31 RESILIENCE STRATEGIES FOR BURNOUT RECOGNITION AND RECOVERY

IN THIS CHAPTER, YOU WILL LEARN:

- Recognize the manifestations of burnout in yourself and others.
- Harness the latest information about the neurotoxicity of burnout to better understand its consequences.
- Utilize a broad range of resilience strategies to help you nurture well-being and combat burnout both for yourself and for your residency program.

INTRODUCTION

The chief year, like other stages of your training, will bring with it many rewarding moments, as well as challenges that will test your resilience and grit. Entering chief year with positive momentum is almost universal; however, maintaining it and continuing to thrive takes active work. When chief residents experience burnout, the morale of a whole program can be affected and their critical responsibilities jeopardized. This chapter discusses the symptoms and neurotoxicity associated with burnout so that you can effectively identify it—in yourself and among your residents—before severe symptoms and consequences develop. Reasons for this widespread epidemic are also examined: from external causes due to the US medical system and its impact on our clinical work environments (and residency programs) to internal drivers, such as our individual personality traits and the profession's cultural norms, which also play a significant role. As chief residents, you must understand these causes of burnout so that you can promote program- and system-level changes that can positively affect resident morale. You will also be a role model for your residents, and the tone you set regarding self-care and well-being will make an impression. The last half of this chapter highlights several evidence-based resilience strategies to help you nurture well-being and combat burnout both for yourself and within your residency program.

BURNOUT: WORRISOME TRENDS

Epidemiology

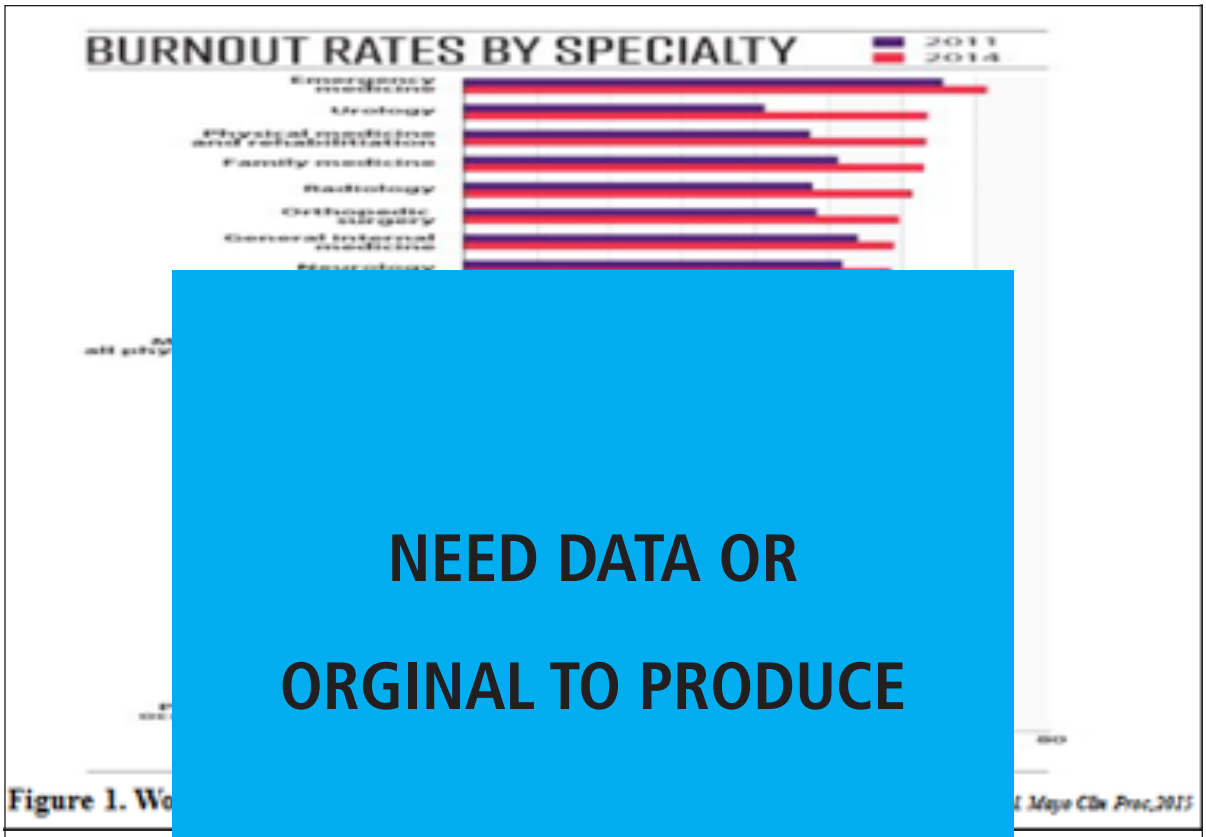
Burnout is a psychological syndrome characterized by emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment (1,2). The validated Maslach Burnout Inventory (MBI) is considered the gold standard for measuring burnout. Published data conventionally report the percentage of participants who meet criteria for high levels of burnout, which is defined as emotional exhaustion, depersonalization, and/or a decreased sense of personal accomplishment at a frequency of at least once a week. Some studies report scores for the separate domains of emotional exhaustion and depersonalization, while others report the composite term "burnout," which is defined as having a high score in either emotional exhaustion or depersonalization.

About half of US medical students meet criteria for high burnout; by graduation, the number declines to 25% (3-6). During training, burnout peaks at 75% during internship year and then decreases to about 50% for the remainder of training, including fellowship (6-9). After training, burnout ranges from 40% to 75%, depending on specialty choice (10,11); it is disturbing to note that these numbers have worsened in every single specialty from 2011 to 2014 (12) (**Figure 1**).

Symptoms and Signs

The symptomatic spectrum of burnout can be quite variable, not just in the intensity of feelings and the frequency of thoughts but also in the symptoms. Emotional exhaustion can be considered compassion fatigue, which is defined as being unable to care about another's troubles or feeling apathetic or emotionally spent. Physicians struggling with depersonalization may feel disconnected from their patients and/or may come across as detached or cynical. A decreased sense of personal accomplishment can feel like incompetence and can also manifest as impostor syndrome, which is a pervasive fear of being exposed as a fraud. A decreased sense of accomplishment can also present as the loss of meaning and purpose in one's work. Burnout can also manifest as unprofessional behaviors: from delayed

FIGURE 1. Worsening Burnout by Specialty from 2011-2014



documentation and decreased email responsiveness to strained work relationships and emotional dysregulation. As chief residents, you need to be cognizant of your own burnout symptoms and the variety of ways burnout can present in your residents as well. Awareness of these signs can improve early recognition before severe symptoms and consequences develop, thus allowing for appropriate and supportive responsiveness to your own health and well-being as well as that of the residents in your program.

Implications and Causes

Many studies have shown negative correlations between burnout and personal, professional, and system-level outcomes (13-25) (**Figure 2**). At the individual level, burnout has been associated with poor physical and mental health (including increased suicide), family dysfunction, increased car accidents, lower standardized testing scores, and higher rates of medical errors. At the professional level, patients report less satisfaction with and trust in physicians who are burned out and are less likely to adhere to their care. At the health care system level, burnout is associated with decreased productivity, higher physician disability and attrition, and increased malpractice rates. If more than half of working physicians currently meet the criteria for high burnout, then the implications of this epidemic are a tremendous threat to nation's health care system.

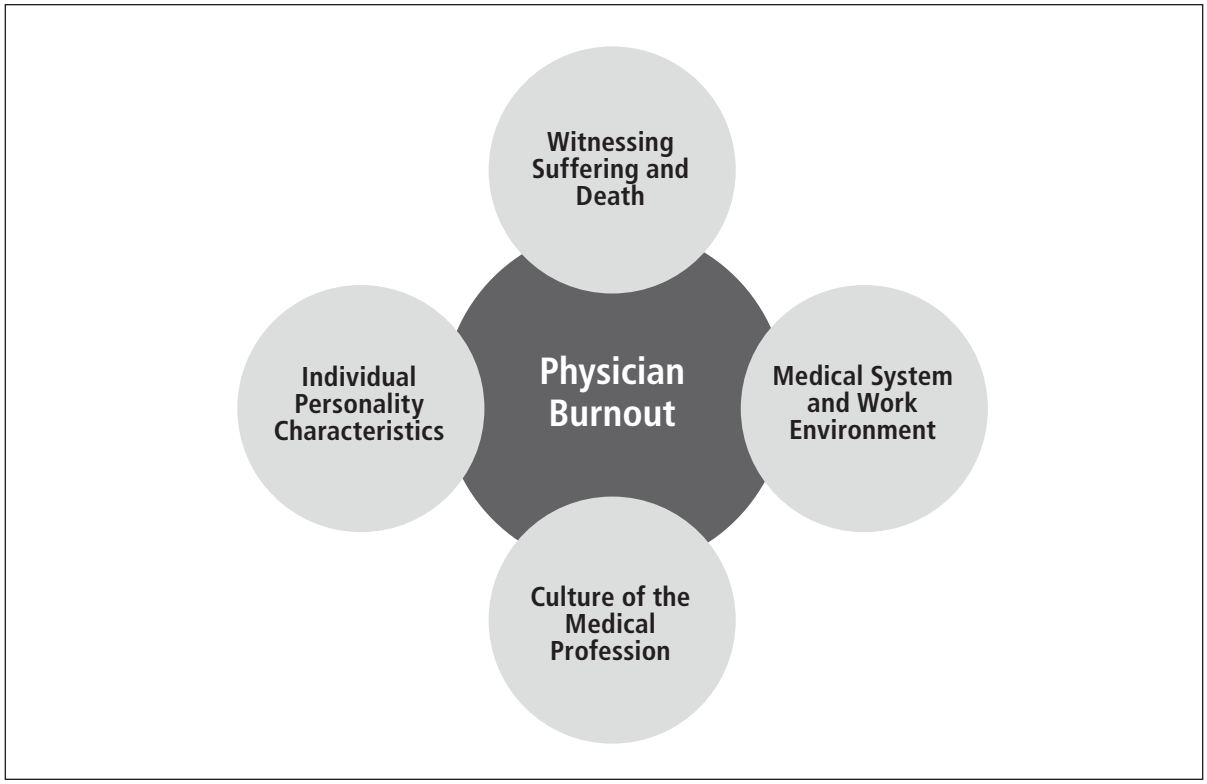
Why is burnout so prevalent? The answer is multifactorial (**Figure 3**). Witnessing suffering and death is inherent to our career and impacts all caregiving professions. Extrinsic causes include the complicated

FIGURE 2. Correlations of Burnout

Physician	Patient	Healthcare System
• Poor physical health • Depression / Suicide • Substance abuse • Family discord • Poor career satisfaction • MVAs; Needle-stick injuries • Lower ITE Scores • Medical Errors	• Erosion of trust • Reduced adherence with treatment recommendations • Decreased satisfaction with healthcare • Suboptimal care • Poor communication	• Physician attrition • Higher malpractice rates • Absenteeism • Rising disability • Decreased productivity • Increased testing / costs

medical system and our fast-paced and challenging work environments, both of which contribute greatly to physician stress and burnout. Internal factors—like our own individual personality and character traits and some of the values and norms of our profession—also contribute to burnout (**Figure 3**). The "physician personality," which has been described as a "triad of compulsiveness" includes having an exaggerated sense of responsibility along with excessive guilt and self-doubt (26). As with any personality trait, balance is critical for health and well-being. A healthy amount of compulsivity is necessary to handle the detailed nature of our jobs; it helps with thoroughness and diagnostic rigor. However, excessive compulsivity, especially if plagued by guilt and self-doubt, can be maladaptive and paralyzing. What aspects of your personality could be contributing to your burnout? Are you viciously self-critical? Do you lean toward perfectionism? Are boundaries with your patients tough to set? Do you struggle with differentiating between healthy self-interest and selfishness? Gain

FIGURE 3. Burnout: A Shared Responsibility



awareness of your internal drivers of burnout since they fall within your locus of control. Be honest with yourself and seek help when needed.

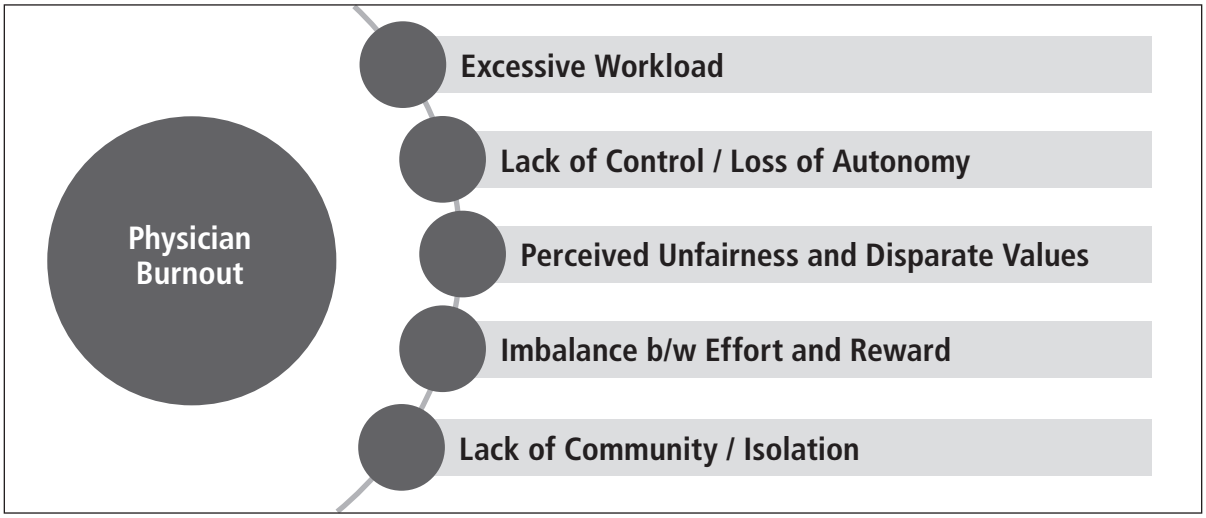
What about the cultural norms of our profession? Much of what we as a profession embrace are beautiful humanistic values; however, some of our norms are destructive. Pathologic altruism, presenteeism, and delayed gratification are maladaptive and lead to disillusionment. Do we as a profession still reward competitiveness above collaboration? Do we mentor our learners from a perspective of deficit (we identify what they are doing wrong and tell them to fix it) rather than one of strength (we help our learners identify what they are doing well and use their inherent strengths to address the areas of deficiency)? Let's move toward a more supportive and positive culture: strength-based interactions and positive reinforcement with acknowledgment and expressions of gratitude. These tenets represent a cultural change opportunity that can be intentionally created by a residency program, a health system, and medical education in general. Each of us has control over whether we participate in or actively resist our professions' norms—choose wisely and with intention.

The complexity of the US health care system and the fast-paced nature of our work environments are external drivers of physician burnout, and both of them contribute extensively to these ailments. Using a conceptual framework from organizational psychology, Jennings and Slavin (27) discussed aspects of medical work environments that contribute to burnout (**Figure 4**). **Excessive workload** occurs when the physical, emotional, and cognitive demands of our work exceed our capabilities and resources. The fast-paced nature of current medical practice creates stressful work environments where individuals may feel overwhelmed. Trainees are especially at risk: they do not have as many resources and coping strategies due to their relative inexperience. **Lack of autonomy/control** is a big risk factor, and having a sense of control has been cited as protective for physicians (28). Other contributing factors include perceived **unfairness** and doing work that clashes with our personal **values**. Additionally, a sense of **imbalance between effort and reward** is another driver of burnout. Trainees define "reward" as expressions of gratitude and/or acknowledgment of their dedication and effort by senior physicians; being taught is also considered a reward. Lastly, **lack of community** and feeling isolated also drive burnout. As chief residents, you have the power to influence some of the external drivers: use this knowledge to bring about program- and system-level changes that have a positive impact on resident morale in your program. This knowledge is also helpful for personal understanding as you gain awareness of what impacts your stress and burnout. In the end, this effort needs to be a shared responsibility: medical system flaws—and there are many of them—need to be addressed at the national and individual hospital levels, and, at the same time, each of us needs to take responsibility for our physical, emotional, and spiritual health.

NEUROTOXICITY OF SUSTAINED STRESS AND BURNOUT STATES

Burnout appears to have a negative impact on memory, clinical reasoning, awareness, empathy, perspective, emotional regulation, and even fine motor skills of resident physicians (29,30). Additionally, compared to controls, the brains of burned-out nonmedical

FIGURE 4. Organizational/System Drivers of Burnout



professionals show larger amygdala volumes and thinner medial prefrontal cortex regions and loss of functional connectivity (decreased signaling on fMRI) between these two regions (31,32). The mechanism of burnout neurotoxicity is sustained stress system activation: when the sympathetic nervous system and hypothalamic–pituitary–adrenal axis are fully activated in a persistent, unremitting manner, the resulting toxic levels of adrenaline and especially cortisol cause neurotoxicity at a cellular and a molecular level (33-35). The down-regulation of vital neurogenic peptides such as brain derived neurotrophic factor (BDNF) plays a central role in the functional and structural toxicity associated with chronic stress (36-39). Studies in medical providers have shown a relationship between low BDNF levels and clinical depression (40), high stress levels (36, 37), and burnout (41). Together, these findings provide a concrete scientific basis and mechanistic explanation for the cognitive symptoms, emotional dysregulation, and many of the negative associations of burnout.

Thinking about burnout from this perspective will allow you to address it with yourself and your residents in a nonjudgmental way. There is still a stigma associated with burnout, and we are quick to vilify physicians and trainees who are acting unprofessionally. None of us entered into this profession with the intention of being a "bad doctor." In fact, compared to age-matched college graduates, matriculating medical students have lower burnout and higher overall physical, emotional, and mental quality of life (42). Understanding how the prolonged stress of medical training can cause neurotoxic changes in our brains,—all of which affect our behaviors—can help us recognize the warning signs early and then focus on supportive interventions.

RESILIENCE STRATEGIES THAT PROMOTE WELL-BEING AND COMBAT BURNOUT

Resilience is the ability to adapt to challenges; to thrive in the face of adversity; and to take risks, fail, and try again. Working to improve your resilience implies embracing the challenges that come your way. While the remainder of this chapter will focus on individual-focused strategies to increase physician resilience, it is important to note again that this is a shared responsibility. Both individual-focused interventions (e.g., mindfulness, small groups [Balint], stress management, and self-care training) as well as system-level structural interventions (e.g., shortened rotation/shift lengths, modifications to clinical work flow processes, and practice delivery changes) result in clinically meaningful reductions in burnout among physicians (43). In fact, system-level interventions have an even larger and longer impact on physician burnout than do individual-focused practices alone (44). As chief residents, you will be role models for your residents; as such, you will set the tone when it comes to the importance of being proactive about self-care and well-being. At the same time, look for structural changes within your program and at the health-system level that can positively affect the well-being of residents individually and the program as a whole. The remainder of this chapter focuses on individual and program-level strategies that can help you achieve these goals.

Create Your Personalized Multidimensional Well-Being Toolkit

Well-being encompasses many domains; therefore, consider using a framework that incorporates a multidimensional approach (**Figure 5**). The key to effective self-care is to identify a few critical strategies in each domain and develop a self-care "tool kit" that you

FIGURE 5. Multi-Dimensional Wellbeing Strategies

Physical	Emotional/Mental	Spiritual/Social
• Strategic sleep • Healthy nutrition • Humor & laughter • Exercise • Healthcare team • Parasympathetic NS activation (breathing)	• Hobbies & fun (playtime) • Creative expression • Slow down (Take 5') • Process your emotions • Practice positive psychology • Learn mindfulness techniques	• Nurture your relationships & communities • Engage in spiritual/religious practices • Work/Life Balance-or-Energy Balance/Integration • Cultivate "meaning and purpose" (in life & career) • Be kind (to yourself/others)

use daily. Having a variety of strategies allows time to adapt them so you know which ones to use during days when you may only have five to 10 minutes to devote to yourself. For example, if exercise is one of your top strategies, think of what you can do for exercise for 10 to 15 minutes (old-school calisthenics in your living room), 30 to 45 minutes (a jog outside or a quick trip to the gym), and when you have two or more hours (an outdoor hike with friends). Even if you only have five to 10 minutes, daily attention to your well-being is critical—and so is expanding your concept of self-care beyond nutrition, exercise, and sleep.

Learn How to Actively Sustain Your Energy Balance

Work–life balance is a tricky and potentially harmful concept: it subtly implies that work is draining and that we have to leave work in order to take care of ourselves. This definition fails to acknowledge the many wonderful and sustaining aspects of our careers. Instead, if we conceptualize ourselves as energy vessels (which, metaphysically speaking, is what we are) and consider the many positive and fulfilling moments that happen both at work and outside of it, we naturally expand what brings us joy and fills us with energy. Make a list of what sustains your energy both at and outside of the workplace. Be aware of sustaining experiences and slow down in those moments to maximize the energy exchange. For instance, when a patient or family gives you positive feedback, how often do you allow yourself to be fully present and receptive? What did you love about your role as a resident that you will experience again as a chief: teaching younger learners, leading a team, being a role model, learning how your program runs? Your sustaining list highlights what is important to you and provides an easy recipe for finding meaning in your work and beyond. Actively replenish your energy tank so you can perform the daily tasks that require energy expenditure, especially the very draining ones.

Finding Meaning: Cultivate Your Mission and Purpose

There are other ways to cultivate meaning in your life. Finding meaning in traumatic experiences is associated with improved stress management, well-being, and personal growth (45,46). What seems to modulate whether traumatic events result in negative consequences or beneficial personal growth is regular personal reflection (47). Several physician studies highlight the concept of finding meaning/having a purpose as a protective coping strategy (48-50). Become proactive in your personal reflection about these "big picture" questions through practices like narrative writing, meditation, and/or creative expression. Talk about it with others: join a support (Balint) group or do psychotherapy. No matter what methods resonate best with you, the key is regular reflection to delve deeper into these philosophical questions.

Cognitive Resilience Strategies for Draining Experiences

Cognitive resilience strategies require reframing challenges and hardships—that is, seeing them as opportunities for your growth. Using the "energy balance" framework above, make another list of what drains your energy both at and outside of work; gain full awareness and healthfully acknowledge the experiences that drain you. The following cognitive strategies should not replace the normal human emotional reactions you have to setbacks, challenges, and frustrations. The recommendation is not that you become a robot and suppress your emotions; rather, allow yourself to appropriately express the normal human emotions you feel, and then utilize these cognitive strategies to respond to whatever challenges come your way.

A key strategy is to view your life experiences, whether draining or sustaining, as important lessons for your development. Even an encounter with an angry or demanding patient or family, while draining, can be informative for the future care of others. Even if you didn't get a fellowship or your evaluations were lower than expected, you can use the opportunity to look beyond the setback to see why it happened and learn from it. Another cognitive strategy is to learn to identify when events are in your control and when they are not. If you have control over an experience, learn from it and apply your focus on affecting change where you can; if you do not have control over it, learn from it, let it go, and move on. Focusing on setbacks, challenges, or frustrations that are not in your control simply drains you of vital energy needed for other endeavors that are. Remember to understand your feelings and then try these cognitive strategies to reframe draining encounters in order to minimize their negative impact and maximize your personal growth.

Practice Positive Psychology

Another important cognitive strategy is to identify your negative thinking and learn ways to counteract that negativity. The human brain has an evolutionarily programmed negativity bias: we survived as a species because we have more neurons designated

for remembering "negative" (dangerous, harmful, upsetting) experiences than we do for the positive things that happen to us (51). While this programming helps us survive as a species, a strong negativity bias without awareness and balance can be harmful. Gain awareness of your negative thought patterns: Do you project negative outcomes into your future? Do you speak negatively about yourself? For many of us, being kind and compassionate toward ourselves is much more difficult than expressing compassion for others. This perfectionism drives the relentless "physician's personality" previously described. What can be done if we see the world and/or ourselves negatively?

Positive psychology, which is the study of positive emotions and character traits, has shown that by harnessing the lifelong neuroplasticity of the human brain through intentional practices, we can increase our happiness and well-being. Three different practices were shown to significantly increase happiness and decrease depression in a randomized controlled study (52). Write down three good things about your day (that went well or for which you were grateful) and consider how you contributed to each one. This type of gratitude practice is especially useful if you feel that everything is going poorly in your life or if you have lost your sense of personal accomplishment. Become aware of your signature strengths (take the free online survey developed by Dr. Seligman's team at https://www.viacharacter.org) and use your strengths to tackle a challenge that you are currently facing. Both of these strategies were shown to increase happiness and decrease depression for six months after the exercise ended. Write a gratitude letter to someone who has been kind to you, and personally deliver it within one week; this practice was shown to significantly increase happiness and decrease depression (for the writer) for one month after delivery. To cultivate positivity within your program, think of ways these practices can be incorporated into resident activities (e.g., add Three Good Things to the start of resident report to acknowledge residents for specific efforts and commitment or include a Signature Strengths activity to a resident retreat). Positive psychology has been incorporated into the framework of medical education (53-56) as well as into a strength-based mentoring structure within an internal medicine residency (57).

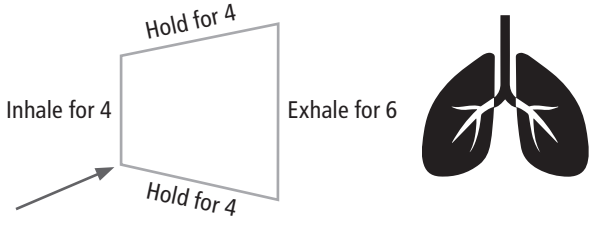
Strengthen Your Parasympathetic Nervous System Tone: Learn to Reset Your Body's Stress Response System

The fast-paced nature of our work and lives results in stress system activation, the sustained nature of which is neurotoxic. Therefore, all of us need effective ways to increase our parasympathetic nervous system tone at critical moments during the day. Activating our parasympathetic nervous system, however briefly, puts an end to sustained stress system activation. Know how to effectively relax your mind and body—for example, deep breathing, exercise, spending time in nature, practicing yoga and/or tai chi, playing with your kids and/or pets—and engage in some relaxation techniques on a regular (at least daily) basis. Even brief reprieves can counteract neurotoxicity. One of the most direct techniques to increase parasympathetic tone is deep diaphragmatic breathing (**Figure 6**).

This type of deep, slow breathing pulls the diaphragm down into the abdomen, exerting pressure on the vagus nerve. Gentle, slow pressure activates it, and because the vagus carries only parasympathetic fibers, afferent signaling from the body to the brain results in additional parasympathetic signaling back to the body via vagal efferent fibers. This is the main physiologic mechanism through which biofeedback, yoga, tai chi, and meditation all work. Practicing this type of breathing on a daily basis is critical to its success. Sit still and breathe for just a few minutes each day. Integrate these slow breaths into your daily activities: link this breathing to an activity you do many times a day (e.g., logging in to a computer, washing your hands, waiting for an elevator,). Get creative and make this type of breathing a regular

FIGURE 6. Deep Diaphragmatic Breathing

- Use all accessory muscles but **slowly**
- Slowly expand **abdominal** muscles first
- **Then rib cage** from the bottom
- Breathe all the way up into your upper lobes ... Hold
- Exhale in reverse...slowly...and try longer E segment...Hold



habit; you will notice a physiological difference almost immediately.

Cultivate Mindfulness—Slow Down

We often speed through our days, multitasking whatever needs to be done. Once the mind gets accustomed to this speed, it is very difficult to slow it down. When we want to relax or be present with families/friends, thoughts intrude and our minds run off, usually back to work. How can we retrain our minds to focus on only one thing at a time? How can we use our minds to multitask when that is required but also to be present during moments when we don't need to think, when we want to just **be**? Mindfulness practices help us develop this type of relationship with our minds. Mindfulness is about cultivating a specific kind of awareness: paying attention to the present moment of both our inner and outer worlds in a nonjudgmental and compassionate way. Mindfulness takes practice and patience. Working with your mind is like training a young, energetic puppy, but the benefits are worth the effort. Mindful clinical practices have been described in detail (58-61). Mindfulness training via a formal eight-week Mindfulness Based Stress Reduction (MBSR) course increased distress tolerance, decreased burnout, and improved quality of life in self-selected medical students (62-64). In practicing physicians, MBSR training was shown to decrease burnout, improve heart rate and blood pressure, positively impact mood, and increase meaningfulness and work satisfaction (65-74). While no study has been published evaluating the eight-week MBSR intervention in residents, few have had mixed success with abbreviated versions (75-77).

There are many additional ways to cultivate this type of mindful awareness: yoga, tai chi, deep breathing techniques, personal narrative writing, and some religious and spiritual practices can help individuals become more aware. Learning to meditate is probably the most efficient way to increase mindfulness. Two very common misconceptions about meditating are worth considering. First, you do not have to meditate for hours a day to notice benefits; a few minutes are enough. The key is daily practice: anything repeated regularly restructures neural networks most effectively. The second misconception is that we have to keep our minds still or not think about anything during meditation. The mind wanders—that's what it does. The only thing you **do** during meditation is gain awareness of when your mind has wandered and bring it back to your present moment; just noticing that your mind has wandered **is** meditation. An easy way to ground your attention in the present moment is to focus on your breathing. You can use your meditation practice to do deep diaphragmatic breathing. By practicing meditation, you train your awareness to notice when your mind has wandered. By being nonjudgmental and kind when bringing it back to the present moment, you reinforce the new relationship with your mind that **you** are in control, but in a compassionate, not authoritarian, way. When you need to think, allow your mind to think so you are able to perform whatever task is asked of you. When you need your mind to be still, practicing mindfulness will allow you greater control over your intrusive thoughts. Other benefits include increased awareness, compassion, and empathy, and less reactivity. There are many mindfulness resources: consider taking a formal MBSR course, read books about the how and why of meditation (78,79);, or download apps that can guide you. The key is to develop a daily habit of sitting still for just two to five minutes a day.

Program-Level Strategies: Exercise and Nutrition Examples

The value of regular exercise for physical health is uncontested. Recent research highlights the physiologic mechanism behind the cognitive and emotional benefits of exercise as it relates to increased BDNF expression and enhanced neuroplasticity (80,81). Aerobic exercise seems to have the best impact on BDNF levels. An innovative study in a large academic medical center showed that a team-based incentivized exercise program significantly increased physical activity among participants, who also experienced significantly improved quality of life scores and a non-significant trend toward lower burnout (82). Consider how your program could benefit from a similar intervention. Does your hospital have exercise facilities for residents? A healthy competition with other residency programs in your health system can also help build a sense of community.

Nutritionally, physicians and trainees do not adequately hydrate or stay nourished. Barriers to good nutrition were identified and included lack of time, stringent work ethic, poor access, limited choice, and cost (83). A creative physician-centered, workplace-based nutrition intervention showed positive impact on physician cognitive functioning, hypoglycemic symptoms, and glucose levels (84). Consider making healthier nutrition and hydration more accessible for your program. Substitute fruit for candy rounds and place water coolers in common resident spaces, especially work rooms on the hospital floor.

CONCLUSION

The goal of this chapter was to help you gain awareness of the various manifestations of burnout so you can

identify appropriate strategies for recovery—for yourself and for your residents. Understanding the neurotoxicity of burnout provides valuable information if someone is struggling with clinical knowledge/reasoning or with unprofessional behaviors such as emotional dysregulation. Remember that recovery from burnout is a shared responsibility: individual physicians, training programs (medical schools and residency/fellowship programs), and the health system as a whole must be involved in this effort. In your chief resident role, you will be able to make program-level and maybe even system-level changes, and you will be a role model for your residents. Take active responsibility for your health and well-being. Redefine your self-care beyond exercise, nutrition, and sleep. Identify multiple strategies for your "self-care tool kit" that you try to use daily to augment your well-being across multiple dimensions. Expand self-care to encompass what you finding meaningful and sustaining at work; this will allow you to draw positive energy during your work days, not just during your time away from work. Incorporate cognitive reframing into your processing and reflection strategies, try to engage in a mindfulness activity on a daily basis, and cultivate your mission and purpose as you progress along your career path. Be a positive role model for your program and stay active in your well-being this year and beyond.

AUTHOR

Oana Tomescu MD, PhD
Associate Program Director
Medicine-Pediatrics Residency Program
Ruth and Raymond Perelman School of Medicine
at the University of Pennsylvania

REFERENCES

1. Maslach C, Jackson SE. The measurement of experienced burnout. *J Occ Behav*. 1981;2:99-113.
2. Maslach C. Job burnout: New directions in research and intervention. *Curr Dir Psychol Sci*. 2003;12:189-92.
3. Dyrbye LN, et al. A multicenter study of burnout, depression, and quality of life in minority and non-minority US medical students. *Mayo Clin Proc*. 2006;81(11):1435-1442.
4. Dyrbye LN, et al. Burnout and suicidal ideation among US medical students. *Ann Intern Med*. 2008;149:334-341.
5. Dyrbye LN, et al. Burnout and serious thoughts of dropping out of medical school: A multi-institutional study. *Acad Med*. 2010;85:94-102.
6. Dyrbye LN, et al. Burnout among US medical students, residents, and early career physicians relative to the general population. *Acad Med*. 2014;89:443-451.
7. Ripp J, et al. The incidence and predictors of job burnout in first-year internal medicine residents: A five-institution study. *Acad Med*. 2011;86(10):1304-1310.
8. Rosen IM, et al. Evolution of sleep quantity, sleep deprivation, mood disturbances, empathy, and burnout among interns. *Acad Med*. 2006;81(1):82-85.
9. Shea JA, et al. Impact of protected sleep period for internal medicine interns on overnight call on depression, burnout, and empathy. *JGME*. 2014;6(2):256-263.
10. Dyrbye LN, et al. Physician satisfaction and burnout at different career stages. *Mayo Clin Proc*. 2013;88(12):1358-1367.
11. Shanafelt TD, et al. Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med*. 2012;172(18):1377-1385.
12. Shanafelt TD, 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(12):1600-1613.
13. Brown SD, et al. Beyond substance abuse: Stress, burnout, and depression as causes of physician impairment and disruptive behavior. *J Am Coll Radiol*. 2009;6:479-485.
14. Center C, et al. Confronting depression and suicide in physicians: A consensus statement. *JAMA* 2003;289(23):3161-3166.
15. Dyrbye LN, et al. Systematic review of depression, anxiety, and other indicators of psychological distress among US and Canadian medical students. *Acad Med*. 2006;81:354-373.
16. Dyrbye LN, et al. Relationship between burnout and professional conduct and attitudes among US medical students. *JAMA*. 2010;304:1173-1180.
17. Ratanawongsa N, et al. Physician burnout and patient-physician communication during primary care encounters. *J Gen Int Med*. 2008;23(10):1581-1588.
18. Shanafelt TD, et al. Burnout and self-reported patient care in an internal medicine residency program. *Ann Intern Med.* 2002;136(5):358-367.
19. Shanafelt TD, et al. Burnout and career satisfaction among American surgeons. *Ann Surg*. 2009:250:463-471.
20. Travado L, et al. Physician-patient communication among southern European cancer physicians: The influence of psychosocial orientation and burnout. *Psychooncology.* 2005;14(8):661-670.
21. West CP, et al. Association of perceived medical errors with resident distress and empathy. *JAMA*. 2006;296:1071-1078.
22. West CP, et al. Quality of life, burnout, educational debt and medical knowledge among internal medicine residents. *JAMA*. 2011;306(9):952-960.
23. Wilcock SM, et al. Burnout and psychiatric morbidity in new medical graduates. *Med J Aust*. 2004;181:357-360.

24. Williams ES, et al. The relationship of organizational culture, stress, satisfaction and burnout with physician-reported error and suboptimal patient care: Results from the MEMO study. *Health Serv Manag Res*. 2007;32(3):203-212.
25. Wilter JH. Stress, burnout and physician productivity. *MGMA J*. 1998;May/June:32-37.
26. Gabbard GO. The role of compulsiveness in the normal physician. *JAMA*. 1985;254(20):2926-2929.
27. Jennings ML, Slavin SJ. Resident wellness matters: Optimizing resident education and wellness through the learning environment. *Acad Med*. 2015;90(9):1246-1250.
28. Keeton K, et al. Predictors of physician career satisfaction, work–life balance, and burnout. *Obstet Gynecol*. 2007;109(4):949-955.
29. Durning SJ, et al. Functional neuroimaging correlates of burnout among internal medicine residents and faculty members. *Front Psychiatry.* 2013;4:131.
30. de Andrade AP, et al. Higher burnout scores in paediatric residents are associated with increased brain activity during attentional functional magnetic resonance imaging task. *Acta Paediatr*. 2016;105(6):705-713.
31. Golkar A, et al. The influence of work-related chronic stress on the regulation of emotion and on functional connectivity in the brain. *PLOS ONE*, 2014.
32. Savic I. Structural changes of the brain in relation to occupational stress. *Cereb Cortex*. 2015;25(6):1554-1564.
33. Duman RS, Monteggia LM. A neurotrophic model for stress-related mood disorders. *Biol Psychiatry*. 2006;59;1116-1127.
34. Frodl T, O'Keane V. How does the brain deal with cumulative stress? A review with focus on developmental stress, HPA axis function and hippocampal structure in humans. *Neurobiol Dis*. 2013;52:24-37.
35. Eriksson PS, Wallin L. Functional consequences of stress-related suppression of adult hippocampal neurogenesis—A novel hypothesis on the neurobiology of burnout. *Acta Neurol Scand*. 2004;110:275-280.
36. Mitoma M, et al. Stress at work alters serum brain-derived neurotrophic factor (BDNF) levels and plasma 3-methoxy-4-hydroxyphenylglycol (MHPG) levels in healthy volunteers: BDNF and MHPG as possible biological markers of mental stress? *Prog Neuro-Psychopharmacol Biol Psychiatry*. 2008;32:679-685.
37. Okuno K, et al. Relationships between stress, social adaptation, personality traits, brain-derived neurotrophic factor and 3-methoxy-4-hydroxyphenylglycol plasma concentrations in employees at a publishing company in Japan. *Psychiatry Res*. 2011;186:326-332.
38. Pluchino N, et al. Steroid hormones and BDNF. *Neuroscience*. 2013;239:271-279.
39. Tapia-Arancibia L, et al. Physiology of BDNF: Focus on hypothalamic function. *Frontiers in Neuroendocrinol*. 2004;24:77-107.
40. Sen S, et al. Serum brain-derived neurotrophic factor, depression, and antidepressant medications: Meta-analyses and implications. *Biol Psychiatry*. 2008;64:527-532.
41. Sertoz O, et al. The role of BDNF and HPA axis in the neurobiology of burnout syndrome. *Prog Neuro-Psychopharm Biol Psychiatry*. 2008;32:1459-1465.
42. Brazeau CM, et al. Distress among matriculating medical students relative to the general population. *Acad Med*. 2014;89(11):1520-1525.
43. West C, et al. Interventions to prevent and reduce physician burnout: A systematic review and meta-analysis. *The Lancet*. 2016;388:2272-2281.
44. Panagioti M, et al. Controlled interventions to reduce burnout in physicians: A systematic review and meta-analysis. *JAMA Intern Med*. 2016.
45. Shakespeare-Finch J, et al. Personality, coping and posttraumatic growth in emergency ambulance personnel. *Traumatology*. 2005;11:325-334.
46. Paton D. Posttraumatic growth in protective services professionals: Individual, cognitive and organizational influences. *Traumatology*. 2005;11:335-346.
47. Tehrani N. Compassion fatigue: Experiences in occupational health, human resources, counselling and police. *Occup Med*. 2010;60(2):133-138.
48. Shanafelt TD, et al. Avoiding burnout: The personal health habits and wellness practices of US surgeons. *Ann Surg*. 2012;255:625-633.
49. Shanafelt TD, et al. The well-being and personal wellness promotion strategies of medical oncologists in North Central Cancer Treatment Group. *Oncology*. 2005;68:23-32.
50. Weiner EL, et al. A qualitative study of physicians' own wellness-promoting practices. *West J Med*. 2001;174:19-23.
51. Hanson R, Mendius R. *Buddha's Brain: The Practical Neuroscience of Happiness, Love and Wisdom*. Oakland, CA: New Harbinger Publications, Inc. 2009; pp. 41-42.
52. Seligman ME, et al. Positive psychology progress: Empirical validation of interventions. *Am Psychol*. 2005;60(5):410-421.
53. Hershberger PJ. Prescribing happiness: Positive psychology and family medicine. *Fam Med*. 2005;37(9):630-634.
54. Reilly JM, Ring JM. Healing and hopefulness: A tool for doctor wellbeing. *Med Educ.* 2005;39(11):1158-1159.
55. Gazelle G, et al. Physician burnout: Coaching a way out. *JGIM*. 2014;30(4):508-513.
56. Pluskota A. The application of positive psychology in the practice of education. *Pluskota SpringerPlus*. 2014;3:147.
57. Palamara K, et al. Promoting success: A professional development coaching program for interns in medicine. *Med Educ*. 2015;7(4):630-637.
58. Epstein R. Mindful practice in action (I): Technical competence, evidenced-based medicine and relationship-centered care. *Fam Syst Health*. 2003;21(1):1-9.
59. Epstein R. Mindful practice in action (II): Cultivating habits of mind. *Fam Syst Health*. 2003;21(1):11-17.
60. Gazella KA. Bringing mindfulness to medicine: An interview with Jon Kabat-Zinn. *Altern Ther*. 2005;11(3):57-64.

61. Connelly JE. Using mindfulness in clinical medicine. *Perspect Biol Med*. 2005;48(1):84-94.
62. Rosenzweig S, et al. Mindfulness-based stress reduction lowers psychological distress in medical students. *Teach Learn Med*. 2003;15(2):88-92.
63. Warnecke E, et al. A randomized controlled trial of the effects of mindfulness practice on medical student stress levels. *Med Educ*. 2011;45(4): 381-388.
64. Dobkin PL, Hutchinson TA. Teaching mindfulness in medical school: Where are we now and where are we going? *Med Educ*. 2013;47(8):768-779.
65. Oman D, et al. Passage meditation reduces perceived stress in health professionals: A randomized, controlled trial. *J Consult Clin Psychol*. 2006;74(4):714-719.
66. Krasner MS, et al. Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *JAMA*. 2009;302(12);1284-1293.
67. Irving JA, et al. Cultivating mindfulness in health care professionals: A review of empirical studies of mindfulness-based stress reduction (MBSR). *Complement Ther Clin Pract.* 2009;15(2):61-66.
68. Goodman MJ, Schorling JB. A mindfulness course decreases burnout and improves well-being among healthcare providers. *Intern J Psychiatry Med.* 2012;43(2):119-128.
69. Beckman HB, et al. The impact of a program in mindful communication on primary care physicians. *Acad Med.* 2012;87(6):815-819.
70. Moody K, et al. Helping the helpers: Mindfulness training for burnout in pediatric oncology—A pilot program. *J Pediatr Oncol Nurs*. 2013;30(5):275-284.
71. Fortney L, et al. Abbreviated mindfulness intervention for job satisfaction, quality of life, and compassion in primary care clinicians: A pilot study. *Ann Fam Med.* 2013;11(5):412-420.
72. Asuero AM, et al. Effectiveness of a mindfulness education program in primary health care professionals: A pragmatic controlled trial. *J Contin Educ Health Prof.* 2014;34(1):4-12.
73. Amutio A, et al. Acceptability and effectiveness of a long-term educational intervention to reduce physicians' stress-related conditions. *J Contin Educ Health Prof.* 2015;35(4):255-260.
74. Dobkin PL, et al. Enhancing clinicians' well-being and patient-centered care through mindfulness. *J Contin Educ Health Prof.* 2016;36(1):11-16.
75. Rosdahl JA, Kingsolver KO. Mindfulness training to increase resilience and decrease stress and burnout in ophthalmology residents: A pilot study. *Invest Ophthalmol Vis Sci.* 2014;55(13):5579.
76. Goldhagen BE, et al. Stress and burnout in residents: Impact of mindfulness-based resilience training. *Adv Med Educ Prac.* 2015;6:525-532.
77. Taylor M, et al. A mindfulness intervention for residents: Relevance for pediatricians. *Pediatric Ann.* 2016;45(10):e373-e376.
78. Kabat-Zinn J. *Wherever You Go There You Are: Mindfulness Meditation in Everyday Life.* New York: Hyperion, 1994.
79. Kabat-Zinn J. *Coming to Our Senses: Healing Ourselves and the World Through Mindfulness*. New York: Hyperion, 2005.
80. Huang T, et al. The effects of physical activity and exercise on brain-derived neurotrophic factor in healthy humans: A review. *Scand J Med Sci Sports.* 2014;24:1-10.
81. Szuhany KL, et al. A meta-analytic review of the effects if exercise on brain-derived neurotrophic factor. *J Psychiatric Res.* 2015;60:56-64.
82. Weight CJ, et al. Physical activity, quality of life, and burnout among physician trainees: The effect of a team-based, incentivized exercise program. *Mayo Clinic Proc.* 2013;88(12):1435-1442.
83. Lemaire JB, et al. Physician nutrition and cognition during work hours: Effect of a nutrition-based intervention. *BMC Health Serv Res*. 2010;10:241.
84. Lemaire JB, et al. Food for thought: An exploratory study of how physicians experience poor workplace nutrition. *Nutr J.* 2011;10(1):18.