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Burnout Across Healthcare and Education: Evidence, Interventions, and a Multilevel Framework

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Abstract

Currently, occupational and academic burnout is impacting the daily operations of many hospitals and schools. For example, burnout affects staff retention, patient safety, and student learning quality. Similar effects are observed among students in radiology, dentistry, pharmacy, anesthesiology, and surgery. However, research findings on burnout remain scattered across different disciplines.

This review summarizes recent research on the prevalence, driving factors, and coping strategies of occupational burnout.Particular attention is given to healthcare systems in low- and middle-income regions and in Asia, where evidence remains limited.

Studies published between 2020 and 2025 were examined. The sample covered healthcare workers and students at different stages of training. Findings were grouped into four areas: how burnout is measured, what conditions contribute to it, which personal and social resources offer protection, and which organisational or system-level actions appear useful.

High burnout levels were reported among radiologists and dentists. In some studies, over 80% of radiologists met criteria on at least one burnout dimension. Dentists often showed severe emotional exhaustion and low professional fulfilment. Community and academic pharmacists also reported heavy strain. Academic radiologists carried greater workload and higher burnout than private practitioners. Among adolescents, roughly one in ten met criteria for academic burnout. For left behind children, neglect, insecurity, and low self-esteem were closely tied to these outcomes. Protective resources including social support, self-compassion, perseverance, and resilience were linked to more favorable outcomes, although their development and availability varied widely across contexts.

The evidence indicates that burnout emerges from interacting influences operating at individual, organizational, and societal levels. Current intervention models remain limited in scope, particularly within Chinese medical and educational institutions. A multilevel approach that spans early education and professional development is therefore required to inform future research and practice.

Keywords: burnout; healthcare workers; medical students; multi-level intervention

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1. Introduction

Healthcare workers are prone to burnout. Numerous studies reflect that clinicians in many hospitals are experiencing chronic fatigue, leading to declining job satisfaction and fulfillment. These problems are particularly pronounced in radiology, dentistry, pharmacy, anesthesiology, surgery, and nursing departments. Burnout is no longer simply considered a temporary emotional reaction among healthcare workers; rather, it reflects problems within the current operational model of the healthcare sector. Consequently, many healthcare institutions are facing problems such as staff turnover, employee dissatisfaction, and difficulty retaining experienced professionals.

Digital technology has added a new layer of stress. Electronic health records, messaging platforms, and algorithm-driven systems now dominate daily routines. Since 2023, multiple studies have reported growing administrative workload, higher frustration, lower work efficiency, and stronger intentions among physicians to leave clinical practice(Ripp et al., 2025).At the same time, views on artificial intelligence remain divided. Some clinicians hope AI will reduce repetitive work. Others worry about data security (Abdulazeem et al., 2025). When new tools are introduced without redesigning workflow, the burden often increases rather than decreases.

Burnout also emerges early in professional training. Many students in health-related fields struggle with intense competition, financial pressure, and uncertain career prospects. Research from 2023 to 2025 shows high rates of academic burnout among adolescents and university students. Among left-behind children in China, emotional and physical neglect strongly predict both depression and academic burnout, partly through feelings of insecurity and low self-esteem(Xu et al., 2025). These early experiences have a significant impact on their later academic and career performance.

Personal resources matter, but they are not enough on their own. Traits such as perseverance and resilience are linked to better mental health among paramedical students(Gogets et al., 2023). Graduate-level nurse practitioners report especially heavy strain. Financial stress, role conflict, imposter feelings, and limited institutional support intensify this pressure and contribute to academic burnout(Cheatham et al., 2025). Focusing only on individual coping fails to address the broader conditions in which burnout develops.

In recent years, several organisational responses have been tested. These include scribe programmes, coaching for surgeons, and flexible scheduling in anesthesiology and perioperative care. Some institutions report short-term improvement. Others see limited effect. Long-term outcomes remain uncertain. What is increasingly clear is that burnout grows from the interaction of policy conditions, organisational demands, work relationships, and personal resources. Much of the existing research remains fragmented, heavily centred on high-income regions, and based on cross-sectional designs. Few studies follow individuals from education into clinical practice, and evidence from rapidly developing healthcare systems, including China, remains scarce. A more integrated and practical approach is needed.

2. Burnout in Contemporary Healthcare and Medical Education

Burnout is reported across many healthcare disciplines and training stages. In radiology, a recent meta-analysis based on the Maslach Burnout Inventory (MBI) found that **about 82.9%** of radiologists and trainees screened positive on at least one MBI dimension, with emotional exhaustion and depersonalisation standing out (Hassankhani et al., 2024).

Pharmacy settings also show persistent strain. A narrative review described high burnout, fatigue, and reduced quality of life among U.S. community pharmacists, with workload and performance metrics repeatedly identified as key contributors (Wash et al., 2024). In a U.S. Veterans Health Administration sample, 86% of pharmacist academic detailers reported moderate-to-severe burnout on the Oldenburg Burnout Inventory, and over one quarter screened positive on validated measures (Bounthavong et al., 2024).

Work context matters, not only profession. In South Korea, academic radiologists reported heavier workload, more teaching and administrative duties, lower satisfaction, and higher burnout than private practitioners(Koo & Do, 2024). A similar “academic penalty” is increasingly discussed in other settings where clinical productivity expectations rise while protected time for teaching and research shrinks.

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In medical education, burnout appears early and can persist. In Mexican public high schools, nearly 10% of students met criteria for academic burnout, with higher risk among female students(Puig-Lagunes et al., 2025). In China, childhood neglect among left-behind adolescents predicted both depression and academic burnout through insecurity and low self-esteem (Xu et al., 2025).

Measurement note

Across clinical and educational studies, burnout is most commonly assessed using the MBI and its variants (Hassankhani et al., 2024). The Oldenburg Burnout Inventory is frequently used in pharmacy and workforce studies(Bounthavong et al., 2024). Academic burnout in adolescents and students is often measured with the MBI-SS, though cut-off criteria differ across studies. These measurement differences partly explain why prevalence ranges can look inconsistent across countries and disciplines.

To provide an overview of the existing evidence, the main characteristics and findings of selected studies are summarized in Table 1.

Table 1. Key studies on occupational burnout and academic burnout across healthcare and educational settings

Population/setting	Country/region	Sample size	Measurement tool(s)	Main findings
Radiologists & trainees (22 studies)	Multiple	-	MBI	82.9% positive on ≥1 MBI dimension; high emotional exhaustion and depersonalisation
Dentists (systematic review & meta-analysis)	Multiple	–	MBI	Overall burnout ≈13%; substantial emotional exhaustion and low personal accomplishment
Community pharmacists	US and others	–	Various	High burnout, fatigue, and poor QOL even pre-COVID-19; workload and metrics implicated
Pharmacist-academic detailers (VHA)	USA	50	OLBI, single-item	86% moderate–high burnout on OLBI; 28% positive on single-item burnout screener
Academic vs private radiologists	Korea	642	Self-report scales	Academic radiologists: higher workload, lower satisfaction, higher burnout
High school students	Mexico	2,190	MBI-SS	Academic burnout prevalence 9.73%; female gender associated with higher risk
Left-behind senior high school students	China (Anhui)	1,597	CTQ, security, self-esteem, depression, burnout scales	Childhood neglect predicts depression and academic burnout via insecurity and low self-esteem
Allied health profession students	USA (north-eastern)	201	Grit-S, WHO-5	Higher grit associated with higher well-being; no significant gender differences

3. How Burnout Develops: Interacting Work, Life, and Institutional Pressures

The studies reviewed in this paper point to a common pattern: burnout rarely follows a single cause. It develops when high demands accumulate and when recovery, support, or control over work/learning is

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limited. In practice, pressures at the policy, organisational, interpersonal, and individual levels reinforce each other.

3.1 Workload, staffing, and scheduling pressure

Workload remains a consistent driver. In radiology and perioperative services, volume growth and staffing constraints increase on-call burden and reduce recovery time. In academic anesthesiology, long and unpredictable shifts create sustained strain and can magnify inequities for clinicians with caregiving responsibilities (Guillow et al., 2025).

Pharmacy work shows a parallel dynamic. Factors such as a large number of patients, high pressure from performance targets, and fixed work processes can all lead to chronic stress, gradually reducing the job satisfaction of medical staff.(Wash et al., 2024).

For healthcare workers, workloads are often multi-layered. Clinical tasks coexist with teaching, research, and administrative responsibilities, while their income may not increase significantly. All of these factors exacerbate their stress, reduce their sense of professional fairness, and may thus accelerate their apathy and lack of motivation(Koo & Do, 2024).

3.2 Digital Systems and Hidden Workload

For many clinicians, digital documentation is an integral part of their work. In urban academic healthcare systems, the burden of writing electronic medical records (EMRs) and other written materials is a contributing factor to burnout among healthcare workers and can even influence career choices (Ripp et al., 2025).

Research on digital transformation frequently explores the use of digital functional tools. While clinicians may be willing to use AI tools, they have concerns about data security, applicability, accountability, and multi-platform integration. New cognitive demands simultaneously present numerous challenges(Abdulazeem et al., 2025). Introducing new tools without redesigning workflows can actually increase, rather than alleviate, staff stress due to additional training requirements and oversight of their effectiveness.

3.3 Academic overload and role conflict in professional training

Burnout in education often looks like overload plus identity strain. Graduate-level nurse practitioners, for example, experience pressure from coursework, clinical duties, family roles, and financial stress(Cheatham et al., 2025).

Among allied health students, perseverance and well-being are linked, but these individual resources do not remove structural academic load or reduce competing demands(Gogets et al., 2023). In other words, the same coping resource can help a student persist, while the system still produces chronic strain.

3.4 Early adversity, insecurity, and self-esteem pathways

For adolescents, early life context matters. In left-behind children in China, childhood neglect predicted depression and academic burnout through feelings of insecurity and reduced self-esteem(Xu et al., 2025).

Related work on neglect and self-compassion also supports a pathway in which early adverse experiences shape later emotional functioning and vulnerability to stress-related outcomes (Dai et al., 2024). These findings matter for medical education because they suggest that burnout risk may be “carried forward” into later training, especially when academic environments remain highly competitive.

3.5 Organisational culture and equity constraints

Finally, organisational culture can convert high demands into chronic burnout. When staffing is tight, evaluation is perceived as unfair, or advancement pathways are opaque, exhaustion becomes harder to recover from. Equity issues can further deepen this risk. In perioperative medicine, gender, racial, and socioeconomic disparities remain widely discussed, with disadvantaged groups reporting fewer leadership opportunities and greater exposure to unfair expectations and workload imbalance (Forkin et al., 2025). These situations not only increase employee stress, but also reduce employees' sense of belonging to the company and their sense of control over their work, which are core protective factors in many burnout models.

4. Why Individual Coping Is Not Enough

Although a large body of literature tends to attribute burnout primarily to individual characteristics, such as poor emotional regulation or insufficient psychological resilience, this perspective has increasingly shown its

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limitations. Consequently, both medical education and clinical training programs have emphasized interventions such as resilience cultivation, self-compassion training, and self-regulation skills. While these approaches may temporarily stabilize emotional states and enhance short-term well-being(Cheatham et al., 2025), the findings of the present review suggest that they are far from sufficient as long-term solutions to burnout.

A notable weakness of existing intervention research lies in its fragmented focus. Many studies examine organizational variables, such as workflow design and administrative workload or concentrate on individual coping strategies, including emotional management and resilience training(Gogets et al., 2023). However, genuinely comprehensive intervention frameworks that integrate personal, organizational, and systemic dimensions remain scarce(Unadkat et al., 2025).

This imbalance is particularly evident among graduate students and early-career clinicians. At this stage, individuals are commonly confronted with intense academic demands, financial strain, and conflicting role expectations, yet often experience limited social support(Cheatham et al., 2025). When institutional structures and working conditions remain unchanged, reliance on individual coping alone may inadvertently shift responsibility onto those already under pressure, thereby intensifying frustration, emotional exhaustion, and ultimately burnout.

The situation is further complicated in rapidly transforming healthcare systems such as that of China. The expansion of clinical services has been accompanied by growing expectations for scientific productivity and academic performance. Under such conditions, burnout should no longer be framed merely as an individual psychological issue, but rather as a multidimensional phenomenon shaped by educational systems, workplace environments, and broader policy contexts(Xu et al., 2025).

From this perspective, improvements in scheduling systems, evaluation standards, workload distribution, and promotion mechanisms may substantially reduce burnout risk. Such structural adjustments do not eliminate the value of individual resilience; instead, they create the necessary conditions under which personal coping resources can function effectively and sustainably.

Therefore, future interventions must move beyond single factors and emphasize coordinated action between organizational reform and individual support. Flexible training pathways and equitable performance evaluations should be combined with self-care, professional identity, and psychological resources(Gogets et al., 2023; Unadkat et al., 2025).Only through this comprehensive approach can we hope to address the growing problem of burnout in modern healthcare systems and medical education.

5. What Has Been Tried: Institutional and System Responses

5.1 Documentation support and scribe programmes

A growing body of work treats documentation burden as a modifiable contributor to clinician strain. Recent implementation work on virtual scribe solutions suggests that virtual scribes may reduce documentation burden for some clinicians, while also highlighting practical concerns such as training quality and workflow fit(Hudelson C et al., 2024).

Quality improvement evaluations of scribe programmes have similarly examined effects on burnout and documentation burden, indicating potential benefit in specific primary care contexts(Abbondanza & White, 2024).

More recent evidence on ambient scribe technology (a form of automated documentation support) links use of the tool with improved clinician efficiency and reduced perceived mental burden of documentation in outpatient settings(Duggan et al., 2025).

That said, the available studies vary in setting, implementation maturity, and outcome definition. As a result, generalisability across institutions and specialties should be treated cautiously.

5.2 Coaching-based approaches

Coaching interventions have been evaluated as a strategy to address clinician burnout and well-being. A randomized clinical trial in *JAMA Network Open* reported that individualized coaching by professionally trained peers was associated with improvements in burnout and well-being outcomes(Kiser et al., 2024).

Evidence specific to surgeons also includes a randomized controlled trial published in *Annals of Surgery*, reporting improvements in surgeon well-being and reductions in burnout-related measures over the intervention period, although effects may attenuate over time(Dyrbye LN et al., 2023).

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Overall, these studies support coaching as a promising option, but they do not imply that coaching alone can compensate for sustained structural pressures such as staffing shortages, scheduling inequity, or high administrative load.

5.3 Flexible scheduling and staffing models

In academic anesthesiology, flexible scheduling is frequently discussed as one approach to improve inclusivity and engagement and potentially reduce burnout risk. A 2025 review in *Anesthesiology Clinics* frames flexible work arrangements as including flexibility in hours, total workload, and career trajectory, and argues that such arrangements can support equity and sustainability in academic settings(Guillow et al., 2025).

However, much of the literature in this area is descriptive or conceptual, and outcomes can depend heavily on local staffing, case mix, and institutional constraints. Where possible, claims about effect size or universality should be avoided unless supported by specific controlled evaluations.

5.4 Digital health technologies and AI-supported tools

The relationship between AI and clinician burnout is still emerging. A 2025 systematic review focused on AI and EHR-associated burnout summarizes a developing evidence base and treats the topic as promising but underexplored, especially in relation to documentation and cognitive burden(Sarraf & Ghasempour, 2025).

In addition, a 2025 scoping review synthesizes existing studies examining AI use and physician burnout, reporting that some studies suggest improved workflow efficiency and reduced administrative burden; nonetheless, the review also reflects heterogeneity in study designs and outcomes(Ko et al., 2025).

Given this mixed and still-maturing evidence base, it is more defensible to state that AI may help in specific workflow segments while also creating new challenges around training, accountability, and integration, rather than claiming consistent burnout reduction across settings.

The major characteristics of these organisational and system-level interventions are summarised in Table 2.

Table 2. Organisational and system-level interventions addressing burnout

Intervention type	Target population/context	Core elements	Reported effects/limitations
Virtual scribe programme	Primary care physicians & NPs	Asynchronous remote documentation support	Reduced documentation burden, improved work–life balance; cost and scalability concerns
Nontechnical coaching (NC)	Academic surgeons	1:1 / group coaching on communication, leadership, stress regulation	Self-reported reductions in burnout, improved decision-making, and team dynamics; small, biased samples, limited quantitative data
Flexible scheduling models	Academic anaesthesiologists	Shorter shifts, protected recovery time, part-time, and flexible career paths	Conceptually reduces fatigue and improves retention, especially for women; limited empirical evaluations
AI-enabled digital health	Primary care physicians	Clinical decision support, automation of routine tasks	Potential efficiency gains; concerns about knowledge gaps, trust, and new cognitive burdens; impact on burnout unknown

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6. A Multilevel Framework for Understanding Burnout

Taken together, the intervention literature indicates that burnout does not arise from isolated causes, nor can it be addressed through a single type of response. Documentation support tools may reduce clerical burden in specific settings, such as virtual and ambient scribe implementations(Hudelson C et al., 2024).

Coaching interventions are associated with improvements in clinician well-being over the periods examined in randomized evaluations(Kiser et al., 2024).

Flexible scheduling is repeatedly proposed as a structural response in high-intensity specialties, particularly with respect to equity and sustainability in academic practice(Guillow et al., 2025).

AI-related approaches are also increasingly discussed as potential contributors to efficiency and workload reduction, although existing evidence remains heterogeneous and implementation challenges are substantial(Sarraf & Ghasempour, 2025).

While these interventions target different aspects of the work environment, the diversity of approaches reflects a deeper structural reality: burnout develops through the interaction of multiple levels of influence. On this basis, a multilevel conceptual framework is proposed as an organising lens for future research and intervention (Figure 1). Rather than treating burnout as a purely individual or organisational problem, the framework integrates influences operating at the policy, organisational, interpersonal, and individual levels, and situates burnout outcomes within this broader system of interacting conditions.

At the macro level, health and education policies, funding mechanisms, labour supply, and broader socioeconomic conditions shape baseline vulnerability to burnout. In the Chinese context, for example, population-level challenges such as the phenomenon of left-behind children may indirectly affect both educational trajectories and later professional well-being.

At the organisational level, institutional arrangements—including staffing ratios, workload distribution, scheduling systems, documentation practices, performance indicators, promotion mechanisms, and organisational culture—structure the chronic demands of daily work and learning.

At the interpersonal level, team functioning, quality of supervision, workplace civility or bullying, school climate, family support, and peer networks influence how individuals experience and manage stress within these organisational conditions.

At the individual level, early life experiences, personality traits, resilience, self-care practices, self-esteem, perseverance, growth mindset, and coping strategies operate as both vulnerability and buffering factors.

These interacting levels ultimately shape core outcomes of occupational and academic burnout, including emotional exhaustion, cynicism, and reduced efficacy, which are further associated with depression, suicidal ideation, staff turnover, academic withdrawal, and risks to patient safety.

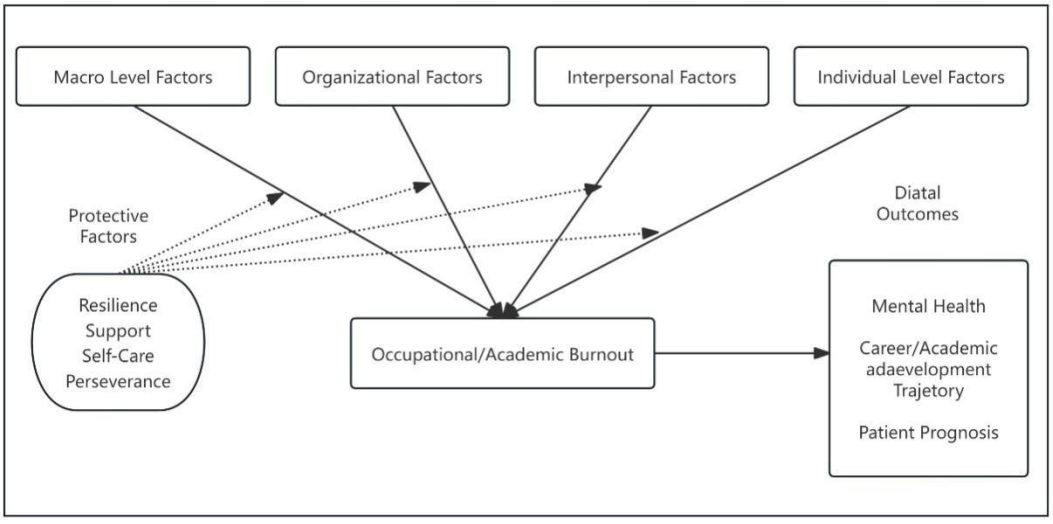

Figure 1 Multi-Level Conceptual Model of Burnout

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7. Implications for Chinese Medical Education and Healthcare Systems

For rapidly developing health systems, the studies reviewed point to two practical considerations.

First, interventions that target documentation burden and workflow design have direct relevance where EHR-related administrative load is salient, and implementation evidence from virtual/ambient scribe tools offers transferable operational lessons (e.g., the need for iterative selection and workflow fit)(Hudelson C et al., 2024).

Second, approaches such as coaching have randomized evidence for improving clinician well-being outcomes, which may inform faculty development and support programmes, while still requiring adaptation to local organisational realities(Kiser et al., 2024).

At the same time, direct evidence from China-specific large-scale intervention studies remains comparatively limited in the sources above, so it is safer to frame China implications as "areas for development and evaluation" rather than definitive prescriptions.

8. Limitations, Gaps, and Directions for Future Research

Although some measures are effective in addressing job burnout, there are still some gaps in the existing literature on intervention measures, and the existing evidence for different measures varies in strength. Literature-focused studies often rely on implementation reporting and quality improvement designs, which provide valuable insights into feasibility and clinical practice but limit causal inference(Hudelson C et al., 2024). Evidence from randomized controlled trials suggests that counseling-based interventions can produce meaningful benefits within certain clinical and educational contexts. Nevertheless, once these approaches are extended beyond their original settings, important practical concerns, such as their real-world applicability, financial cost, and the persistence of their effects remain insufficiently addressed(Kiser et al., 2024). A similar limitation is observed in studies examining flexible scheduling and staffing reforms. Much of the existing evidence is derived from conceptual models or observational findings, while rigorous experimental testing within healthcare systems is often constrained by ethical, logistical, and operational barriers. As a result, the generalizability of these reforms remains difficult to establish with confidence(Guillow et al., 2025).More recently, the application of artificial intelligence as a potential tool for reducing burnout has attracted increasing attention. Although this field offers innovative and promising possibilities, current research is still in an early stage, facing notable challenges related to study design, outcome measurement, and the complexity of implementation in real clinical environments(Sarraf & Ghasempour, 2025).

These findings highlight the need for future research to move beyond isolated interventions and adopt more coherent methodological frameworks. Greater consistency in research design, standardized outcome measures, and careful consideration of feasibility are essential. Moreover, large-scale trials, particularly randomized controlled studies conducted across diverse healthcare systems and practice environments, are critical for establishing the reliability and long-term effectiveness of burnout intervention models.

9. Conclusion

An integrated reading of the available evidence suggests that burnout in healthcare and medical education is unlikely to be effectively managed through any single intervention strategy. Rather than relying on isolated solutions, future efforts should be guided by a multi-layered framework that acknowledges the complexity of burnout as a systemic phenomenon.

Such a perspective recognizes that burnout emerges from the dynamic interaction of multiple levels of influence, including the broader policy environment, institutional and organizational arrangements, day-to-day working conditions, and individual psychological resources. These elements do not operate independently; instead, they continuously shape and reinforce one another in ways that either exacerbate or alleviate burnout among students and healthcare professionals.

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