOUT INCREASING?

Unfortunately, a lack of large, multi-institutional or national studies using similar methodologies makes it difficult to draw conclusions about historical trends. Prior to May 2005 there was one publication on burnout among medical students.³¹ A decade later such publications are common, raising the possibility that either the prevalence is increasing or at least interest in the topic is increasing. When reviewing results from large cross-sectional, multi-institutional or national studies conducted over the last decade using similar methodologies, the mean emotional exhaustion and depersonalisation scores, as well as the prevalence of high emotional exhaustion, high depersonalisation and overall burnout, among responding medical students appear to have an upward trajectory overall (Table 1).

Whether the likelihood of burnout is higher among residents today compared with in the past is similarly difficult to determine. Three of seven US studies using historical controls suggest the prevalence of burnout has declined since 2003.³² However, a recent national study of over 16 000 US internal medicine residents who started training after 2003 found a prevalence of burnout similar to earlier studies.⁶ To really get a sense of changes in the experience of burnout large, longitudinal studies using consistent methodology are needed.

HOW BIG A PROBLEM IS IT, REALLY, WHEN COMPARED WITH OTHER HIGHLY DEMANDING FIELDS?

The high prevalence of burnout among trainees begs the question of whether burnout just affects everyone. Data suggest that despite having gone

through the rigorous academic preparation required for acceptance, medical students begin medical school with mental health profiles similar to or better than peers who pursue other careers.^{33,34} A 2012 study of medical students at six US medical schools found that matriculates had a lower prevalence of burnout (27.3% versus 37.3%) and depression and higher reported quality of life relative to age-matched college graduates pursuing other careers.³⁴ Once medical school begins, however, data suggest many medical students' mental health follows a downward trajectory and becomes worse than that of peers outside medicine.^{1,33,35} In national samples of 4402 medical students and 1701 residents high emotional exhaustion, high depersonalisation and overall burnout was substantially more prevalent among medical students and residents than age-matched college graduates not studying medicine.¹

It is not known if burnout is more prevalent among medical trainees than trainees preparing for other highly demanding fields (e.g. the airline industry, police or military). However, a national study of burnout in a sample of more than 7000 US doctors and a probability-based sample of the general US population conducted in 2011 found that relative to individuals with a high school diploma, doctors were at increased risk of burnout (odds ratio [OR], 1.36), whereas those with a bachelor's degree (OR, 0.80), master's degree (OR, 0.71) or professional or doctoral degree other than MD or DO (OR, 0.64; e.g. JD or PhD) were at lower risk of burnout, after adjusting for age, sex, relationship status and hours worked per week. Although useful for providing context, the importance of such comparisons is debatable, as distress among any of the groups should not be disregarded, no matter how the groups' relative distress levels compare.

WHY SHOULD WE BE CONCERNED ABOUT TRAINEES WITH BURNOUT?

Burnout has potentially serious professional as well as personal consequences (Table 2). Data suggest that burnout may erode medical students' professional development and diminish a number of professional qualities (e.g. honesty, integrity, altruism and self-regulation). In a multi-institutional study of US medical students, those with burnout were substantially more likely to engage in unprofessional behaviours, with the potential to undermine competency (e.g. cheating and plagiarism) as well as impair the delivery of timely and accurate patient

Table 2 Potential ramifications of burnout among medical students and residents

Professional	Decreased empathy	
	Cheating/dishonest behaviours	
	Dishonesty regarding patient care*	
	Problems identifying and managing conflicts of interest	
	Decreased altruistic professional values	
	Inappropriate prescribing behaviours	
	Decreased personal accountability regarding impaired colleagues	
	Dropping out of medical school	
	Influence on specialty choice	
	Suboptimal patient care	
	Medical errors	
	Decreased medical knowledge	
	Personal	Suicidal ideation
		Greater sense of stigma regarding mental health problems
		Motor vehicle incidents

* Reporting laboratory test as pending when not sure it had been ordered or knew it had not been; reporting physical examination as normal when knew it had been omitted from the physical examination.

care (e.g. reporting a laboratory test as pending when not sure if it had been ordered, or reporting a physical examination finding as normal when it had been omitted from the physical examination).⁴ Burnout has also been associated with lower empathy scores and less altruistic views of a doctor's responsibility to society.^{4,19,36,37} Medical students with burnout are also less likely to (i) identify how to appropriately manage conflicts of interest, (ii) report impaired colleagues and (iii) endorse appropriate prescribing practices.^{4,18} Together these findings suggest that burnout is a broad and insidious threat to medical students' professional development.

During residency the implications of burnout magnify. Several studies have now reported that patients cared for by residents with burnout are at increased risk of receiving suboptimal care and experiencing a medical error.^{8,15,30} Residents with burnout report greater difficulty concentrating at work.³⁸ Burnout may impede the cognitive processes needed for knowledge and skill acquisition and application.³⁹ This is supported by a recent national study of

nearly all US internal medicine residents that found those with burnout scored significantly lower on a national standardised examination of medical knowledge, with the differences in medical knowledge across the continuum of burnout as large as the difference observed across an entire year of residency training.⁶ Similarly, pilot data from a small study of residents using functional magnetic resonance imaging recently reported that burnout negatively impacted performance on multiple choice questions assessing clinical reasoning with corresponding brain activity changes.⁴⁰

The experience of burnout may also have an impact on trainees' views of medicine as a career. In a 2006–2007 longitudinal, multi-institutional study of medical students, burnout at baseline independently predicted serious thoughts of dropping out of medical school during the following year.⁴¹ A more recent small cross-sectional study found that students with high emotional exhaustion were more likely to choose a specialty with a more controllable lifestyle whereas those with low personal accomplishment were more likely to choose a higher-income specialty.⁴² Once in residency burnout is associated with lower career satisfaction,^{10,26} increased likelihood of seriously considering changing specialty, and abandoning medicine altogether.¹¹ Although longitudinal research is needed to better inform our understanding, existing data suggest burnout has the potential to impact the size and specialty distribution of the doctor workforce and consequentially patients' access to care.

Beyond its professional ramifications, burnout can have a tremendous personal impact. A 2012 national study of 4402 US medical students recently reported that burnout was independently associated with an increased risk of alcohol abuse or dependence,⁷ a finding also found in large samples of surgeons and US doctors.^{43,44} Additionally, a prospective study involving over 4000 medical students from seven medical schools found that burnout at baseline was an independent predictor of suicidal ideation over the following year.⁵ Recovery from burnout dramatically decreased the prevalence of suicidal ideation, providing evidence of potential causality (e.g. reversibility).⁵ Students with suicidal ideation are also likely to have coexistent alcohol abuse or dependence.⁷ Burnout, suicidal ideation and alcohol abuse or dependence may be a particularly hazardous triad as alcohol increases impulsivity and the risk of completed suicide.^{45–47} Suicidal thoughts have also been demonstrated to be more

common among residents with burnout.⁴⁸ Although data regarding the frequency of medical student and resident suicide are limited, the prevalence of suicide among US doctors is substantially higher than that among the US population, despite a similar prevalence of depression.⁴⁹ Other personal ramifications of burnout include higher relationship stress²⁶ and risk of motor vehicle incidents.⁵⁰

Together these studies suggest that burnout has potentially wide ramifications for the profession and the public it serves, with its effects on professional behaviour, attitudes and competency, safety and quality of care, career or specialty decision making, and individual risk behaviours and decisions.

WHAT IS DRIVING BURNOUT?

The finding that matriculating medical students have a similar or even better mental health profile than age-matched college graduates pursuing other careers and that medical students' mental health deteriorates once in medical school to become worse than that of age-matched college graduates,^{1,34} suggests that the origins of burnout are rooted in the learning and work environment. This framework resonates with studies demonstrating that workplace conditions, more than individual characteristics, are the major determinants of doctors' well-being⁵¹ and drivers of burnout.⁵²

What is the role of the curriculum and training experiences?

Although some sources of stress persist throughout training and into practice, other sources of stress vary at the different career stages (Table 3). In a large multi-institutional study designed to identify modifiable curricular factors related to first- and second-year student burnout, grading schemes were independently associated with an increased risk of burnout.⁵³ Students in a grading system with three or more hierarchies (e.g. A F letter grade; honours/high pass/pass/marginal pass/fail; honours/pass/fail) rather than a strict pass or fail curriculum had 1.97 times increased odds of experiencing burnout. Other studies have demonstrated that pass or fail grading schemes during the first 2 years of medical school promote group cohesion,^{53–55} suggesting that grading scheme may influence the degree to which the learning environment is supportive, help ease the initial adjustment to medical school and facilitate development of social support networks that are important to resilience.⁵⁶ Peer

collaboration has also been shown to relate to resident burnout.⁵⁷ In a national study of orthopaedic residents in the Netherlands poor peer collaboration was the strongest learning climate factor studied associated with increased symptoms of burnout.⁵⁷

In the above-mentioned multi-institutional study of year 1 and year 2 students, there was no significant association between hours spent in lectures and small groups, hours of clinical experiences, hours and number of exams, weeks of vacation, and any measure of student well-being.⁵³ Similarly, a separate study of third and fourth-year students found no independent relationship between clinical rotation characteristics and workload (e.g. outpatients, inpatients, intensive care unit, overnight call frequency, and number of patients seen per day or admitted per week) and burnout.⁵⁸ These studies suggest that curricular and clinical hours may not drive the burnout experienced by medical students.

Among residents burnout is commonly attributed to excessive workload, with higher patient volumes, more frequent overnight calls, greater work-hours and lower autonomy associated with an increased risk of burnout, although studies are inconsistent.^{2,11,26,30,32,59} Two longitudinal studies on the post-2003 Accreditation Council for Graduate Medical Education (ACGME)-mandated work-hour limitations, reported no relationship between self-reported workload (e.g. average number of patients admitted per on-call day), work-hours, overnight call frequency and incidence of burnout.^{60,61} Other studies examining the prevalence of burnout among residents before and after the 2003 ACGME-mandated work-hour reform have mixed results, with only three of seven studies showing statistically significant reduction in burnout.³² A national study of over 16 000 US internal medicine residents who started training after 2003 found a prevalence of burnout similar to earlier studies.⁶ Although studies examining the impact of the 2011 ACGME duty hour standards (shift length and night float limits, protected sleep time) on overall well-being and mood and depression scores have had mixed results,⁶² a recent study of first-year internal medicine residents at three institutions found similar year-end prevalence and incidence of burnout between the 2011–2012 and 2008–2009 cohorts.⁶³ It is possible that some of the benefits of limiting total work hours have been offset by work compression,⁶⁴ where the same workload and educational requirements must be completed in fewer hours, such that

Table 3 Potential stressors and contributors to burnout among medical trainees

	Medical students	Residents
Stage-specific stressors	Human dissection First death experience	Added responsibility for patient care Research productivity Medical licensure requirements Job search Lack of control Excessive administrative tasks
Stressors for both medical students and residents (at all stages of training)	Adjustment Competition Patient and family suffering Specialty/sub-specialty decision making High stake assessments Lack of personal time Financial concerns related to student debt Negative personal life events	
Learning and work environment factors associated with burnout	Poor learning environment Inadequate support from faculty staff, medical school staff and peers Education of medical students is not a priority for faculty staff Disorganised clinical rotations Poor supervision Cynical residents Little variety of medical problems encountered Mistreatment Grading schema	Work compression Excessive workload Overnight call frequency Work-hours Limited autonomy Lack of timely feedback Stressful relationships with supervisors Uncertainty about the future Medical error Perception that personal needs are inconsequential to training programme

the net effect of work-hour limitations on residents' mental health is neutral.

Does supervisor behaviour relate to trainee experience of burnout?

In a multi-institutional study involving over 3000 students, dissatisfaction with the overall learning environment and amount of support from faculty staff most strongly related to burnout among year 1 and year 2 students, whereas dissatisfaction with the overall learning environment, poor clerkship organisation and working with cynical residents most strongly related to burnout among year 3 and year 4 students.⁵⁸ Studies have also found that students who perceive they have been mistreated or belittled are more likely to have burnout.^{16,58,65} For example, in a 2006 multi-institution study, medical students

from an ethnic minority who perceived their race had adversely impacted their medical school experience were substantially more likely than ethnic minority students who reported no such experiences to have high emotional exhaustion, high depersonalisation and burnout.¹⁶ More recently, a national study of 564 third-year medical students found that perceptions of recurrent mistreatment by faculty staff or residents were associated with an increased risk of burnout.⁶⁵

Similarly, stressful relationships with supervisors,² attending physician demands,²⁶ insufficient autonomy,²⁶ a perception that personal needs are inconsequential⁸ and lack of timely feedback⁶⁰ are associated with resident burnout. By contrast, perceptions that supervisors within the work environment accept residents' need for education, feedback

and support may buffer the development of exhaustion, as measured by the OLBI, during postgraduate training.⁵⁹ Furthermore, a Dutch study found that residents who describe their relationship with supervising doctors as mutually supportive and beneficial had lower emotional exhaustion and depersonalisation scores than residents who felt under-appreciated by their supervising doctor.⁶⁶ Although there are substantial data supporting a relationship between supervisor behaviour and trainee burnout, there is no direct evidence of causality. It is possible that trainees with symptoms of burnout view the learning environment differently, leading to lower ratings of factors within the learning environment, or that a poor learning environment leads to trainees experiencing burnout. In a single-centre longitudinal study of third-year medical students, perceptions of mistreatment by superiors or poor role modelling were associated with higher end-point depression scores,⁶⁷ suggesting the directionality is one of suboptimal behaviour by faculty staff adversely impacting trainees' well-being. Additional studies designed to understand modifiable factors within the training and work environment that drive burnout are needed to broaden our understanding of burnout and identify targets for intervention studies.

Are there individual factors that increase vulnerability to burnout?

Although the learning or work environment rather than individual characteristics (e.g. demographics and personality) is thought to be the primary contributor to burnout,^{2,3} individual characteristics and experiences influence how workload and level of support are perceived.^{9,68} With respect to demographics, studies have found non-minority students to be more likely to have burnout than ethnic minority students, after controlling for age, sex, parenting and marital status.^{16,58,69} Similar findings have been reported among residents² and outside of medicine.³ Why minority students have a lower prevalence of burnout is not known. It may be differences in life experiences that have culminated in them being more resilient to the stressors of training. Some studies suggest female medical students and residents may also be at greater risk of burnout⁵⁸ or emotional exhaustion,² whereas male residents may more often experience depersonalisation² but these relationships are not strong.² In terms of personality, a study found weak but statistically significant associations between degree of neuroticism and emotional exhaustion.⁶⁸ Personal disposition, social support and coping

mechanisms are likely to have some degree of moderation of the stress that effects vulnerability to burnout.²

Life stressors outside of medicine also drain trainees' personal resources. Personal experiences, such as personal illness, illness in a family member, going through a divorce, family-related stress and financial concerns increase the risk of burnout among medical students and residents.^{2,9,17,60,61} Medical students⁷⁰ and residents⁶ with a high educational debt are also more likely to experience burnout. Accordingly, the experience of burnout is a complex phenomenon due to the multifaceted interplay of personal, professional and environmental characteristics.

What might be some new drivers of burnout among trainees?

A number of new stressors are on the horizon for the next generation of doctors. For one, competition for residency slots is increasing as a result of new medical schools opening, existing medical schools expanding and relatively stagnant growth of residency and fellowship programmes. This will increase competition and stress as trainees strive harder to achieve the highest test scores and grades, potentially fuelling a culture of competition that could undermine social support. Second, a milestone-based flexible progression to shortened paths to completion of training could accelerate assessments and amplify stress, increasing the risk of burnout, or lead to reduced educational burden and lower risk of burnout. Third, seemingly exponential growth in the medical knowledge to be learned, coupled with new competencies to be reached within fields such as interprofessional teamwork, quality and safety, population health and data analytics, increases the challenges that accompany curriculomegaly. Fourth, trainees today are entering a rapidly evolving and changing health care system experiencing dramatic environmental and cultural shifts. In addition, they will work in an era of workforce shortages. Hence, trainees face an enormous amount of uncertainty coupled with new constraints.⁷¹ This is concerning because studies suggest that residents who feel uncertain about the future are more likely to experience burnout.⁸

WHAT SOLUTIONS OR STRATEGIES MIGHT BE EFFECTIVE?

Trainee well-being is a shared responsibility of individual trainees, training programmes (i.e. medical

school or residency), academic medical centres, accreditation organisations and organised medicine. Given the myriad of stressors and individual preferences, a one-sized solution is unlikely. Rather, strategies should systematically engage trainees in addressing burnout, use available resources, be grounded in best available data, be customised to the local environment and include a variety of approaches. We should aspire to eliminate or reduce the root causes of burnout and promote resilience and well-being. After all, being mentally healthy is more than the absence of mental illness, and is critical to personal well-being and to society.⁷²

What should trainees be encouraged to do to reduce their risk for burnout?

Despite the rigours of training, not all medical trainees experience burnout.^{60,69} Notably, among those who do burnout, 15–25% recover over the course of the next 1–2 years without any specific programmatic intervention.^{61,69} Although many factors contributing to burnout are beyond individual control, personal choices have some influence on how stressors impact well-being. For example, being employed in order to have an income while a medical student increases the risk of developing burnout, and if already burned out, employment is strongly associated with not recovering from burnout.⁶⁹ Medical students and residents who report higher levels of social support are less likely to have burnout symptoms,^{29,69} whereas individuals with higher levels of fatigue are at increased risk of burnout.⁶⁹

Relying on a personal strategy to find meaning in work or training, engaging regularly in recreation, hobbies or exercise, maintaining a positive outlook and avoiding a mentality of delayed gratification (i.e. 'survival attitude') lowers the risk of burnout.^{8,73} Personal choices that ensure adequate sleep during time off, build relationships and social support, maintain personal health, reduce debt burden and manage stress reduce the risk of burnout (Table 4).^{6,9,58,66,69} In taking ownership of their own mental well-being, it is important that trainees are attentive to integrating their personal and professional lives, with appropriate allocation of time for independent study, personal pursuits and rest. Other constructive coping strategies, such as positive reframing and problem solving, have also been shown to decrease the risk of other mental health problems⁶⁷ and promote resilience.⁵⁶ Resiliency is the ability to remain positive despite adversity.⁷⁴ It is important to note that resilience is

a skill that can be learned and strengthened.⁵⁶ In fact, the psychological literature confirms that social support and constructive coping skills are pivotal to resiliency, and as such should be part of an individual's approach to cultivating personal resiliency.⁵⁶

Trainees may also find mindfulness training useful for combating stress and promoting engagement in self-care activities. Mindfulness training can include self-awareness and positive self-reinforcement, strategies to lower physical and emotional reactions to stressors, communication skills training, meditation and yoga exercises.^{75,76} Although rigorous randomised trials with a comparative control group are lacking,⁷⁶ data from a 1-year longitudinal study found that primary care doctors who voluntarily participated in a 52-hour mindfulness training programme delivered after hours and on weekends experienced markedly reduced burnout and improved empathy and mindfulness, with results sustained 3 months post-intervention.⁷⁷

Additional strategies include seeking support and frank discussions with supervising faculty staff when a trainee suspects he or she may have had a role in a medical error. Such conversations can help prevent future errors and reduce inappropriate self-blame and distress.^{15,78} Trainees also have a personal responsibility to seek additional instruction for specific work-related tasks they find particularly stressful (e.g., relaying bad news, procedural tasks), set reasonable personal expectations for the amount of work-related tasks that can be completed within allowed work hours, and handover all patient care needs at the end of a shift to avoid extending work once officially relieved of duty. Doing so, however, can be extremely difficult and may amplify stress if the trainee feels their own inadequacy prevented them from getting needed work done before the end of their shift or if they hear conflicting messages about their personal responsibility for patients' welfare and need to leave the hospital with patient-care work yet to be completed. Trainees will also need to embrace a culture of change and continuous improvement as new health care systems are designed and implemented consistent with key strategies⁷⁹ and national quality priorities⁸⁰ to improve patient outcomes and reduce costs.

To promote well-being trainees should also take steps to calibrate personal distress and well-being, determine if their mental health is adversely impacting their learning or care of patients, and seek help when appropriate. How well trainees perform these

Table 4 Personal strategies to promote well-being

	Medical students	Residents
Stage-specific strategies	Do not work for income (e.g. employed while in medical school)	Seek extra training for stressful job-related tasks specific to your specialty discipline (e.g. delivering bad news, dealing with angry patients, procedures) Improve organisation skills Handover all patient care needs at end of shift to avoid extending work once officially relieved of duty Set reasonable personal expectations for work tasks to be completed within allowed work hours
Strategies for all stages	Use available tools to assess personal level of well-being Obtain treatment for mental or emotional concerns Manage time away from work to ensure adequate sleep Build relationships with peers, mentors and faculty staff Seek support from supervisors when worried about possible medical error Find meaning in work Engage regularly in recreation and hobbies to reduce stress Maintain a positive outlook Seek advice about debt reduction Avoid an attitude of delayed gratification Focus on what is most important in life Obtain mindfulness training to become more self-aware and lower physical and emotional reactions to stressors Allocate time for independent study and personal pursuits Find ways to contribute to society (e.g. donate blood or volunteer) Exercise in accordance with CDC guidelines Obtain age and sex-appropriate health screening	

tasks is unknown; however, data suggest that doctors in practice are poor at calibrating their own level of distress⁸¹ and both trainees and doctors in practice are reluctant to seek help for mental health concerns.^{30,82} Unfortunately, few trainees with burnout seek help due to perceived stigma, negative personal experiences and social and cultural factors,⁸³ which means that early identification and treatment of trainees with burnout is difficult.

What organisational-level strategies might be helpful?

Organisations need a multi-faceted approach that attends to primary, secondary and tertiary prevention to reduce the risk of trainees experiencing burnout and helps those with burnout recover (Table 5).

Curriculum

One reasonable step is to introduce the concept of self-care, well-being and resilience into the training curriculum. Innovative curricula focused on awareness of burnout, self-care (reduction of stress and fatigue), mindfulness, strategies for taking tests, maintaining health and personal interests, work-life balance, dealing with suffering and medical error, debt management and adaptive coping strategies (e.g. positive reframing, problem solving, etc.) may be useful for primary prevention.^{6,8,56,67,69,75,76,84-87}

A curriculum that helps trainees understand how to support peers in distress, and when, why and how to personally intervene when peers are impaired due to a mental health problem, also appears to be needed.⁸³ Supporting such cognitive knowledge with understanding and experience of the process

Table 5 Potential ways medical schools, residency programmes, academic medical centres, accrediting organisations and organised medicine can promote a culture of wellness

Wellness curriculum

Implement and evaluate effectiveness of a wellness curriculum for doctors in training^{*†}

Provide funding and necessary support[‡]

Include promotion of personal mental health within core competency and milestone framework[§]

Require wellness programming[§]

New educational strategies

Adapt pass or fail grading in years 1 and 2 (preclinical years)^{*}

Reorganise a large group of students into smaller learning communities to build group cohesion and social support^{*}

Provide opportunities for meaningful patient care roles and continuity with preceptor^{*}

Address work-compression^{†,‡}

Include evaluation of patient mix, organisation of rotation, opportunity for meaningful work, adequacy of supervision, perceived support, learning climate and other controllable factors during programmatic evaluation^{*†}

Monitor and respond to absences to support trainees during major life events and facilitate detection of distress^{*†}

Organise social activities to foster peer peer and peer faculty relationships^{*†}

Subsidise access to fitness facilities^{*†,‡}

Implement career advice[†] that includes contract negotiation, medical billing, office management, health care reform and similar practice topics for senior residents to ease transition from training into medical practice[†]

Promote culture of no tolerance of harassment through novel ways of monitoring and responding to reports of harassment and suboptimal role-modelling behaviours^{*†}

Implement faculty staff development to raise awareness and facilitate a positive learning environment with effective, timely feedback, and enable them to detect and respond to emotional distress in trainees^{*†,‡}

Develop a compensation strategy that enables faculty members to prioritise education of trainees (e.g. reasonable workload when supervising, and compensation plans to offset lowered productivity)[§]

Screening tools

Make tools available that individuals can use to self-calibrate^{*†,‡,§,¶}

Screen for distress in a group of medical trainees using a third party^{*†,‡}

Access to care

Empower and educate trainees to prioritise their own health through adequate access to care and an adequate absenteeism policy^{*†}

Structure required curricular time and work assignments to allow for time-off during a typical workday^{*†}

Assess for perceived and feared discrimination due to mental health problems and implement response^{*†}

Support national efforts to expand the mental health provider workforce^{*†,‡,§,¶}

Advocate for reporting requirements (state licensing boards, hospitals, clinics and malpractice insurance carriers) to ask about current impairment from a mental health condition, rather than past or current diagnosis or treatment^{*†,‡,§,¶}

Tackle stigma toward mental health problems and barriers to seeking help by educating trainees and faculty staff about confidentiality policies and procedures; monitor and respond to reports of discrimination due to mental health problems^{*†,‡}

Ensure adequate access to conveniently located mental health counsellors on and off campus who are not involved in trainees' academic assessment or promotion^{*†,‡}

Help local and national initiatives targeting negative attitudes about mental illness and treatment^{*†,‡,§,¶}

* Medical schools; † residency programmes, ‡ academic medical centres, § accreditation organisations (e.g. Liaison Committee on Medical Education, Accreditation Council for Graduate Medical Education), ¶ organised medicine (e.g. American Medical Association, Association of American Medical Colleges).

of behavioural change can help translate knowledge into action, as illustrated by the experience at Northwestern University Feinberg School of

Medicine.⁸⁸ Facilitated small-group meetings with colleagues to address such topics (e.g. self-care, meaning in work, dealing with suffering, mindful

practice and work-life balance) have been shown to be useful in a randomised clinical trial involving doctors at the Mayo Clinic.⁸⁸ Extra-curricular strategies with some supportive outcome data include Vanderbilt School of Medicine's comprehensive medical student wellness programme and the Mayo Clinic Graduate School of Medical Education's team-based, incentivised exercise programme.^{89,90}

Inserting such a curriculum into the existing undergraduate and graduate medical education programmes has numerous challenges. Wellness programming and curricula, however, could fulfill Liaison Committee on Medical Education requirements (accreditation standard 12.3)⁹¹ for US and Canadian medical schools and potentially new ACGME Clinical Learning Environment Review (CLER) Pathway⁹² requirements for education on strategies for managing burnout and fatigue. Obtaining the necessary resources and infrastructure to optimally design, implement, evaluate and sustain such initiatives is likely to be difficult. Widespread adoption of self-care as a core competency, as recognised by the Canadian Royal College of Physicians and Surgeons,⁹³ the UK General Medical Council⁹⁴ and some US medical schools,⁸⁸ would facilitate development of evidence-based curricula and thoughtful assessment strategies, and send the important message to learners that self-care is an essential part of being a doctor. Inclusion of self-awareness of emotional limitations and appropriate help-seeking in the 2013 milestones⁹⁵ developed by the ACGME and the American Board of Pediatrics is evidence that the concept of self-care is becoming a fundamental principle in US graduate medical education.

The effectiveness of any new curriculum, however, should be subject to a rigorous evaluation to ensure efficacy and optimal resource allocation. Such evaluations should be held to the same standards of evidence required elsewhere in medicine. Reductions in burnout or improvements in well-being should be demonstrated and study designs must include appropriate comparator or control groups and address volunteer bias.

New educational strategies

Providing training regarding how to deal with work-related stress in the absence of a simultaneous effort to identify and address factors contributing to burnout can increase cynicism (e.g. 'this is your problem'). By contrast, a cohesive and simultaneous effort that pairs such training with structural

changes to the training or practice environment demonstrates a shared commitment to addressing the issue.

Adopting a pass or fail grading scheme during the first 2 years of medical school is an example of an evidence-based organisational change to reduce burnout and improve well-being.^{53–55} Fortunately, studies have found that switching to a pass or fail approach in year 1 and year 2 does not decrease medical knowledge scores on standardised tests or clerkship performance.^{54,55} Although not directly studied, using criterion-based grading rather than norm-based grading may facilitate a collegial learning environment during the clinical years that could promote well-being. Reorganising medical students from a single large group into smaller learning communities has been shown in a single institution study to reduce stress, anxiety and depression.⁹⁶ Organising retreats and social activities may foster relationships and peer support.^{56,66} Longitudinal clerkships may provide greater opportunity for continuity with a preceptor and facilitate more meaningful relationships, higher support and more substantive involvement in patient care.⁹⁷ Whether students participating in longitudinal clerkships or other educational experiences where students learn while measurably improving health care⁹⁸ leads to a lower risk of burnout or other forms of distress remains to be determined.

Programmatic evaluation is a key way for medical schools and residency programmes to optimise the learning environment by identifying and addressing controllable factors that impact the well-being of trainees (e.g. organisation of rotations, patient mix, opportunity for meaningful work and emotional support, adequacy of supervision, and role modelling by faculty staff^{2,58}). Attention to the sequence of clinical assignments can help ensure learners are adequately prepared for the next level of responsibility while allowing for the level of challenge needed for intellectual stimulation and learning to occur. The ACGME CLER Pathway⁹² is designed to evaluate and improve the clinical learning environment within US teaching hospitals, medical centres and health systems. As such it is hoped to better ensure that residents have effective supervision, work in a supportive culture and have a manageable workload – all of which have the potential to reduce burnout.

Although challenging,⁹⁹ eliminating harassment will indirectly reduce burnout.^{16,65} Given reports of mistreatments and barriers to reporting to

authorities despite existing efforts, new or accelerated institutional efforts are needed to more effectively address trainee harassment, discrimination and belittlement. Doing so is likely to require a culture change as existing multipronged strategies have not effectively addressed this problem.^{71,99,100}

Initiatives for faculty staff development should inform staff about the extent of the problem, common drivers of burnout, how to identify and refer trainees with burnout and how to maintain confidentiality. As supervisor behaviour relates to trainee burnout, staff development should ensure that core faculty members have the requisite teaching skills needed to establish an optimal learning climate, provide effective feedback and foster reciprocal relationships.^{66,85,86} Reacting to students' and residents' evaluations of faculty staff with individualised remediation plans targeting problematic faculty staff behaviours or reassignment of teaching duties is also necessary.⁷¹ Given that medical education still relies heavily on the apprenticeship model, faculty staff discussing and personally modelling self-care strategies will strengthen norms for future doctors that support limit-setting, help-seeking and work-life balance. Doing so could help establish a culture of wellness that reduces burnout among faculty members.

Screening tools

Given the high prevalence of distress and challenges with self-calibration,⁸¹ secondary prevention strategies to promote early identification of burnout and prevention of serious personal or professional consequences should be put in place.^{101,102} This approach is congruent with the ACGME CLER expectation of monitoring medical trainee burnout as a strategy to optimise patient safety.⁹² Such approaches may include self-assessment tools for use by individuals or by medical schools and residency programmes to screen for distress and identify those most likely to benefit from individualised counselling or other support resources. The latter approach would likely require involvement by an independent third party, such as a student health service or an employee assistance programme. Trainees who screen positive for a substantial burden of distress should be directed or referred to their primary care doctor or mental health provider for further assessment.

One available self-assessment tool, the 7-item Medical Student and Physician Well-Being Index, has now been validated in medical students, residents

and practising doctors.^{103–105} The Physician Well-Being Index helps doctors self-calibrate and reflect on behavioural changes to improve personal well-being.⁸¹ A web-based version of this tool is now being evaluated in both medical students and doctors across multiple centres. This tool enables students or doctors to: (i) receive immediate feedback on how their current level of well-being compares with medical students and doctors nationally, (ii) ascertain whether their level of well-being puts them at a higher risk of potentially serious personal and professional repercussions, (iii) track changes in their personal well-being over time, and (iv) access just-in-time local and national resources designed to both promote and nurture well-being and provide support for a variety of concerns experienced by doctors in training (e.g. burnout, fatigue, financial concerns, relationship issues, career decision making, resilience, etc.). Medical schools and residency programmes can access and download aggregate school-level reports on their trainees showing the number using the tool, mean score by year and sex, mean score over time, resources accessed, and how trainees' scores compare with national data.

Access to care

Although self-assessment tools may facilitate recognition of distress and awareness of how to access help, they are unlikely to fully overcome barriers to help-seeking among trainees. An absentee policy that allows time-off for personal medical appointments during clinical hours is important to facilitate access to care. Trainees should have access to mental health providers who are not involved in their academic assessment or advancement process. Ideally, trainees should be provided 'in-network' options for off-campus or external mental health care providers to minimise concerns regarding confidentiality and stigma related to seeking care for mental health issues.^{83,106} A recent national study found that medical students are less willing to seek professional help for a serious emotional problem than both the general US population and age-matched peers.⁸³ A large proportion of medical students in this cohort reported that they had observed faculty staff and fellow students breaching the confidentiality of other students' mental health issues and engaging in discriminatory behaviour toward students with emotional problems. The students also expressed concern that disclosing mental health issues would adversely impact their residency training opportunities as well as patients' views of them. Perhaps related to these factors, in a recent national study

medical students were less willing to report a colleague impaired due to mental health problems than one impaired due to alcohol or substance abuse.¹⁸

Residents may be reluctant to seek help for a mental health issue due in part to concern it may result in loss of privileges or even their license to practice medicine.⁸² To address this potential barrier to seeking help, state licensing boards, hospitals, clinics and malpractice insurance carriers should be transparent on how data regarding mental health will be used and only inquire about current impairment due to a mental health condition, rather than a past or current diagnosis or treatment.⁴⁹ In addition, academic medical centres, accreditation organisations and organised medicine need to confront a professional culture that is indifferent to personal wellness, suggests that work should always be prioritised over personal needs, and discourages doctors from acknowledging their personal struggles and vulnerabilities.³⁰

CONCLUSION

Today burnout is prevalent during the process of medical training. Anticipated new challenges in medical education, such as greater competition for residency places, additional competencies and more rigorous assessment required for flexible progression, coupled with the uncertainty of what future practice will look like for doctors practising in our evolving health care systems with new cost and work force constraints, may fuel stress, leading to an even higher burden of burnout symptoms amongst trainees in the near future. Given the important personal and professional consequences, individual trainees, medical schools, residency programmes, accreditation organisations, academic medicine and organised medicine have a shared responsibility to create a culture and work environment that promotes trainee wellness and to implement primary, secondary and tertiary prevention strategies. Approaches need to address the medical culture and other contextual factors that drive burnout and impact willingness to seek care. Although action is clearly needed, change must be implemented in a meticulous and stepwise manner with appropriate evaluation of efficacy to ensure optimal resource allocation. The aims of such efforts should seek to promote more than the absence of burnout and include an environment in which trainees flourish, achieve high well-being and acquire the skills necessary to promote resilience. Achieving

these aims will help foster the competency, dedication and professionalism of future doctors, both during the training process and over the course of their careers.

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REFERENCES

- 1 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**:443–51.
- 2 Prins JT, Gazendam-Donofrio SM, Tubben BJ, van der Heijden FMMA, van de Wiel HBM, Hoekstra-Weebers JEHM. Burnout in medical residents: a review. *Med Educ* 2007;**41**(8):788–800.
- 3 Maslach C, Jackson SE, Leiter MP. *Maslach Burnout Inventory Manual*, 3rd edn. Palo Alto, CA: Consulting Psychologists Press 1996.
- 4 Dyrbye LN, Massie FS Jr, Eacker A *et al.* Relationship between burnout and professional conduct and attitudes among US medical students. *JAMA* 2010;**304**:1173–80.
- 5 Dyrbye LN, Thomas MR, Massie FS *et al.* Burnout and suicidal ideation among US medical students. *Ann Intern Med* 2008;**149**:334.
- 6 West CP, Shanafelt TD, Kolars JC. Quality of life, burnout, educational debt, and medical knowledge among internal medicine residents. *JAMA* 2011;**306**:952–60.
- 7 Jackson ER, Shanafelt TD, Hasan O, Satele D, Dyrbye LN. Burnout and alcohol abuse/dependence among U.S. medical students. *Acad Med*. In press.
- 8 Shanafelt TD, Bradley KA, Wipf JE, Back AL. Burnout and self-reported patient care in an internal

- medicine residency program. *Ann Intern Med* 2002;**136**:358–67.
- 9 Dahlin ME, Runeson B. Burnout and psychiatric morbidity among medical students entering clinical training: a three year prospective questionnaire and interview-based study. *BMC Med Educ* 2007 doi:10.1186/1472-6920-7-6.
 - 10 Becker J, Milad M, Klock S. Burnout, depression, and career satisfaction: cross-sectional study of obstetrics and gynecology residents. *Am J Obstet Gynecol* 2006;**195**:1444–9.
 - 11 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**:2708–15.
 - 12 Willcock SM, Daly MG, Tennant CC, Allard BJ. Burnout and psychiatric morbidity in new medical graduates. *Med J Aust* 2004;**181**:357–60.
 - 13 Pantaleoni JL, Augustine EM, Sourkes BM, Bachrach LK. Burnout in pediatric residents over a 2-year period: a longitudinal study. *Acad Pediatr* 2014;**14**:167–72.
 - 14 West CP, Huschka MM, Novotny PJ *et al.* Association of perceived medical errors with resident distress and empathy: a prospective longitudinal study. *JAMA* 2006;**296**:1071–8.
 - 15 West CP, Tan AD, Habermann TM, Sloan JA, Shanafelt TD. Association of resident fatigue and distress with perceived medical errors. *JAMA* 2009;**302**:1294–300.
 - 16 Dyrbye LN, Thomas MR, Eacker A *et al.* Race, ethnicity, and medical student well-being in the United States. *Arch Intern Med* 2007;**167**:2103–9.
 - 17 Dyrbye LN, Thomas MR, Huntington JL *et al.* Personal life events and medical student well-being: a multicenter study. *Acad Med* 2006;**81**:374–84.
 - 18 Dyrbye LN, West CP, Satele D, Boone S, Sloan J, Shanafelt TD. A national study of medical students' attitudes toward self-prescribing and responsibility to report impaired colleagues. *Acad Med* 2015;**90**(4):485–93.
 - 19 Paro HBMS, Silveira PSP, Perotta B *et al.* Empathy among medical students: is there a relation with quality of life and burnout? *PLoS One* 2014;**9**:e94133.
 - 20 Dahlin M, Joneborg N, Runeson B. Performance-based self-esteem and burnout in a cross-sectional study of medical students. *Med Teach* 2007;**29**:43–8.
 - 21 Dyrbye LN, Moutier C, Durning SJ *et al.* The problems program directors inherit: medical student distress at the time of graduation. *Med Teach* 2011;**33**:756–8.
 - 22 Demerouti E, Bakker AB, Vardakou I, Kantas A. The convergent validity of two burnout instruments: a multi-trait-multimethod analysis. *Eur J Psychol Assess* 2003;**19**(1):12–23.
 - 23 Dahlin M, Fjell J, Runeson B. Factors at medical school and work related to exhaustion among physicians in their first postgraduate year. *Nord J Psychiatry* 2010;**64**:402–8.
 - 24 Rosen IM, Gimotty PA, Shea JA, Bellini LM. Evolution of sleep quantity, sleep deprivation, mood disturbances, empathy, and burnout among interns. *Acad Med* 2006;**81**:82–5.
 - 25 Michels PJ, Probst JC, Godenick MT, Palesch Y. Anxiety and anger among family practice residents: a South Carolina family practice research consortium study. *Acad Med* 2003;**78**:69–79.
 - 26 Golub J, Weiss P, Ramesh A, Ossoff R, Johns M. Burnout in residents of otolaryngology-head and neck surgery: a national inquiry into the health of residency training. *Acad Med* 2007;**82**:596–601.
 - 27 Campbell J, Prochazka AV, Yamashita T, Gopal R. Predictors of persistent burnout in internal medicine residents: a prospective cohort study. *Acad Med* 2010;**85**:1630–4.
 - 28 Shanafelt TD, Boone S, Tan L *et al.* Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med* 2012;**172**:1377–85.
 - 29 Eckleberry-Hunt J, Lick D, Boura J *et al.* An exploratory study of resident burnout and wellness. *Acad Med* 2009;**84**:269–77.
 - 30 Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. *Lancet* 2009;**374**:1714–21.
 - 31 Guthrie E, Black D, Bagalkote H, Shaw C, Campbell M, Creed F. Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *J R Soc Med* 1998;**91**:237–43.
 - 32 Fletcher KE, Reed DA, Arora VM. Patient safety, resident education and resident well-being following implementation of the 2003 ACGME duty hour rules. *J Gen Intern Med* 2011;**26**:907–19.
 - 33 Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety and other indicators of psychologic distress among U.S. and Canadian medical students. *Acad Med* 2006;**81**:354–73.
 - 34 Brazeau CM, Shanafelt T, Satele D, Sloan J, Dyrbye LN. Distress among matriculating medical students relative to the general population. *Acad Med* 2014;**89**:1520–5.
 - 35 Dahlin M, Joneborg N, Runeson B. Stress and depression among medical students: a cross-sectional study. *Med Educ* 2005;**39**(6):594–604.
 - 36 Thomas MR, Dyrbye LN, Huntington JL *et al.* How do distress and well-being relate to medical student empathy? A multicenter study. *J Gen Intern Med* 2007;**22**:177–83.
 - 37 Brazeau CM, Schroeder R, Rovi S, Boyd L. Relationships between medical student burnout, empathy, and professionalism climate. *Acad Med* 2010;**85**:S33–6.
 - 38 Fahrenkopf A, Sectish T, Barger L *et al.* Rates of medication errors among depressed and burnt out residents: prospective cohort study. *BMJ* 2008;**336**:488–91.
 - 39 McConnell MM, Eva KW. The role of emotion in the learning and transfer of clinical skills and knowledge. *Acad Med* 2012;**87**:1316–22.

- 40 Durning SJ, Costanzo M, Artino AR Jr *et al.* Functional neuroimaging correlates of burnout among internal medicine residents and faculty members. *Front Psychiatry* 2013;**4**:131.
- 41 Dyrbye LN, Thomas MR, Power DV *et al.* Burnout and serious thoughts of dropping out of medical school: a multi-institutional study. *Acad Med* 2010;**85**:94–102.
- 42 Enoch L, Chibnall JT, Schindler DL, Slavin SJ. Association of medical student burnout with residency specialty choice. *Med Educ* 2013;**47** (2):173–81.
- 43 Oreskovich MR, Kaups KA, Balch C *et al.* The prevalence of alcohol use disorders among american surgeons. *Arch Surg* 2011;**147**:168–74.
- 44 Oreskovich MR, Shanafelt T, Dyrbye LN *et al.* The prevalence of substance use disorders in American physicians. *Am J Addict* 2015;**24**(1):30–8.
- 45 Larkin C, Di Blasi Z, Arensman E. Risk factors for repetition of self-harm: a systematic review of prospective hospital-based studies. *PLoS One* 2014;**9**: e84282.
- 46 Ohberg A, Vuori E, Ojanpera I, Lonngvist J. Alcohol and drugs in suicides. *Br J Psychiatry* 1996;**169**:75–80.
- 47 Yaldizli O, Kuhl HC, Graf M, Wiesbeck GA, Wurst FM. Risk factors for suicide attempts in patients with alcohol dependence or abuse and a history of depressive symptoms: a subgroup analysis from the WHO/ISBRA study. *Drug Alcohol Rev* 2010;**29**: 64–74.
- 48 Van der Heijden F, Dillingh G, Bakker A, Prins JT. Suicidal thoughts among medical residents with burnout. *Arch Suicide Res* 2008;**12**:344–6.
- 49 Center C, Davis M, Detre T *et al.* Confronting depression and suicide in physicians: a consensus statement. *JAMA* 2003;**289**:3161–6.
- 50 West CP, Tan AD, Shanafelt TD. Association of resident fatigue and distress with occupational blood and body fluid exposures and motor vehicle incidents. *Mayo Clinic Proc* 2012;**87**:1138–44.
- 51 Williams ES, Konrad TR, Linzer M *et al.* Physician, practice, and patient characteristics related to primary care physician physical and mental health: results from the physician worklife study. *Health Serv Res* 2002;**37**:119–41.
- 52 Maslach C, Leiter MP. *The Truth about Burnout*. San Francisco: Jossey-Bass 1997.
- 53 Reed DA, Shanafelt TD, Satele DW *et al.* Relationship of pass/fail grading and curriculum structure with well-being among preclinical medical students: a multi-institutional study. *Acad Med* 2011;**86**:1367–73.
- 54 Rohe DE, Barrier PA, Clark MM, Cook DA, Vickers KS, Decker PA. The benefits of pass-fail grading on stress, mood, and group cohesion in medical students. *Mayo Clin Proc* 2006;**81**:1443–8.
- 55 Bloodgood RA, Short JG, Jackson JM, Martindale JR. A change to pass-fail grading in the first two years at one medical school results in improved psychological well-being. *Acad Med* 2009;**84**:655–62.
- 56 Howe A, Smajdor A, Stöckl A. Towards an understanding of resilience and its relevance to medical training. *Med Educ* 2012;**46**(4):349–56.
- 57 van Vendeloo SN, Brand PLP, Verheyen CCPM. Burnout and quality of life among orthopaedic trainees in a modern educational programme: importance of the learning climate. *Bone Joint J* 2014;**96-B**:1133–8.
- 58 Dyrbye LN, Thomas MR, Harper W *et al.* The learning environment and medical student burnout: a multicentre study. *Med Educ* 2009;**43** (3):274–82.
- 59 Dahlin M, Fjell J, Runeson B. Factors at medical school and work related to exhaustion among physicians in their first postgraduate year. *Nord J Psychiatry* 2010;**64**:402–8.
- 60 Ripp J, Babyatsky M, Fallar R *et al.* The incidence and predictors of job burnout in first-year internal medicine residents: a five-institution study. *Acad Med* 2011;**86**:1304–10.
- 61 Campbell J, Prochazka AV, Yamashita T, Gopal R. Predictors of persistent burnout in internal medicine residents: a prospective cohort study. *Acad Med* 2010;**85**:1630–4.
- 62 Reed DA, Fletcher KE, Arora VM. Systematic review: association of shift length, protected sleep time, and night float with patient care, residents' health, and education. *Ann Intern Med* 2010;**153**:829–42.
- 63 Ripp JA, Bellini L, Fallar R, Bazari H, Katz JT, Korenstein D. The impact of duty hours restrictions on job burnout in internal medicine residents: a three-institution comparison study. *Acad Med* 2015;**90**:494–9.
- 64 Ludmerer KM. Redesigning residency education – moving beyond work hours. *N Eng J Med* 2010;**362**:1337–8.
- 65 Cook AF, Arora VM, Rasinski KA, Curlin FA, Yoon JD. The prevalence of medical student mistreatment and its association with burnout. *Acad Med* 2014;**89**:749–54.
- 66 Prins JT, Gazendam-Donofrio SM, Dillingh GS, van de Wiel HBM, van der Heijden FMMA, Hoekstra-Weebers JEHM. The relationship between reciprocity and burnout in Dutch medical residents. *Med Educ* 2008;**42**(7):721–8.
- 67 Haglund ME, van der Rot M, Cooper NS *et al.* Resilience in the third year of medical school: a prospective study of the associations between stressful events occurring during clinical rotations and student well-being. *Acad Med* 2009;**84**:258–68.
- 68 McManus IC, Keeling A, Paice E. Stress, burnout and doctors' attitudes to work are determined by personality and learning style: a twelve year longitudinal study of UK medical graduates. *BMC Med* 2004;**2**:29.
- 69 Dyrbye LN, Power DV, Massie FS, Eacker A, Harper W, Thomas MR, Szydlo DW, Sloan JA, Shanafelt TD.

- Factors associated with resilience to and recovery from burnout: a prospective, multi-institutional study of US medical students. *Med Educ* 2010;**44**(10):1016–26.
- 70 Dyrbye LN, Sloan J, Shanafelt T. In response. Is there a connection between high educational debt and suicidal ideation among medical students. *Ann Intern Med* 2009;**150**:285.
- 71 Mareiniss DP. Decreasing GME training stress to foster residents' professionalism. *Acad Med* 2004;**79**:825–31.
- 72 U.S. Department of Health and Human Services. *Mental health: A report of the Surgeon General-Executive Summary*. Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health 1999.
- 73 Shanafelt TD. Enhancing meaning in work: a prescription for preventing physician burnout and promoting patient-centered care. *JAMA* 2009;**302**:1338–40.
- 74 Dyrbye L, Shanafelt T. Nurturing resiliency in medical trainees. *Med Educ* 2012;**46**(4):343–4.
- 75 Regehr C, Glancy D, Pitts A, LeBlanc VR. Interventions to reduce the consequences of stress in physicians: a review and meta-analysis. *J Nerv Ment Dis* 2014;**202**:353–9.
- 76 Dobkin PL, Hutchinson TA. Teaching mindfulness in medical school: where are we now and where are we going? *Med Educ* 2013;**47**(8):768–79.
- 77 Krasner MS, Epstein RM, Beckman H *et al*. Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *JAMA* 2009;**302**:1284–93.
- 78 Waterman AD, Garbutt J, Hazel E *et al*. The emotional impact of medical errors on practicing physicians in the United States and Canada. *Jt Comm J Qual Patient Saf* 2007;**33**:467–76.
- 79 Cosgrove DM, Fisher M, BAGow P *et al*. Ten strategies to lower cost, improve quality, and engage patients: the view from leading health system CEOs. *Health Aff* 2013;**32**:321–7.
- 80 U.S. Department of Health and Human Services. National strategy for quality improvement in health care. Annual progress report to congress. 2012. <http://www.ahrq.gov/workingforquality/nqs/nqs2012annlrpt.pdf>. [Accessed 4 December 2013.]
- 81 Shanafelt T, Kaups KA, Nelson H *et al*. An interactive individualized intervention to promote behavioral change to increase personal well-being in US surgeons. *Ann Surg* 2014;**259**:82–8.
- 82 Shanafelt TD, Balch CM, Dyrbye LN *et al*. Suicidal ideation among American surgeons. *Arch Surg* 2011;**146**:54–62.
- 83 Dyrbye LN, Eacker A, Durning SJ *et al*. Impact of stigma and personal experiences on help seeking behaviors among medical students with burnout. *Acad Med* 2015;**90**(7):961–9.
- 84 West CP, Dyrbye LN, Rabatin JT *et al*. An intervention to promote physician well-being, job satisfaction, and professionalism. A randomized clinical trial. *JAMA Intern Med* 2014;**174**:527–33.
- 85 Thompson D, Goebert D, Takeshita J. A program for reducing depressive symptoms and suicidal ideation in medical students. *Acad Med* 2010;**85**:1635–9.
- 86 General Medical Council. Supporting medical students with mental health conditions. 2013. <http://www.gmc-uk.org/education/undergraduate/23289.asp>. [Accessed 16 January 2015.]
- 87 Shanafelt TD, Sloan JA, Habermann TM. The well-being of physicians. *Am J Med* 2003;**114**:513–9.
- 88 Kushner RF, Kessler S, McGaghie WC. Using behavior change plans to improve medical student self-care. *Acad Med* 2011;**86**:901–6.
- 89 Drolet BC, Rodgers S. A comprehensive medical student wellness program—design and implementation at vanderbilt school of medicine. *Acad Med* 2010;**85**:103–10.
- 90 Weight C, Sellon J, Lessard-Anderson C, Shanafelt T, Olsen KD, Laskowski ER. Physical activity, quality of life, and burnout among physician trainees: the effect of a team-based, incentivized exercise program. *Mayo Clin Proc* 2013;**88**:1435–42.
- 91 Liaison Committee on Medical Education. *Accreditation Standards 2015–2016*. Chicago, IL and Washington, DC: Association of American Medical Colleges and American Medical Association 2003. <http://www.lcme.org/2015-reformat-project.htm>. [Accessed 16 January 2015.]
- 92 Accreditation Council for Graduate Medical Education. Clinical Learning Environment Review (CLER). http://www.acgme.org/acgmeweb/Portals/0/PDFs/CLER/CLER_Brochurepdf. [Accessed 31 December 2014.]
- 93 Royal College of Physicians and Surgeons of Canada. CanMEDS 2005. http://www.royalcollege.ca/portal/page/portal/rc/common/documents/canmeds/framework/the_7_canmeds_roles_e.pdf. [Accessed 5 June 2014.]
- 94 General Medical Council. The New Doctor. Guidance on foundation training. www.gmc-uk.org/index.asp. [Accessed 5 June 2014.] 2009.
- 95 Accreditation Council for Graduate Medical Education, American Board of Pediatrics. The Pediatrics Milestone Project. 2013.
- 96 Slavin SJ, Schindler DL, Chibnall JT. Medical student mental health 3.0: improving student wellness through curricular changes. *Acad Med* 2014;**89**(4):573–7.
- 97 Curry RH. Meaningful roles for medical students in the provision of longitudinal patient care. *JAMA* 2014;**312**:2335–6.
- 98 Lucey CR. Medical education: part of the problem and part of the solution. *JAMA Intern Med* 2013;**173**:1639–43.

- 99 Fnais N, Soobiah C, Chen MH *et al.* Harassment and discrimination in medical training: a systematic review and meta-analysis. *Acad Med* 2014;**89**:817–27.
- 100 Fried JM, Vermillion M, Parker NH, Uijtdehaage S. Eradicating medical student mistreatment: a longitudinal study of one institution's efforts. *Acad Med* 2012;**87**:1191–8.
- 101 Clark DC, Zeldow PB. Vicissitudes of depressed mood during four years of medical school. *JAMA* 1988;**260**:2521–8.
- 102 Goebert D, Thompson D, Takeshita J *et al.* Depressive symptoms in medical students and residents: a multischool study. *Acad Med* 2009;**84**:236–41.
- 103 Dyrbye LN, Schwartz A, Downing SM, Szydlo DW, Sloan JA, Shanafelt TD. Efficacy of a brief screening tool to identify medical students in distress. *Acad Med* 2011;**86**:907–14.
- 104 Dyrbye LN, Satele D, Sloan J, Shanafelt TD. Utility of a brief screening tool to identify physicians in distress. *J Gen Intern Med* 2013;**28**:421–7.
- 105 Dyrbye LN, Satele D, Sloan J, Shanafelt TD. Ability of the physician well-being index to identify residents in distress. *J Grad Med Educ* 2014;**6**:78–84.
- 106 Schwenk TL, Davis L, Wimsatt LA. Depression, stigma, and suicidal ideation in medical students. *JAMA* 2010;**304**:1181–90.

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