



Clinical Training Environment Characteristics and Resident Physician Burnout: An Integrative Review

Anran Liu^{1#} and Zhen Zhang^{2*}

¹Department of Clinical Nutrition, The Seventh Affiliated Hospital, Sun Yat-sen University, Shenzhen, China; ²Department of Endocrinology, The Seventh Affiliated Hospital, Sun Yat-sen University, Shenzhen, China.

#Corresponding author: Zhen Zhang, PhD, Department of Endocrinology, The Seventh Affiliated Hospital, Sun Yat-sen University, 628 Zhenyuan Road, Guangming District, Shenzhen, China. Tel: +86-0755-81206795. Email address:

zhangzhen@sysush.com

ABSTRACT

Resident physician burnout poses a critical challenge to healthcare systems worldwide, with the clinical training environment serving as the fundamental context in which burnout develops and perpetuates. This integrative review synthesizes empirical evidence examining the relationships between training environment characteristics and resident burnout, systematically analyzing four core environmental domains: workload and time pressure, organizational support and educational guidance, interpersonal relationships and team atmosphere, and compensation equity, as key determinants of burnout risk. Drawing upon the Job Demands-Resources model and organizational justice theory, the review elucidates mechanistic pathways through which environmental factors precipitate burnout, identifying human capital depletion as the central process, with professional identity erosion and perceived inequity serving as critical mediating mechanisms. Learning opportunities and professional autonomy emerge as significant buffers against workload-induced stress, whereas workplace mistreatment and compensation imbalance exacerbate depersonalization and diminish personal accomplishment. Multilevel interventions integrating individual-level practices, organizational reforms, and systemic policies demonstrate greater efficacy than single-level strategies alone. The synthesized evidence leads to the conclusion that resident burnout fundamentally reflects systemic ecological imbalance within training environments rather than individual psychological deficits. Future research should prioritize longitudinal designs, standardized outcome measures, and specialty-specific interventions, alongside a paradigm shift from deficit-focused burnout mitigation toward strengths-based approaches that foster work engagement and professional fulfillment, thereby building sustainable medical education systems that safeguard both resident well-being and patient care quality.

ARTICLE HISTORY

Received: June 29, 2026

Revised: July 5, 2026

Accepted: July 6, 2026

KEYWORDS

Resident burnout, Clinical training environment, Job Demands-Resources Model, Workload, Time pressure

Introduction

Worldwide, resident physicians constitute a pivotal workforce within healthcare systems, shouldering the dual burden of intensive clinical service and rigorous academic training. This demanding phase of medical education is marked by high workloads, frequent role transitions, and significant psychological strain, rendering residents particularly susceptible to occupational burnout. Burnout is a multifaceted syndrome encompassing emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment, which collectively impair the well-being of

residents and compromise their professional efficacy [1]. The clinical and systemic implications of burnout are profound, extending from individual distress to patient safety, care quality, and system sustainability, with increased medical errors, reduced empathy, and higher turnover rates posing direct threats to workforce retention and healthcare delivery.

The clinical training environment, serving as the primary context for residents' daily work and learning, plays a critical role in shaping their experiences and outcomes. This environment involves a complex interplay among workload intensity, organizational

culture, social support networks, teaching quality, and feedback mechanisms. Empirical evidence indicates that specific characteristics of the training environment—such as excessive work hours, poorly designed training schedules, inadequate social support, and mistreatment—are independently associated with heightened burnout risk among residents [2]. Despite extensive research on these factors, much of the extant literature has focused on isolated elements of the training environment, lacking a comprehensive synthesis that integrates these diverse factors into a coherent framework.

Given these complexities, a systematic and integrative review of the clinical training environment's characteristics in relation to resident physician burnout is warranted. Such a synthesis would elucidate key environmental determinants, clarify their mechanisms of influence, and identify actionable targets for intervention. This review aims to fill the existing gap by comprehensively examining empirical evidence on how various features of the clinical training environment, ranging from workload and organizational culture to mentorship and social support, relate to burnout among resident physicians. By delineating these relationships, the review seeks to inform the development of evidence-based strategies to optimize training environments, enhance resident well-being, and ultimately improve patient care outcomes.

1. Core Characteristics of the Clinical Training Environment and Their Association with Physician Burnout

1.1 Workload and Time Pressure

Heavy workload and incessant time pressure are primary stressors in clinical training, driving elevated burnout rates among resident physicians. Extended working hours, frequent overnight shifts, and consecutive on-call duties are pervasive features of residency programs that impose substantial physiological and psychological demands on trainees. Empirical evidence indicates that residents working over 80 hours per week or enduring continuous shifts exceeding 24 hours exhibit markedly higher burnout scores, particularly in emotional exhaustion, compared to those on duty-hour-compliant schedules [3]. This emotional exhaustion reflects the depletion of emotional resources caused by sustained work demands without adequate recovery. In addition, the sheer volume of patient management responsibilities and extensive

documentation further encroach on residents' time for learning and rest. This creates a vicious cycle that exacerbates depersonalization, which is characterized by a distant and disengaged attitude toward patients [4]. The cumulative effect of these factors extends beyond residents' well-being to directly threaten patient care quality. Elevated fatigue and stress, for instance, correlate with more frequent medical errors and reduced empathy—two outcomes of paramount concern in clinical practice [5]. The physiological consequences are equally telling: decreased cortisol levels among residents with high job demands point to stress system dysregulation, a biological signature of burnout [6]. Taken together, this evidence establishes workload and time pressure not as mere operational inconveniences but as fundamental drivers of burnout, a problem that demands systemic responses, including duty hour reforms, workload redistribution, and strengthened support systems.

1.2 Organizational Support and Educational Guidance

Organizational support and structured educational guidance constitute critical safeguards against burnout in clinical training environments. Positive feedback from supervising physicians, clearly defined curricula, and explicit career development pathways are not merely administrative niceties but core elements of support that actively bolster residents' self-efficacy and psychological resilience [7]. When these support systems function effectively, they do more than ease stress. They foster a genuine sense of competence and belonging that enables trainees to withstand the inherent pressures of clinical work. Conversely, training environments characterized by absent mentorship or predominantly critical feedback do more than discourage. They actively cultivate helplessness and erode personal accomplishment, thereby rendering residents particularly vulnerable to burnout, especially in the domain of diminished achievement [8].

The empirical case for structured educational support is compelling. Programs that offer at least one hour of formal teaching per week report roughly 30% lower burnout rates than those without such sessions [9], demonstrating that educational investment yields measurable protective returns. Mentorship, in particular, proves indispensable. Pediatric surgical residents deprived of mentors exhibit markedly higher emotional exhaustion and significantly lower personal accomplishment, a deficit that directly undermines

their professional development and long-term retention [10]. Beyond mentorship, formal coaching interventions have consistently shown efficacy in reducing burnout and enhancing professional fulfillment. They achieve this not by eliminating stressors, but by providing psychological safety and holistic support that reframe challenges as manageable and normalize the difficulties inherent in medical training [11].

Critically, organizational support does not merely complement resilience. It actively cultivates it. The positive correlation between support and resilience, coupled with the inverse relationship between resilience and both emotional exhaustion and depersonalization, underscores an inescapable conclusion [12]. Without robust organizational backing, resilience erodes, and burnout flourishes. The evidence is unequivocal. Fostering a supportive educational climate, anchored in structured mentorship and constructive feedback, is not optional but essential. It is the foundation upon which sustainable professional development rests and the most viable strategy for safeguarding the well-being of the next generation of physicians.

1.3 Interpersonal Relationships and Team Atmosphere

Interpersonal relationships and the overall team atmosphere are critical determinants of resident burnout within the clinical training environment. A harmonious collegial climate, characterized by open communication, mutual respect, and effective interdisciplinary collaboration, strengthens residents' sense of belonging and psychological safety. This, in turn, reduces feelings of isolation and vulnerability to burnout [13]. Positive peer support networks, such as mutual aid groups among colleagues, have been empirically shown to alleviate emotional exhaustion and function as natural buffers against burnout [14].

Conversely, workplace mistreatment tells a different and more troubling story. Exposure to verbal abuse, discrimination, and hostile supervisory behaviors does more than offend—it actively undermines psychological safety and drives burnout, most notably through elevated depersonalization [15]. The mediating roles of emotional regulation and social support are particularly instructive in this context. Emotional dysregulation intensifies the deleterious impact of mistreatment on burnout, whereas robust social support can effectively attenuate these negative effects [16]. This distinction highlights a critical point: fostering supportive interpersonal dynamics within

training programs is not merely beneficial but essential.

The consequences of poor interpersonal climates extend beyond individual distress. Residents who experience frequent workplace conflicts or discrimination report higher burnout scores and diminished professional fulfillment, perpetuating a cycle of disengagement and reduced empathy [17]. Qualitative research further illuminates the complexity of these dynamics. Residents' decisions regarding activation of back-up call systems, for instance, are shaped by inner conflicts between collegial loyalty and personal burnout, illustrating how team dynamics and workload stressors are inextricably intertwined [18].

Taken together, the evidence points to a clear imperative. Cultivating a positive team atmosphere and systematically addressing mistreatment are not ancillary concerns but central strategies for enhancing resident well-being, reducing burnout prevalence, and ultimately improving patient care outcomes.

1.4 Compensation Inequity and Workload-Remuneration

Compensation imbalance and perceived fairness of remuneration represent critical yet frequently overlooked dimensions of the clinical training environment that significantly influence resident burnout. Despite shouldering substantial clinical responsibilities and working hours that often exceed those of attending physicians, residents receive compensation that is disproportionately low relative to their workload, educational debt, and professional contributions. This disparity between effort and reward constitutes a fundamental violation of distributive justice, which, as discussed earlier, erodes professional identity and accelerates emotional exhaustion. The financial strain experienced by residents is compounded by the escalating burden of medical school debt. Average debt levels among graduating medical students have reached historically high levels, while resident salary growth has, in many contexts, failed to keep pace with inflation or the rising cost of living when evaluated over certain periods and using specific inflation measures [19]. Residents carrying substantial debt often perceive themselves as having limited career flexibility, feeling compelled to prioritize higher-paying subspecialties over personal interests or primary care, thereby compromising their intrinsic motivation and long-term professional fulfillment [20]. Furthermore, the workload-remu-

neration imbalance extends beyond absolute salary levels to encompass compensation for overtime, night shifts, and weekend duties. In many programs, these additional responsibilities are inadequately compensated or treated as routine expectations, intensifying perceptions of inequity and exacerbating the sense that residents' labor is undervalued [21]. This perceived exploitation not only fuels resentment but also diminishes the psychological rewards of clinical work, undermining the sense of personal accomplishment that typically sustains professional engagement. When residents perceive their compensation as unfair relative to their workload and level of training, the resulting dissatisfaction reinforces the emotional exhaustion already generated by excessive job demands. This dynamic underscores the need for systemic reforms that address compensation structures, including transparent salary scales, equitable overtime pay, and financial wellness programs, as integral components of comprehensive burnout prevention strategies.

2. Mechanistic Analysis of Clinical Training Environment Leading to Occupational Burnout

2.1 Human Capital Depletion: A Job Demands-Resources Perspective

The job demands-resources model provides a comprehensive theoretical lens for examining how the clinical training environment precipitates occupational burnout among resident physicians. According to this framework, burnout emerges when elevated workplace demands excessively tax an individual's energetic resources, particularly when insufficient organizational or personal resources are available to facilitate recovery and replenishment. Within the clinical training context, residents face a convergence of intense demands, including extended duty hours, emotionally burdensome patient interactions, and high-acuity decision-making. These factors collectively trigger sustained sympathetic nervous system activation and perpetuate chronic stress responses. This prolonged neuroendocrine arousal disrupts circadian rhythmicity and compromises essential restorative processes such as sleep, progressively culminating in emotional exhaustion, a cardinal manifestation of burnout. Empirical evidence corroborates that extended shifts and cognitively demanding clinical judgments deplete both emotional and cognitive reserves, heightening residents' susceptibility to burnout symptomatology [22].

The model further underscores the buffering function of personal resources, particularly psychological resilience and perceived work-related control. However, within resource-constrained training environments, these personal protective factors frequently prove inadequate or become progressively eroded over time, thereby lowering the threshold for the onset of burnout initiation. Prior investigations have demonstrated that residents exhibiting higher resilience scores report diminished emotional exhaustion and depersonalization, affirming the moderating influence of individual resources [23]. Conversely, deficits in institutional support, effective mentorship, and professional autonomy impair residents' adaptive coping mechanisms, thereby accelerating the attrition of human capital. The dynamic interplay between excessive occupational demands and deficient resource availability engenders a self-reinforcing cycle in which residents' energetic capacities are persistently depleted without sufficient opportunities for restoration, ultimately resulting in burnout. This mechanistic conceptualization underscores the imperative of realigning clinical expectations with robust organizational infrastructures and personal resource development to sustain resident well-being and optimize professional performance.

2.2 Mediating Role of Organizational Justice and Professional Identity

Organizational justice, which encompasses distributive, procedural, and interactional fairness, plays a pivotal mediating role in the relationship between the clinical training environment and resident burnout. Distributive justice pertains to the perceived fairness of outcomes such as salary compensation and workload allocation. Procedural justice relates to the fairness of processes including rotation scheduling and evaluation mechanisms. Interactional justice concerns the respectful and dignified treatment residents receive from supervising faculty. When residents perceive inequities across these domains, their professional identity and work engagement deteriorate, precipitating emotional distancing and depersonalization, both of which are hallmark features of burnout. Empirical studies reveal that perceived organizational injustice correlates strongly with diminished professional commitment and elevated burnout symptoms among trainees [24]. This erosion of professional identity frequently manifests as disillusionment and a tendency to view clinical duties as burdensome obligations rather than meaningful

vocational pursuits. Longitudinal evidence indicates that shifts in organizational justice perceptions precede the onset of burnout symptoms, suggesting a causal pathway and identifying a critical window for preventive intervention [25]. Furthermore, the decline in professional identity resulting from perceived injustice undermines intrinsic motivation and job satisfaction, thereby exacerbating emotional exhaustion. Interventions designed to enhance fairness in workload distribution, promote transparent and participatory scheduling processes, and foster respectful interactions between supervisors and trainees have demonstrated efficacy in mitigating burnout risk. In sum, organizational justice not only influences residents' immediate emotional responses but also shapes their deeper professional self-concept, thereby mediating their vulnerability to burnout within the demanding clinical training environment.

2.3 Moderating Effects of Learning Opportunities and Autonomy

High-quality learning opportunities and autonomy within clinical training environments serve as critical moderators that attenuate the adverse effects of workload-induced stress on resident burnout. Engagement in complex case discussions and hands-on procedural experiences enhances residents' clinical competence and self-efficacy, which in turn bolster their confidence and reinforce their sense of personal accomplishment. This sense of accomplishment constitutes an important protective factor against burnout. Research indicates that residents who perceive abundant and meaningful learning opportunities report higher levels of personal achievement and lower emotional exhaustion, even when facing high clinical demands [26]. Autonomy, defined as the degree to which residents can participate in decision-making, select learning pathways, and regulate their work pace, has been consistently linked to reduced burnout. Low autonomy correlates strongly with elevated emotional exhaustion and depersonalization, whereas greater control over the work environment fosters professional engagement and psychological resilience [27]. Recent studies have demonstrated that residents who actively manage their learning schedules and participate in rotation planning maintain higher professional fulfillment and exhibit lower susceptibility to burnout, even under high-pressure conditions [28]. This evidence suggests that autonomy not only empowers residents but also facilitates adaptive coping by enabling optimal alignment between work

demands and personal capacities. Consequently, optimizing clinical training to provide rich educational experiences and enhance resident autonomy represents a strategic approach to mitigating burnout, preserving human capital, and promoting sustainable professional development.

3. Interventions to Reduce Burnout Among Trainee Physicians

3.1 Individual-Level Interventions

3.1.1 Mindfulness and Meditation Training

Mindfulness and meditation-based interventions have emerged as promising approaches to improving physician psychological well-being through the cultivation of present-moment awareness and emotional regulation capacities. Empirical evidence suggests that key mindfulness dimensions, including non-reactivity and acting with awareness, are positively correlated with mental health outcomes and workplace productivity among junior doctors, while also mitigating stress perception and threat appraisals [29]. By facilitating more adaptive responses to the emotional intensity of clinical practice, these practices may bolster psychological resilience and serve as a buffer against burnout. Incorporating structured mindfulness curricula during residency training thus represents a viable strategy for enhancing coping effectiveness and fostering long-term professional engagement.

3.1.2 Cognitive Behavioral Therapy and Stress Management Skills Training

Cognitive behavioral therapy (CBT) and stress management skills training have proven effective in equipping physicians with practical strategies to address occupational stress and anxiety. Randomized controlled trials indicate that proof-of-concept training programs significantly reduce stress and anxiety scores among junior medical staff while simultaneously enhancing psychological resilience [30]. These interventions focus on restructuring maladaptive cognitive patterns and cultivating adaptive coping mechanisms, capacities that are particularly critical during transitional phases of medical careers. The integration of CBT-based modules into residency curricula may strengthen physicians' ability to navigate clinical pressures and emotional challenges more effectively.

3.1.3 Physical Exercise and Sleep Hygiene Interventions

Physical exercise and sleep hygiene constitute essential components of physician mental health maintenance and resilience building. Research conducted among psychiatry residents has revealed that insufficient sleep, defined as less than six hours per night, and extended working hours are significantly associated with elevated levels of depression, stress, and burnout, as well as increased self-reported medical errors [31]. Promoting regular physical activity and optimizing sleep practices may effectively mitigate these adverse outcomes. Structured interventions that target sleep hygiene and actively encourage physical exercise within residency programs can facilitate recovery, reduce emotional exhaustion, and enhance overall clinical performance.

3.2 Organization-Level Interventions

3.2.1 Peer Support Groups and Narrative Medicine Practice

Peer support groups and narrative medicine practices provide essential emotional and social resources that strengthen physicians' psychological resilience. Qualitative research has demonstrated that sharing experiences of grief and emotional distress, particularly following patient deaths, within supportive peer environments helps alleviate disenfranchised grief and facilitates adaptive coping strategies [32]. Narrative medicine encourages reflective practice, enabling physicians to process complex emotional responses and reaffirm their core professional values. Establishing regular peer support sessions and integrating narrative-based approaches into medical education can cultivate psychological safety and foster collective resilience among physicians.

3.2.2 Rotation System and Workload Optimization

Optimizing rotation schedules and workload distribution plays a crucial role in reducing occupational stress and mitigating burnout risk among resident physicians. A well-structured rotation system effectively balances clinical exposure with adequate rest periods, thereby preventing excessive work strain and supporting recovery. Evidence indicates that organizational readiness and institutional capacity significantly influence the successful implementation of workload adjustments, which in turn enhances intervention fidelity and promotes staff well-being [33]. Furthermore, aligning organizational priorities with

system-level policies can help overcome barriers related to structural capacity and resource constraints, thereby facilitating sustainable workload optimization [34]. Such systemic adjustments are essential for maintaining healthcare workers' performance and reducing their vulnerability to burnout.

3.2.3 Reform of Mentorship and Leadership Support Systems

Effective mentorship and leadership support serve as cornerstones of a supportive clinical work environment. Leaders who actively champion diversity, equity, inclusion, and belonging (DEIB) initiatives function as catalysts for organizational change, driving the implementation of strategies that improve workplace culture and enhance staff engagement [35]. Leadership interventions that prioritize psychological safety and community building have demonstrated considerable potential in promoting professional well-being and reducing burnout [36]. Reforming mentorship programs to embed these leadership qualities can empower healthcare workers, strengthen organizational commitment, and cultivate resilience.

3.2.4 Establishing Psychological Safety and a Culture of Seeking Help

Creating a psychologically safe environment fosters open communication and reduces the stigma associated with seeking support. Organizational climate and culture exert a strong influence on healthcare providers' attitudes and readiness to adopt supportive interventions [37]. Participatory organizational interventions have been shown to enhance social capital and promote readiness for change, both of which are critical to fostering psychological safety [38]. Embedding a culture that normalizes help-seeking behaviors and prioritizes mental health can alleviate stress-related outcomes and enhance the long-term sustainability of the healthcare workforce.

3.2.5 Flexible Scheduling and Enhancing Autonomy

Flexible work schedules and enhanced autonomy empower residents to manage work-life integration more effectively, an ability that has been consistently linked to higher job satisfaction and stronger organizational commitment [39]. Interventions incorporating flexible rostering and opportunities for self-directed decision-making can alleviate job strain and improve overall well-being [40]. Such organizational strategies align with evidence supporting multi-level interventions that address both individual and sys-

tem-level factors to optimize sustained behavioral change and health outcomes [41]. Enhancing autonomy through flexible scheduling thus represents a key organizational intervention for reducing burnout and strengthening workforce resilience.

3.3 System- and Policy-Level Interventions

3.3.1 Work Hour Restrictions and Compensation Reform

Work hour limitations and improvements in remuneration are critical systemic interventions to mitigate physician burnout. Excessive working hours correlate strongly with depression, stress, and burnout among medical residents, as evidenced by Singapore psychiatry residents where working ≥ 60 hours per week and sleeping less than six hours significantly increased depression and burnout risk [31]. Reforming work schedules to ensure adequate rest and fair compensation can enhance mental health and job satisfaction, thereby improving patient care quality. These measures create a sustainable work environment that supports physicians' well-being and professional longevity.

3.3.2 Positive Psychology Perspective: From Burnout to Work Engagement

Emerging research emphasizes the shift from solely mitigating burnout to fostering positive psychological states such as work engagement and professional fulfillment. The virtue ethics framework, including character strengths like courage and resilience, has been proposed as a foundation for medical education to enhance moral character and reduce burnout. Interventions incorporating mindfulness, gratitude, and positive psychology have demonstrated effectiveness in decreasing emotional exhaustion and depersonalization among nurses, promoting sustained work engagement [42]. Moreover, the integration of spiritual frameworks, such as the Seven Spiritual Works of Mercy, offers novel approaches to support medical trainees' psychological well-being [43]. Network analyses reveal that work-family conflict, particularly work interfering with family, plays a central role in burnout and engagement dynamics, suggesting that addressing these conflicts can improve overall occupational well-being [44]. Future studies should explore comprehensive models that integrate positive psychology constructs with burnout prevention to cultivate enduring professional commitment and satisfaction.

Conclusion

This systematic review has comprehensively examined the characteristics of the clinical training environment associated with resident physician burnout, the mechanistic pathways through which these factors operate, and the interventions available to mitigate their impact. The evidence synthesized across the reviewed studies leads to several key conclusions.

First, the clinical training environment exerts a profound influence on resident burnout through multiple interconnected domains. Excessive workload and time pressure, deficient organizational support, inadequate compensation, and toxic interpersonal dynamics collectively deplete residents' emotional and cognitive reserves. These factors do not operate in isolation but interact synergistically, creating a self-reinforcing cycle in which high demands erode personal resources, while insufficient institutional support accelerates human capital depletion. The Job Demands-Resources model provides a coherent theoretical framework for understanding these dynamics, conceptualizing burnout as the outcome of chronic imbalance between excessive demands and inadequate resources.

Second, the mechanisms linking training environment characteristics to burnout are mediated and moderated by several key factors. Organizational justice, encompassing distributive, procedural, and interactional fairness, plays a pivotal mediating role, with perceived inequity undermining professional identity and accelerating emotional exhaustion. Conversely, learning opportunities and professional autonomy serve as critical moderators that buffer the adverse effects of workload-induced stress. These mechanistic insights highlight that burnout is not merely an individual problem, but a systemic issue rooted in the structural and cultural fabric of training environments.

Third, a range of interventions across individual, organizational, and systemic levels have demonstrated efficacy in reducing burnout. Mindfulness training, cognitive behavioral therapy, and physical exercise programs address individual-level coping and resilience. Peer support groups, narrative medicine, and mentorship reforms target social and emotional resources within the training environment. At the organizational and policy levels, workload optimization, flexible scheduling, compensation reform, work hour restrictions, and leadership development offer structural solutions that address the root causes of burnout. The evidence strongly suggests that multilevel

collaborative interventions, those integrating individual, organizational, and systemic approaches, are more effective than single-level strategies alone.

Fourth, despite the growing body of evidence, significant knowledge gaps remain. Longitudinal studies are needed to establish causal pathways and assess the long-term sustainability of intervention effects. Standardized outcome measures would facilitate meaningful comparisons across studies and settings. Furthermore, the differential impact of burnout across medical specialties calls for precision interventions tailored to the unique stressors and resilience factors of specific specialties, such as surgery, emergency medicine, and psychiatry. Emerging technologies, including artificial intelligence and digital intervention tools, offer promising avenues for early risk detection, administrative burden reduction, and personalized support, though rigorous validation and ethical frameworks are essential before widespread implementation.

Finally, the shift from a deficit-focused perspective, merely mitigating burnout, to a strengths-based approach that actively fosters work engagement, professional fulfillment, and positive psychological states represents a promising paradigm transition. Cultivating resilience, emotional intelligence, and moral character through virtue ethics and positive psychology frameworks may not only protect against burnout but also promote enduring professional commitment and satisfaction.

In conclusion, addressing resident physician burnout requires a fundamental reorientation of clinical training environments. The evidence reviewed here underscores that fostering supportive organizational cultures, ensuring fair compensation and workload distribution, providing structured mentorship and educational guidance, promoting psychological safety and help-seeking, and implementing multilevel interventions are not optional enhancements but essential foundations for sustainable medical education. The responsibility for this transformation rests not with individual residents alone but with health-care institutions, training programs, and policymakers collectively. Only through sustained, coordinated, and evidence-based efforts can the next generation of physicians be safeguarded, ensuring both their well-being and the quality of patient care they provide.

Authors' Contributions:

Anran Liu contributed to the conception, design, and acquisition of data, and drafted the manuscript.

Zhen Zhang contributed to the interpretation of data, critically revised the manuscript for important intellectual content, and provided final approval. Both authors agree to be accountable for all aspects of the work.

Conflicts of interest:

The authors declare no competing interests.

References

- [1] West CP, Dyrbye LN, Shanafelt TD, et al. **Physician burnout: contributors, consequences and solutions.** *J Intern Med.* 2018; 283(6):516-529. doi:10.1111/joim.12752.
- [2] Dyrbye LN, Thomas MR, Harper W, et al. **The learning environment and medical student burnout: a multicentre study.** *Med Educ.* 2009; 43(3):274-282. doi:10.1111/j.1365-2923.2008.03282.x.
- [3] Nituica C, Bota OA, Blebea J, et al. **Factors influencing resilience and burnout among resident physicians: a national survey.** *BMC Med Educ.* 2021; 21(1):514. doi:10.1186/s12909-021-02950-y.
- [4] Wang MK, Geen O, Mach ZH, et al. **Resident burnout on the internal medicine ward.** *J Gen Intern Med.* 2024; 39(3):366-372. doi:10.1007/s11606-023-08505-9.
- [5] Bordbar S, Mousavi SM, Samadi S, et al. **The association between burnout and medical professionalism in medical trainees: a systematic review.** *BMC Med Educ.* 2025; 25(1):1176. doi:10.1186/s12909-025-07687-6.
- [6] Olivé V, Navinés R, Macías L, et al. **Psychosocial and biological predictors of resident physician burnout.** *Gen Hosp Psychiatry.* 2022; 78:68-71. doi:10.1016/j.genhosppsych.2022.07.007.
- [7] Olson K, Marchalik D, Farley H, et al. **Organizational strategies to reduce physician burnout and improve professional fulfillment.** *Curr Probl Pediatr Adolesc Health Care.* 2019;49(12):100664. doi:10.1016/j.cppeds.2019.100664.
- [8] Bailey E, Robinson J, McGorry P, et al. **Depression and suicide among medical practitioners in Australia.** *Intern Med J.* 2018; 48(3):254-258. doi:10.1111/imj.13717.
- [9] Liu K, Patey C, Norman P, et al. **Interventions to reduce burnout in emergency medicine: a national inventory of the Canadian experience to support global implementation of wellness initiatives.** *Intern Emerg Med.* 2025; 20(4):1245-1264. doi:10.1007/s11739-024-03811-4.

- [10] Silver CM, Yuce TK, Clarke CN, et al. **Disparities in Mentorship and Implications for US Surgical Resident Education and Wellness.** *JAMA Surg.* 2024; 159(6):687-695. doi:10.1001/jamasurg.2024.0533.
- [11] Smeds MR, Janko MR, Allen S, et al. **Burnout and its relationship with perceived stress, self-efficacy, depression, social support, and programmatic factors in general surgery residents.** *Am J Surg.* 2020; 219(6):907-912. doi:10.1016/j.amjsurg.2019.07.004.
- [12] An J, Chang Y, Zhang X, et al. **Status quo and influencing factors of job burnout among residents in standardized training.** *Front Public Health.* 2024; 12:1470739. doi:10.3389/fpubh.2024.1470739.
- [13] Zheng B, Merkebu J, Dong T, et al. **From mistreatment to burnout: the mediating role of emotional regulation in graduate medical trainees.** *Perspect Med Educ.* 2025; 14(1):655-664. doi:10.5334/pme.2126.
- [14] Wei Q, Xiao H, Liang S, et al. **The association between adverse practice experiences and residency trainee occupational burnout.** *Front Public Health.* 2025; 13:1729142. doi:10.3389/fpubh.2025.1729142.
- [15] Sheikh N, Ng SL, Flett H, et al. **Internal medicine trainee perspectives on back-up call systems and relationships to burnout.** *Med Educ.* 2023; 57(3):256-264. doi:10.1111/medu.15003.
- [16] Houqani MA, Hashim MJ, Anwar E, et al. **Burnout syndrome among trainee doctors in a nationally accredited postgraduate medical training system.** *BMC Med Educ.* 2026; 26(1). doi:10.1186/s12909-026-08857-w.
- [17] Caruso R, Toffanin T, Folesani F, et al. **Violence against physicians in the workplace: trends, causes, consequences, and strategies for intervention.** *Curr Psychiatry Rep.* 2022; 24(12):911-924. doi:10.1007/s11920-022-01398-1.
- [18] Hacer TY, Ali A. **Burnout in physicians who are exposed to workplace violence.** *J Forensic Leg Med.* 2020; 69:101874. doi:10.1016/j.jflm.2019.101874.
- [19] Kraus MB, Hasan SH, Buckner-Petty SA, et al. **Out-of-State Students at State Medical Schools and Increasing Medical Education Debt.** *Acad Med.* 2023; 98(5):595-605. doi:10.1097/ACM.0000000000005079. Epub 2022 Nov 8. PMID: 36512837.
- [20] Verduzco-Gutierrez M, Larson AR, Capizzi AN, et al. **How Physician Compensation and Education Debt Affects Financial Stress and Burnout: A Survey Study of Women in Physical Medicine and Rehabilitation.** *PM R.* 2021; 13(8):836-844. doi:10.1002/pmrj.12534. Epub 2021 Feb 1. PMID: 33301648.
- [21] Coulshed A, Fernandes B, Hettige S, et al. **Overtime claiming among Australian doctors-in-training.** *Aust Health Rev.* 2022; 46(2):163-169. doi:10.1071/AH21323. PMID: 35314024.
- [22] Trockel MT, Menon NK, Rowe SG, et al. **Assessment of physician sleep and wellness, burnout, and clinically significant medical errors.** *JAMA Netw Open.* 2020; 3(12):e2028111. doi:10.1001/jamanetworkopen.2020.28111.
- [23] Fischer J, Alpert A, Rao P, et al. **Promoting intern resilience: individual chief wellness check-ins.** *MedEdPORTAL.* 2019; 15:10848. doi:10.15766/mep_2374-8265.10848.
- [24] Vásquez-Trespalcacios EM, Aranda-Beltrán C, López-Palomar MDR, et al. **Organizational identification and burnout syndrome in healthcare workers: The mediating effect of organizational justice.** *Work.* 2023; 75(3):965-974. doi:10.3233/WOR-220107. PMID: 36710700.
- [25] Jin WM, Zhang Y, Wang XP, et al. **Job burnout and organizational justice among medical interns in Shanghai, People's Republic of China.** *Adv Med Educ Pract.* 2015; 6:539-44. doi:10.2147/AMEP.S88953. PMID: 26345642; PMCID: PMC4555971.
- [26] Winkel AF, Porter B, Scheer MR, et al. **Evaluating the impact of coaching through the transition to residency.** *J Gen Intern Med.* 2025; 40(1):10-16. doi:10.1007/s11606-024-08865-w.
- [27] Waddimba AC, Ashmore J, Douglas ME, et al. **Association of well-being-centered leadership with burnout and professional fulfillment among physicians: mediating effects of autonomy support and self-valuation.** *Leadersh Health Serv (Bradf Engl).* 2025; 38(5):65-81. doi:10.1108/LHS-01-2025-0001. PMID: 40488340; PMCID: PMC12616283.
- [28] Palamara K, McKinley SK, Chu JT, et al. **Impact of a virtual professional development coaching program on the professional fulfillment and well-being of women surgery residents: a randomized controlled trial.**

- Ann Surg.* 2023; 277(2):188-195. doi:10.1097/SLA.0000000000005562.
- [29] Matthias C, Bu C, Cohen M, et al. **The role of mindfulness in stress, productivity and well-being of foundation year doctors: a mixed-methods feasibility study of the mindful resilience and effectiveness training programme.** *BMC Med Educ.* 2024; 24(1):834. doi:10.1186/s12909-024-05810-7.
- [30] Zheng H, Rong H, Meng L, et al. **Effects of proof-of-concept training on reducing work stress and anxiety of junior medical staff: a randomized controlled trial proof-of-concept.** *Acta Neurol Belg.* 2024; 124(4):1273-1279. doi:10.1007/s13760-024-02504-1.
- [31] Kwok C, et al. **Depression, stress, and perceived medical errors in Singapore psychiatry residents.** *Acad Psychiatry.* 2021; 45(2):169-173. doi:10.1007/s40596-020-01376-w.
- [32] Katti AR, Nandanikar AR, Karthikeyan A, et al. **Navigating grief in the realm of patient mortality: insights from trainee doctors from a tertiary medical hospital in India—a qualitative study.** *Indian J Psychol Med.* 2024. doi:10.1177/02537176241281904.
- [33] Parshuram CS, Amaral AC, Ferguson ND, et al. **Patient safety, resident well-being and continuity of care with different resident duty schedules in the intensive care unit: a randomized trial.** *CMAJ.* 2015; 187(5):321-329. doi:10.1503/cmaj.140752.
- [34] Dapuelto JJ, Nozar F, Artucio S, et al. **Effectiveness of an organizational intervention aimed to reduce burnout and emotional distress, and improve quality of life of an Obstetrics-Gynecology team.** *J Healthc Qual Res.* 2026; 41(3):101156. doi:10.1016/j.jhqr.2025.101156.
- [35] Hogan TH, O'Rourke BP, Weeks E, et al. **Top-level leaders and implementation strategies to support organizational diversity, equity, inclusion, and belonging interventions: a qualitative study of top-level DEIB leaders in healthcare organizations.** *Implement Sci.* 2023; 18(1):59. doi:10.1186/s13012-023-01319-7.
- [36] Lapen K, Chino F, Noble A, et al. **Key strategies to promote professional wellness and reduce burnout in oncology clinicians.** *JCO Oncol Pract.* 2025; 21(7):936-941. doi:10.1200/OP.24.00199.
- [37] Pellecchia M, Mandell DS, Tomczuk L, et al. **A mixed-methods evaluation of organization and individual factors influencing provider intentions to use caregiver coaching in community-based early intervention.** *Implement Sci Commun.* 2024; 5(1):17. doi:10.1186/s43058-024-00552-5.
- [38] Jakobsen MD, Clausen T, Andersen LL, et al. **Can a participatory organizational intervention improve social capital and organizational readiness to change? Cluster randomized controlled trial at five Danish hospitals.** *J Adv Nurs.* 2020; 76(10):2685-2695. doi:10.1111/jan.14441.
- [39] Şimşekli D, Öztürk K, Karahan TF, et al. **Factors affecting organizational commitment among nurses: a cross-sectional study on job satisfaction, life satisfaction, and demographic characteristics.** *BMC Nurs.* 2025; 24(1):1338. doi:10.1186/s12912-025-03930-z.
- [40] Giezek M, Szpakow A, Mintus B, et al. **Risk factors for harmful alcohol consumption among employees and intervention strategies used in the workplace: current state of knowledge based on a literature review.** *Front Public Health.* 2025; 13:1685325. doi:10.3389/fpubh.2025.1685325.
- [41] Hagger MS, Hamilton K, et al. **Optimizing behavior change through integration of individual- and system-level intervention approaches.** *Behav Brain Sci.* 2023; 46:e157. doi:10.1017/S0140525X23001012.
- [42] Jiménez-García S, Flor-Martínez A, et al. **Interventions for preventing or reducing nurse burnout: a systematic review and meta-analysis.** *Int J Nurs Stud.* 2026; 178:105391. doi:10.1016/j.ijnurstu.2026.105391.
- [43] Shaniuk PM, et al. **The spiritual works of mercy as a tool to prevent burnout in medical trainees.** *Linacre Q.* 2020; 87(4):399-406. doi:10.1177/0024363920920400.
- [44] Zhu W, Gan R, Liu D, et al. **Which is more influential in university teachers: work interfering with family or family interfering with work? A network analysis.** *Behav Sci (Basel).* 2026; 16(3):322. doi:10.3390/bs16030322.