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Burnout among medical students and young doctors in Poland: risk factors and preventive strategies: a review of current literature

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Abstract

Background: Burnout among medical students and young doctors is an increasing occupational concern. Defined in ICD-11 as a syndrome resulting from chronic, unsuccessfully managed workplace stress, it is particularly relevant in healthcare systems facing staff shortages, heavy workloads, and organizational instability. These pressures are also visible in Poland.

Objective: To synthesize current evidence (2020–2025) regarding prevalence, risk factors, consequences, and preventive strategies related to burnout among medical students and early-career physicians, with attention to the Polish context.

Methods: A narrative review of peer-reviewed literature published between 2020 and 2025 was conducted using PubMed/MEDLINE, Scopus, and Web of Science. Included studies comprised original research, systematic reviews, meta-analyses, and randomized trials examining burnout

in medical students, residents, and junior doctors. Findings were analyzed qualitatively, prioritizing higher-level evidence for intervention assessment.

Results: Organizational factors-high workload, long hours, staffing deficits, administrative burden, and hierarchical culture-emerge as primary drivers of burnout. Psychological traits such as maladaptive perfectionism and empathic distress increase vulnerability but are secondary to structural determinants. Burnout is strongly associated with depression, anxiety, substance use, and elevated risk of medical errors and reduced patient safety. Polish data indicate substantial distress and burnout, particularly during the COVID-19 period. Individual interventions, including mindfulness-based programs, show modest effects, whereas mentoring, coaching, and organizational reforms targeting workload and leadership demonstrate stronger impact.

Conclusions: Burnout in Polish medical trainees is predominantly system-driven. Sustainable reduction requires structural and organizational change alongside supportive individual-level strategies.

Key words: burnout, medical students, junior doctors, Poland, organizational risk factors, mental health, preventive interventions

1. Introduction

Burnout among medical students and young doctors is best framed by combining the ICD-11 syndrome definition (QD85) with the dimensional model of the Maslach Burnout Inventory (MBI). The ICD-11 classifies burnout as an occupational phenomenon, rather than an individual weakness or a general mental disorder, resulting specifically from chronic workplace stress that has not been successfully managed [1, 2]. This syndrome is characterized by three core features: feelings of energy depletion or exhaustion, manifesting as persistent physical and emotional fatigue; increased mental distance from one's job, or feelings of negativism and cynicism related to one's work, often characterized by detachment and a "why should I care?" attitude; and reduced professional efficacy, involving feelings of being ineffective, unproductive, or inadequate in one's role [1, 2]. In the specific population of medical trainees and junior physicians, the "workplace" encompasses both clinical duties and highly structured training environments where chronic stress stems from heavy workloads, evaluation pressure, limited control, and often inadequate institutional support [1]. Because burned-out students frequently carry this state into residency and early practice, early identification is critical, as students in this state often become burned-out physicians [1, 3]. To assess this, the MBI serves as the most widely used instrument, conceptualizing burnout as a three-dimensional syndrome consisting

of measurable subscales [1–6]. The first dimension, emotional exhaustion (EE), involves persistent physical and emotional fatigue driven by long hours, exam stress, night shifts, and high patient loads [1, 6, 7]. The interpersonal dimension, depersonalization (DP), is marked by the development of cynicism, detachment, or dehumanizing attitudes, which may appear as treating patients as "cases," irritability toward peers, or disengagement from learning [4, 6]. Finally, reduced personal accomplishment (PA) reflects a pervasive sense of inefficacy and lack of achievement, characterized by chronic self-doubt and feeling incompetent despite objective progress [4–6]. In many medical studies, burnout is operationalized as high EE and/or high DP, often with low PA as an additional marker, while student-specific versions like the MBI - Student Survey adapt wording to academic tasks and serve as brief screening tools for severe distress [1–4, 6]. Synthesizing these models, burnout in this population is defined as a work-related syndrome arising from chronic, inadequately managed stress in medical training and early practice, characterized by persistent emotional exhaustion, cynicism or detachment from patients, studies, or work, and a subjective decline in academic or professional efficacy [1–6]. This integrated perspective emphasizes that the context is structural and occupational-linked to the organization of training, workload, and support - rather than merely a matter of individual resilience [1, 4, 5]. Furthermore, the syndrome often begins in medical school and continues into junior doctorhood, linking student and early-career burnout as a single developmental continuum [1, 3]. In the specific context of the Polish healthcare system (2020-2026), systemic pressures significantly shape the experiences of these groups. Young Polish physicians describe chronic workforce shortages and specialization bottlenecks, including limited residency slots in preferred specialties and high workloads, which drive a strong desire for better working conditions, work-life balance, and flexible hours [8]. Moreover, migration intentions among final-year students and junior doctors are strongly associated with dissatisfaction regarding healthcare system organization, the socio-political climate-including hostility toward doctors-and concerns about career pathways, factors that carry more weight than salary alone [9]. While the COVID-19 response was a factor, it was perceived as an additional rather than a primary push factor [9]. These local conditions map directly onto known burnout antecedents: an imbalance between job demands and available resources, organizational dysfunction, and a lack of support, all of which drive high rates of exhaustion, depersonalization, and reduced accomplishment in healthcare professionals [2, 4–6, 10].

2. Materials and Methods

This study was conducted as a narrative literature review synthesizing current evidence on burnout among medical students and young doctors, with particular focus on risk factors, consequences, and preventive strategies relevant to the Polish context. The review was based on peer-reviewed articles published between 2020 and 2025, corresponding to the temporal range of the included references. A structured search was performed in PubMed/MEDLINE, Scopus, and Web of Science using combinations of the following terms: “burnout”, “medical students”, “junior doctors”, “resident physicians”, “Poland”, “risk factors”, “mental health”, “patient safety”, “mindfulness”, “mentoring”, and “organizational interventions”. Boolean operators (AND/OR) were applied to refine results. Reference lists of eligible articles were additionally screened to identify further relevant publications. Eligible studies included original quantitative or qualitative research, systematic reviews, meta-analyses, and randomized controlled trials examining burnout in medical students, residents, junior doctors, or comparable healthcare professionals. Studies addressing organizational determinants,

psychological correlates, mental health outcomes, patient-care consequences, or preventive interventions were included. Articles not focused on healthcare populations or lacking empirical data were excluded. Data from included studies were analyzed descriptively. Particular attention was paid to research including Polish samples; when such data were limited, multinational studies incorporating Poland or structurally comparable healthcare systems were considered. Given heterogeneity in study designs and outcome measures, findings were synthesized qualitatively rather than through meta-analytic pooling. Systematic reviews and randomized trials were prioritized when evaluating preventive interventions.

3.Risk Factors

3.1 Organizational Risk Factors

Evidence does not directly study Polish junior doctors exclusively, but multicountry and UK/Polish-inclusive research highlights several organizational drivers highly relevant to the Polish context. Research suggests a focus on organizational climate-including safety culture, support, staffing, and autonomy-rather than country-specific factors alone. Collectively, organizational determinants consistently emerge as the strongest predictors of burnout across healthcare settings (Table 1).

3.1.1 Work Hours and Workload

High work demands, including long or intense hours, heavy patient loads, and inadequate staffing, nearly tripled the odds of burnout and stress among trainee physicians (OR ≈ 2.8)[11]. Long shifts (≥8 hours) were independently associated with higher burnout scores among hospital staff [12]. In a multinational study including Poland, patient-facing doctor roles and a higher number of days worked significantly predicted burnout [13]. During the COVID-19 pandemic, working "long hours," high patient volumes, and being stationed in highly loaded hospitals or COVID wards further increased physician burnout risk [14, 15]. For Polish junior doctors, chronic overtime, frequent night shifts, and structural understaffing remain core risks.

3.1.2 Bureaucracy and Administrative Burden

While research often avoids the explicit term "bureaucracy," several organizational factors map directly onto bureaucratic overload. A poor work environment-characterized by excessive non-clinical tasks, inefficient processes, and inadequate resources-doubled the odds of burnout/stress in trainees [11]. In a large US hospital survey, clinicians strongly preferred management interventions to improve care delivery and staffing over individual wellness programs, highlighting system-level constraints like poor workflow design [16]. Global healthcare professional (HCP) surveys also found burnout associated with feeling pushed beyond training, high time pressure, and limited organizational support [17]. In Poland, high

documentation demands, rigid procedures, and a lack of support staff contribute significantly to perceived inefficiency and workload.

3.1.3 Hierarchy, Supervision, and Culture

Hierarchical culture and poor support are primary amplifiers of burnout. Qualitative work in the UK identified toxic work cultures (including bullying, blaming, shaming, sexism, and racism), a lack of support, and the stigma surrounding seeking help as key sources of distress [18]. Residents often function as first-line providers with high responsibility but low decisional autonomy. This imbalance, combined with role ambiguity, negative attitudes from superiors, and the requirement to "take orders" from supervisors, increases burnout risk [14]. Conversely, respectful and civil interactions, collegiality, and the confidence to address unprofessionalism without reprisal were strongly associated with higher professional fulfillment and lower burnout [19]. For junior doctors in Poland, steep hierarchies, limited voice in decisions, and punitive or dismissive supervisory styles are plausible evidence-based risks.

3.1.4 Evidence Specific to Poland

A multinational study including the UK, Poland, and Singapore found a high overall burnout rate, with 67% of participants screening positive. While Poland showed a nonsignificant trend toward higher burnout compared to the UK after adjustment, factors such as job role, redeployment, and poor safety attitudes were stronger predictors of burnout than nationality [13].

Table 1. Organizational risk factors associated with burnout

Factor	**Key findings**	**Supporting studies**
High workload and long hours	Nearly 3× higher odds of burnout/stress in trainees (OR≈2.8)	Zhou et al., 2020 [11]; Denning et al., 2021 [13]
Understaffing and poor work environment	Strong association with burnout and turnover	Aiken et al., 2023 [16]; Aiken et al., 2024 [20]

Administrative burden	Poor workflow and non-clinical overload linked to higher burnout	Aiken et al., 2023 [16]; Meredith et al., 2022 [21]
Toxic hierarchy or poor supervision	Bullying, stigma, low autonomy increase distress	Riley et al., 2021 [18]; Burns et al., 2021 [19]
Pandemic redeployment & COVID wards	Increased burnout risk during pandemic surge	Lasalvia et al., 2021 [14]; Alrawashdeh et al., 2021 [15]

3.2 Psychological

Currently, no studies directly link perfectionism, empathy fatigue, and burnout specifically in Eastern European medical students, though related work in other regions allows for cautious inference. Psychological traits appear to function primarily as vulnerability modifiers rather than primary causes of burnout (Table 2).

3.2.1 Burnout and Empathy in Medical Students

Large national studies demonstrate high burnout rates, ranging from approximately 37% to 50%, with substantial emotional exhaustion and depersonalization among medical trainees [1, 22, 23]. Empathy, usually measured as a trait, sometimes coexists with high exhaustion but tends to be negatively associated with depersonalization and cynicism, which are core dimensions of burnout [22, 24–26]. Furthermore, evidence from Thai and US samples suggests that poorer mental health, mistreatment, and negative learning environments are linked to higher burnout and the erosion of empathy over time [24, 25].

3.2.2 Empathy Fatigue / Compassion Fatigue

By analogy, research on nurses and other clinicians shows that empathy and compassion fatigue are deeply intertwined with burnout; both rise with higher distress and poor coping, while

resilience and mindfulness serve as protective factors [27–29]. This supports a model where sustained empathic exposure without adequate coping mechanisms leads to empathy fatigue, which in turn feeds burnout.

3.2.3 Perfectionism and Related Traits

Regarding personality traits, perfectionism is more common and more strongly tied to burnout and distress in medical students than in their non-medical peers [1]. A scoping review on impostor syndrome in medical trainees also finds strong links between perfectionistic traits, stress, anxiety, depression, and burnout [1, 30]. While factors such as neuroticism and perfectionism increase vulnerability, conscientiousness and extraversion are considered somewhat protective [30].

3.2.4 Integrative Picture

The hypothesized integrative pathway suggests a positive relationship between perfectionism and burnout, driven by self-criticism and fear of failure [1, 30]. Similarly, high empathic distress is positively linked to burnout and empathy fatigue, especially when paired with poor coping strategies [27–29]. Conversely, perspective-taking empathy has a negative, protective relationship with depersonalization [24, 25, 27].

Table 2. Psychological correlates and vulnerability modifiers

Factor	Association with burnout	Supporting studies
Maladaptive perfectionism	Positive association with distress and burnout	Cotobal Rodeles et al., 2025 [1]; Chua et al., 2025 [30]
Impostor syndrome	Associated with anxiety, stress, burnout	Chua et al., 2025 [30]
Empathic distress	Linked to burnout and compassion fatigue	Zhou, 2025 [27]; Yeşil & Polat, 2023 [28]
Protective empathy (perspective-taking)	Lower depersonalization	Dyrbye et al., 2021 [25]; Pitanupong et al., 2023 [24]

Low resilience (Polish data)	Higher burnout levels	Forycka et al., 2022 [31]

3.3 Work-Life Strain and Financial Pressures

Work-life strain and financial pressures are key drivers of poor mental health in young medical professionals, although Poland-specific evidence regarding low salaries and debt remains indirect.

3.3.1 Work-Life Imbalance and Workload

Across medical students and physicians internationally, heavy workloads, long hours, and study-life imbalance are consistently linked to higher stress, burnout, depression, and anxiety [32–34]. Academic and workload pressures, online or shift work, and blurred boundaries between work and home reduce well-being and increase distress [31, 32, 35–37]. Specifically, the combination of high workload and poor work-life balance is a primary driver of burnout, depression, anxiety, and suicidal ideation [31–33, 37, 38].

3.3.2 Financial Strain and Economic Insecurity

Financial strain and economic insecurity are also significantly associated with worse mental health outcomes. Among French medical students, having "important" or "very important" financial difficulties nearly doubled the odds of a 12-month major depressive episode [39]. A meta-analysis of medical students during COVID-19 identified economic trouble as a risk factor for depression, anxiety, stress, and suicidal ideation [33]. General UK student data suggest that financial anxieties and the need to work longer hours can indirectly harm mental health by reducing time for social support and leisure [7, 40]. Broadly, financial strain and economic trouble lead to higher depression and anxiety, as well as more suicidal thoughts [7, 33, 39, 40]. The combination of economic pressure plus high workload is identified as a toxic combination for the mental health of young medical professionals [33, 38, 39].

3.3.3 Evidence from Poland

Specific evidence from the Polish context further highlights these critical stressors. Polish medical students during COVID-19 showed low resilience, high burnout, and widespread distress, a burden exacerbated by increased use of alcohol and other stimulants and perceived social mistrust toward doctors [31]. A nationwide Polish study found that healthcare professionals experienced more anxiety, insomnia, and somatic symptoms than other workers, with perceived lack of institutional support and fear for family serving as important predictors [36]. Polish university students more broadly reported stress from worsened material conditions, job insecurity, and educational disruption during the pandemic [7]. Furthermore, institutional insecurity-encompassing concerns over job safety, PPE (Personal Protective Equipment), and lack of support-is a distinct risk factor strongly linked to distress, insomnia, and somatic symptoms among medical professionals [36–38, 41].

4. Consequences

4.1 Patient care

Across global and European data, physician burnout in hospital settings-common in public systems - is consistently linked to higher rates of self-reported medical errors, more adverse events, and worse perceived quality and safety of care. Improving staffing, workloads, and team environments appears central to mitigating both burnout and patient-care risks.

4.1.1 Strength and nature of the association

A large meta-analysis of 170 studies (239,000+ physicians worldwide, many in hospitals) found that physicians with burnout had about twice the odds of being involved in patient safety incidents (OR≈2.0), twice the odds of low professionalism, and over twice the odds of patient dissatisfaction compared with non-burned-out peers [42]. Patient safety incidents included a broad range of errors; depersonalisation (cynicism) showed the strongest adverse association with quality and satisfaction [42]. Separate data on nurses (288,000 from 32 countries, many in Europe) found burnout associated with more nosocomial infections, falls, medication errors, adverse events, and missed care, as well as lower nurse-rated quality and patient satisfaction [43, 44].

4.1.2 Evidence specific to European public hospitals

A cross-sectional survey of 64 acute hospitals in six European countries (all public-sector systems) showed that approximately 25% of physicians had high burnout; hospitals with better work environments and staffing had fewer clinicians reporting high burnout and fewer unfavourable ratings of quality and patient safety [20]. The effect of improving the work environment by 1 IQR was associated with 7.2% fewer physicians with high burnout and 14.2% fewer physicians giving their hospital an unfavourable quality rating [20]. Swiss anaesthesia providers reported both high burnout rates and 65% reporting work-related errors due to high workload or fatigue, highlighting safety risks in European tertiary care [45].

4.1.3 Mechanisms and context

Burnout clusters with poor work-life balance, understaffing, bureaucracy, and inadequate support, which themselves predict both turnover and poorer safety culture [16, 20, 21]. Sleep-related impairment and exhaustion further increase self-reported clinically significant medical errors even after adjusting for burnout [46].

4.2 Mental health

Burnout in young doctors and medical trainees is strongly associated with depression, anxiety and increased substance use [13, 47, 48], but precise Polish prevalence estimates in doctors (vs. students) are limited. The major consequences of burnout for both patient safety and physician mental health are summarized in Table 3.

4.2.1Comorbidities with Burnout

A multinational study (n=3,537 HCWs) including the UK, Poland, and Singapore found that 67% screened positive for burnout, 20% for anxiety, and 11% for depression [13]. In this study, anxiety (OR≈4.9)and depression (OR≈4.1) were identified as strong, independent predictors of burnout, indicating substantial comorbidity [13]. Comparatively, broader data for global medical staff during the COVID-19 era showed prevalence rates of 43.6% for burnout, 37.1% for anxiety, and 37.6% for depression, with substance use change not specified [47]. A narrative review focusing on physicians and medical students notes that burnout can trigger depression, substance abuse, and suicide attempts, and shares common risk factors such as young age, workload, low income, and being single [1].

4.2.2 Polish Medical Students

Using Polish medical students as a proxy for young doctors, a national survey (n=1,858) conducted during COVID-19 revealed that the majority showed high burnout and low resilience [31]. Specifically, 39.1% reported needing psychological or psychiatric consultation; among those with prior diagnoses, 26.4% reported symptom worsening [31]. Furthermore, 28.6% reported increased use of alcohol, cigarettes, or other stimulants during the pandemic [31]. These mental health problems and substance use were strongly associated with worse well-being and burnout scores, with the study ultimately reflecting high levels of burnout, anxiety, and depression in this group [31].

Table 3. Consequences of burnout for patient care and mental health

Domain	**Main findings**	**Supporting studies**
Patient safety incidents	~2× higher odds of errors	Hodkinson et al., 2022 [42]
Poor quality & satisfaction	Strong association with burnout	Hodkinson et al., 2022 [42]; Aiken et al., 2024 [20]

Depression & anxiety	Strong comorbidity (OR≈4–5)	Denning et al., 2021 [13]; Zhu et al., 2023 [47]
Substance use	Increased alcohol/stimulant use (Polish students 28.6%)	Forycka et al., 2022 [31]
Sleep-related errors	Sleep impairment independently predicts errors	Trockel et al., 2020 [46]

5. Preventive Strategies

5.1Individual level

Mindfulness-based interventions (MBIs), including Mindfulness-Based Stress Reduction (MBSR), are generally effective at reducing stress and improving mindfulness or self-compassion in medical students, though effects on depression, anxiety, and burnout remain mixed or limited. While evidence regarding coping strategy training is promising, it is currently less developed.

5.1.1 Overall Effects in Medical Students

A 2023 systematic review and meta-analysis of 31 studies (24 samples) found that MBSR/MBCT-style interventions, typically lasting 4-10 weeks, produced significantly lower stress and distress and higher mindfulness in medical students compared to controls [49]. In the same pooled analyses, effects for depression, anxiety, and overall well-being were smaller or nonsignificant, yet satisfaction and adherence were generally good, and benefits often persisted for months to years in follow-up [49]. Furthermore, an overview of systematic reviews specific to medical students indicated that mindfulness and mental health programmes can improve well-being, although the overall evidence quality was low and effects on anxiety and depression were inconsistent [50].In the wider university and health-professional context, MBIs have demonstrated consistent small-to-moderate reductions in perceived stress and distress [49–51]. Findings for anxiety and depression are more varied, with some meta-analyses showing benefits and others reporting no significant effect [49–51]. Conversely, frequent qualitative and quantitative improvements have been observed in areas of self-compassion, empathy, and coping [49, 51, 52]. Regarding burnout and fatigue, some reductions have been noted, but the evidence remains sparse and inconsistent [49, 50].

5.1.2 Coping Strategy Training and Stress-Management

Coping strategy training and stress management also play a vital role. Integrative reviews in nursing and midwifery students show that MBSR programmes conducted over 7-8 weeks reduce stress and improve sleep, concentration, and negative cognition, often alongside other

coping-focused interventions such as exercise, peer support, spiritual learning, and hardiness training [53]. Among graduate students, MBSR-type packages consisting of education, guided practice, and homework have been shown to consistently reduce perceived stress [54]. Finally, broader reviews of university interventions indicate that skill-oriented programmes with supervised practice-including CBT, mindfulness, and relaxation-outperform psychoeducation alone in reducing stress, anxiety, and depression, with mindfulness emerging as particularly effective within this group [51].

5.2 Systemic level

Balint groups, mentoring, and organizational change all show potential to reduce resident burnout, but organizational fixes and high-quality coaching/mentoring have the strongest evidence, while Balint-specific data in residents are sparse.

5.2.1 Balint and other reflective groups

Regarding Balint and other reflective groups, most interventional trials in clinicians use mindfulness, reflection, or group-based stress management, which generally yield small-moderate reductions in burnout domains, especially emotional exhaustion, but often without lasting or clinically large effects [55, 56]. Recent meta-analyses conclude that individually focused interventions like mindfulness, reflection, and resilience training help but usually produce modest changes that may not meaningfully shift clinical burnout [55, 56]. Specific, high-quality trials of Balint groups in residents are limited in the retrieved literature, with evidence being indirect via broader mindfulness/reflective programs; overall, these groups likely provide small-moderate benefits despite the limited resident-specific data [55, 56].

5.2.2 Mentoring / Coaching Programs

Mentoring and coaching programs demonstrate RCT-level evidence of reduced emotional exhaustion and better well-being [57–61]. Professional coaching, often delivered in groups, reduces emotional exhaustion and improves self-compassion and impostor syndrome in female residents according to an RCT [58]. Furthermore, a multisite coaching program for interns showed reduced emotional exhaustion and depersonalization in subgroups, with benefits linked to goal setting and reflection [59]. Individual professional coaching in mixed physicians, including trainees, led to approximately 20-30% relative reductions in burnout indices and improved work engagement versus controls [60, 61]. Reviews of surgical residents further highlight structured mentorship and wellness initiatives as consistently associated with lower burnout and better well-being [57].

5.2.3 Organizational and Leadership Changes

Organizational and leadership changes, focusing on workload, staffing, and leadership, represent a top priority for residents and are supported by strong observational and some interventional evidence [16, 55, 62–65]. Residents themselves prioritize systemic changes-including workload, schedule control, EHR burden, protected learning time, and social

connectedness - over individual stress skills [62]. Large hospital surveys show clinicians rate better staffing, workload control, and work environment as more important than wellness classes, as poor environments strongly track burnout and turnover [16]. System-level interventions like workload reduction, job crafting, and peer networks show benefit but remain under-studied compared with individual tools [55, 65]. Additionally, good leadership behavior is strongly associated with lower burnout and less intent to leave [63].

6. Discussion

Burnout among medical students and young doctors in Poland should be interpreted within the conceptual framework established by ICD-11, which classifies burnout as an occupational phenomenon arising from chronic, unsuccessfully managed workplace stress rather than as an individual psychological weakness or psychiatric disorder. This distinction is critical in the Polish context, where structural pressures within medical education and healthcare delivery systems exert sustained strain on trainees. The evidence supports a developmental continuum model in which burnout frequently originates during undergraduate medical education and persists into residency and early independent practice [1, 3]. Emotional exhaustion and depersonalization acquired in the academic environment often remain stable or intensify under the demands of postgraduate training, reinforcing the need to conceptualize student and junior doctor burnout as phases of a single occupational trajectory rather than discrete phenomena. Within Poland's healthcare system, systemic determinants appear particularly salient. Chronic workforce shortages, limited availability of preferred residency positions, and rigid specialization pathways create a bottleneck effect that amplifies stress during the transition from student to trainee physician [8]. Migration intentions among Polish medical graduates are strongly associated with dissatisfaction regarding healthcare organization, socio-political climate, and perceived hostility toward physicians, outweighing purely financial considerations [9]. Such findings underscore that burnout-related dissatisfaction is embedded in institutional trust, career predictability, and professional respect. The COVID-19 pandemic acted as an accelerant rather than a primary driver, intensifying pre-existing organizational vulnerabilities [9, 31, 36]. These contextual stressors align with the broader job demands-resources model, in which high demands combined with inadequate organizational support precipitate exhaustion, cynicism, and reduced professional efficacy [2, 4–6, 10]. Analysis of risk factors reveals a clear hierarchy in which organizational determinants outweigh individual predispositions. High workload, long hours, and staffing deficits nearly triple the odds of burnout and stress among trainees (OR≈2.8) [11], and similar associations are observed in multinational samples including Poland [13]. Administrative inefficiency and excessive non-clinical tasks approximately double burnout risk, reflecting the cumulative impact of bureaucratic overload [11, 16, 17]. Toxic hierarchical cultures-characterized by limited autonomy, bullying, stigma surrounding help-seeking, and poor supervisory support-further amplify risk [14, 18, 19]. Importantly, nationality per se appears less predictive than job role, safety climate, and redeployment pressures [13], reinforcing that structural features rather than cultural identity drive vulnerability. By contrast, psychological traits such as perfectionism, impostor tendencies, and high empathic distress function as vulnerability modifiers rather than primary causes [1, 30]. While perfectionism and neuroticism correlate with burnout and depressive symptoms, protective traits such as conscientiousness and extraversion mitigate risk [30]. Financial strain and economic insecurity also contribute significantly to mental health deterioration. In student populations, substantial financial difficulties nearly double the odds of a major depressive

episode (OR≈2.0)[39], and economic stress is associated with anxiety, depression, and suicidal ideation in broader meta-analytic data [33, 39]. However, these individual and socioeconomic variables operate within, and are often intensified by, the structural environment of excessive workload and limited institutional support. Thus, while psychological resilience and coping styles influence outcomes, the magnitude and consistency of associations with workload and organizational climate indicate that systemic factors remain dominant drivers. The consequences of burnout extend beyond individual distress and represent a substantial public health concern. A large meta-analysis involving over 239,000 physicians demonstrated that burnout is associated with approximately doubled odds of patient safety incidents (OR≈2.0), as well as higher rates of low professionalism and patient dissatisfaction [42]. European hospital data further indicate that better staffing and improved work environments correlate with lower burnout prevalence and improved quality ratings [20]. These findings are particularly salient for Poland's overstretched public sector, where staffing constraints and high patient volumes are endemic. The association between exhaustion, sleep impairment, and clinically significant medical errors underscores that burnout is not merely a workforce well-being issue but a determinant of healthcare system safety and performance [20, 42, 46]. Preventive strategies must therefore be evaluated within a hierarchy of effectiveness. Individual-level interventions, particularly mindfulness-based stress reduction and related programmes, consistently yield small-to-moderate reductions in perceived stress and improvements in self-compassion and coping [49–51]. However, effects on core burnout dimensions, anxiety, and depression are often modest or inconsistent [49, 50]. Similarly, Balint and reflective groups show potential for reducing emotional exhaustion, yet robust resident-specific evidence remains limited and effect sizes are generally small to moderate [55, 56]. Such interventions may serve as supportive adjuncts but cannot compensate for structurally adverse environments. In contrast, systemic and relational interventions demonstrate comparatively stronger and more durable impact. Randomized controlled trials of professional coaching and structured mentoring programmes report approximately 20-30% relative reductions in burnout indices, particularly emotional exhaustion, alongside improvements in work engagement and self-compassion [58–61]. Organizational reforms targeting workload, schedule control, staffing adequacy, and leadership behavior are consistently prioritized by residents and associated with lower burnout and reduced turnover intention [16, 62–65]. Improvements in work environment quality correlate with measurable reductions in burnout prevalence and enhanced patient safety ratings [20]. Collectively, the literature indicates that while individual resilience-building strategies have value, the most meaningful reductions in burnout among Polish medical students and young doctors will require structural interventions addressing workload, autonomy, leadership culture, and career predictability. Recognizing burnout as an occupational syndrome embedded within a developmental continuum compels a shift from resilience-focused narratives toward systemic reform, aligning physician well-being with patient safety and healthcare sustainability. A comparative overview of preventive strategies and their relative strength of evidence is presented in Table 4.

Table 4. Preventive interventions and strength of evidence

Level	Intervention	Evidence
Individual	Mindfulness-based programs	Kaisti et al., 2024 [49]; Bennett-Weston et al., 2024 [50]
Coaching	RCT evidence; ~20–30% reduction in burnout indices	Fainstad et al., 2022 [58] ; Kiser et al., 2024 [61]
Mentoring	Associated with lower burnout	Shah et al., 2023 [57]
Organizational reform	Strongest and most sustainable impact	Aiken et al., 2023 [16]; Linzer et al., 2025 [65]
Leadership quality	Lower burnout and intent to leave	Mete et al., 2022 [63]

7. Conclusions

Burnout among medical students and young doctors in Poland is a prevalent and multifactorial problem rooted primarily in structural and organizational stressors rather than individual weakness. High workload, long working hours, administrative burden, hierarchical culture, and insufficient institutional support constitute the most consistent risk factors. Psychological traits such as maladaptive perfectionism and high empathic distress may further increase vulnerability, particularly in environments characterized by strong performance pressure and limited autonomy. The consequences of burnout extend beyond individual well-being, being closely associated with depression, anxiety, substance use, and impaired quality and safety of patient care. Evidence suggests that although individual-level interventions-such as mindfulness or coping-skills training-may reduce stress, their effects on burnout are modest. A stronger and more sustainable impact is observed in mentoring, coaching, and especially organizational and leadership-level interventions addressing workload, staffing, and work environment. Overall, effective prevention of burnout in this population requires systemic

reform alongside individual support strategies, with future research needed to generate high-quality, Poland-specific longitudinal data and intervention studies.

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References

[1] Cotobal Rodeles S, Martín Sánchez FJ, Martínez-Sellés M. Physician and Medical Student Burnout, a Narrative Literature Review: Challenges, Strategies, and a Call to Action. *J Clin Med* 2025; 14: 2263. https://doi.org//10.3390/jcm14072263

[2] Surawattanasakul V, Siviroj P, Kiratipaisarl W, et al. Physician burnout, associated factors, and their effects on work performance throughout first-year internships during the COVID-19 pandemic in Thailand: a cross-sectional study. *BMC Public Health* 2025; 25: 1967. https://doi.org//10.1186/s12889-025-23172-7

[3] Mann A, Fainstad T, Sullivan I, et al. Medical students: They're not just little doctors! Impact of an online group-coaching program on medical student well-being: A randomized clinical trial. *PLOS ONE* 2025; 20: e0328546. https://doi.org//10.1371/journal.pone.0328546

[4] Papazian L, Hraiech S, Loundou A, et al. High-level burnout in physicians and nurses working in adult ICUs: a systematic review and meta-analysis. *Intensive Care Med* 2023; 49: 387–400. https://doi.org//10.1007/s00134-023-07025-8

[5] Quesada-Puga C, Izquierdo-Espin FJ, Membrive-Jiménez MJ, et al. Job satisfaction and burnout syndrome among intensive-care unit nurses: A systematic review and meta-analysis. *Intensive Crit Care Nurs* 2024; 82: 103660. https://doi.org//10.1016/j.iccn.2024.103660

[6] Naidoo T, Tomita A, Paruk S. Burnout, anxiety and depression risk in medical doctors working in KwaZulu-Natal Province, South Africa: Evidence from a multi-site study of resource-constrained government hospitals in a generalised HIV epidemic setting. *PLOS ONE* 2020; 15: e0239753. https://doi.org//10.1371/journal.pone.0239753

[7] Babicka-Wirkus A, Wirkus L, Stasiak K, et al. University students' strategies of coping with stress during the coronavirus pandemic: Data from Poland. *PLOS ONE* 2021; 16: e0255041. https://doi.org//10.1371/journal.pone.0255041

[8] Michalik B, Kulbat M, Domagała A. Factors affecting young doctors' choice of medical specialty—A qualitative study. *PLOS ONE* 2024; 19: e0297927. https://doi.org//10.1371/journal.pone.0297927

[9] Pszczółkowska D, Bojarczuk S, Duszczyk M, et al. Did Covid-19 make things worse? The pandemic as a push factor stimulating the emigration intentions of junior doctors from Poland: A mixed methods study. *PLOS ONE* 2024; 19: e0301757. https://doi.org//10.1371/journal.pone.0301757

[10] Wright T, Mughal F, Babatunde OO, et al. Burnout among primary health-care professionals in low- and middle-income countries: systematic review and meta-analysis. *Bull World Health Organ* 2022; 100: 385-401A. https://doi.org//10.2471/BLT.22.288300

[11] Zhou AY, Panagioti M, Esmail A, et al. Factors Associated With Burnout and Stress in Trainee Physicians: A Systematic Review and Meta-analysis. *JAMA Netw Open* 2020; 3: e2013761. https://doi.org//10.1001/jamanetworkopen.2020.13761

[12] Tan BYQ, Kanneganti A, Lim LJH, et al. Burnout and Associated Factors Among Health Care Workers in Singapore During the COVID-19 Pandemic. *J Am Med Dir Assoc* 2020; 21: 1751-1758.e5. https://doi.org//10.1016/j.jamda.2020.09.035

[13] Denning M, Goh ET, Tan B, et al. Determinants of burnout and other aspects of psychological well-being in healthcare workers during the Covid-19 pandemic: A multinational cross-sectional study. *PLOS ONE* 2021; 16: e0238666. https://doi.org//10.1371/journal.pone.0238666

[14] Lasalvia A, Amaddeo F, Porru S, et al. Levels of burn-out among healthcare workers during the COVID-19 pandemic and their associated factors: a cross-sectional study in a tertiary hospital of a highly burdened area of north-east Italy. *BMJ Open* 2021; 11: e045127. https://doi.org//10.1136/bmjopen-2020-045127

[15] Alrawashdeh HM, Al-Tammemi AB, Alzawahreh MKh, et al. Occupational burnout and job satisfaction among physicians in times of COVID-19 crisis: a convergent parallel mixed-method study. *BMC Public Health* 2021; 21: 811. https://doi.org//10.1186/s12889-021-10897-4

[16] Aiken LH, Lasater KB, Sloane DM, et al. Physician and Nurse Well-Being and Preferred Interventions to Address Burnout in Hospital Practice: Factors Associated With

Turnover, Outcomes, and Patient Safety. *JAMA Health Forum* 2023; 4: e231809. https://doi.org//10.1001/jamahealthforum.2023.1809

[17] Morgantini LA, Naha U, Wang H, et al. Factors contributing to healthcare professional burnout during the COVID-19 pandemic: A rapid turnaround global survey. *PLOS ONE* 2020; 15: e0238217. https://doi.org//10.1371/journal.pone.0238217

[18] Riley R, Buszewicz M, Kokab F, et al. Sources of work-related psychological distress experienced by UK-wide foundation and junior doctors: a qualitative study. *BMJ Open* 2021; 11: e043521. https://doi.org//10.1136/bmjopen-2020-043521

[19] Burns KEA, Pattani R, Lorens E, et al. The impact of organizational culture on professional fulfillment and burnout in an academic department of medicine. *PLOS ONE* 2021; 16: e0252778. https://doi.org//10.1371/journal.pone.0252778

[20] Aiken LH, Sermeus W, McKee M, et al. Physician and nurse well-being, patient safety and recommendations for interventions: cross-sectional survey in hospitals in six European countries. *BMJ Open* 2024; 14: e079931. https://doi.org//10.1136/bmjopen-2023-079931

[21] Meredith LS, Bouskill K, Chang J, et al. Predictors of burnout among US healthcare providers: a systematic review. *BMJ Open* 2022; 12: e054243. https://doi.org//10.1136/bmjopen-2021-054243

[22] Capdevila-Gaudens P, García-Abajo JM, Flores-Funes D, et al. Depression, anxiety, burnout and empathy among Spanish medical students. *PLOS ONE* 2021; 16: e0260359. https://doi.org//10.1371/journal.pone.0260359

[23] Michael K, Schujovitzky D, Karnieli-Miller O. The associations between resilience, self-care, and burnout among medical students. *PLOS ONE* 2024; 19: e0309994. https://doi.org//10.1371/journal.pone.0309994

[24] Pitanupong J, Sathaporn K, Ittasakul P, et al. Relationship of mental health and burnout with empathy among medical students in Thailand: A multicenter cross-sectional study. *PLOS ONE* 2023; 18: e0279564. https://doi.org//10.1371/journal.pone.0279564

[25] Dyrbye LN, Satele D, West CP. Association of Characteristics of the Learning Environment and US Medical Student Burnout, Empathy, and Career Regret. *JAMA Netw Open* 2021; 4: e2119110. https://doi.org//10.1001/jamanetworkopen.2021.19110

[26] Anishchuk S, Seery A. Examining the relationship between empathy and burnout in dental students: a systematic review. *Evid Based Dent* 2025; 26: 178–178. https://doi.org//10.1038/s41432-025-01182-z

[27] Zhou H. Relationship between empathy and burnout as well as potential affecting and mediating factors from the perspective of clinical nurses: a systematic review. *BMC Nurs* 2025; 24: 38. https://doi.org//10.1186/s12912-025-02701-0

[28] Yeşil A, Polat Ş. Investigation of psychological factors related to compassion fatigue, burnout, and compassion satisfaction among nurses. *BMC Nurs* 2023; 22: 12. https://doi.org//10.1186/s12912-023-01174-3

[29] Ruiz-Fernández MD, Ramos-Pichardo JD, Ibáñez-Masero O, et al. Professional quality of life, self-compassion, resilience, and empathy in healthcare professionals during COVID-19 crisis in Spain. *Res Nurs Health* 2021; 44: 620–632. https://doi.org//10.1002/nur.22158

[30] Chua SM, Tan IYK, Thummachai ME, et al. Impostor syndrome, associated factors and impact on well-being across medical undergraduates and postgraduate medical professionals: a scoping review. *BMJ Open* 2025; 15: e097858. https://doi.org//10.1136/bmjopen-2024-097858

[31] Forycka J, Pawłowicz-Szlarska E, Burczyńska A, et al. Polish medical students facing the pandemic—Assessment of resilience, well-being and burnout in the COVID-19 era. *PLOS ONE* 2022; 17: e0261652. https://doi.org//10.1371/journal.pone.0261652

[32] Hawsawi AA, Nixon N, Nixon E. Navigating the medical journey: Insights into medical students' psychological wellbeing, coping, and personality. *PLOS ONE* 2025; 20: e0318399. https://doi.org//10.1371/journal.pone.0318399

[33] Peng P, Hao Y, Liu Y, et al. The prevalence and risk factors of mental problems in medical students during COVID-19 pandemic: A systematic review and meta-analysis. *J Affect Disord* 2023; 321: 167–181. https://doi.org//10.1016/j.jad.2022.10.040

[34] Józefiak M, Sobkiewicz P, Niekurzak K, et al. The Impact of Competitive Sports on the Mental Health of Young People. *Qual Sport* 2024; 19: 53637–53637. https://doi.org//10.12775/QS.2024.19.53637

[35] Jakubowski TD, Sitko-Dominik MM. Teachers' mental health during the first two waves of the COVID-19 pandemic in Poland. *PLOS ONE* 2021; 16: e0257252. https://doi.org//10.1371/journal.pone.0257252

[36] Maciaszek J, Ciulkowicz M, Misiak B, et al. Mental Health of Medical and Non-Medical Professionals during the Peak of the COVID-19 Pandemic: A Cross-Sectional Nationwide Study. *J Clin Med* 2020; 9: 2527. https://doi.org//10.3390/jcm9082527

[37] Stuijfzand S, Deforges C, Sandoz V, et al. Psychological impact of an epidemic/pandemic on the mental health of healthcare professionals: a rapid review. *BMC Public Health* 2020; 20: 1230. https://doi.org//10.1186/s12889-020-09322-z

[38] Harvey SB, Epstein RM, Glozier N, et al. Mental illness and suicide among physicians. *The Lancet* 2021; 398: 920–930. https://doi.org//10.1016/S0140-6736(21)01596-8

[39] Rolland F, Hadouiri N, Haas-Jordache A, et al. Mental health and working conditions among French medical students: A nationwide study. *J Affect Disord* 2022; 306: 124–130. https://doi.org//10.1016/j.jad.2022.03.001

[40] Campbell F, Blank L, Cantrell A, et al. Factors that influence mental health of university and college students in the UK: a systematic review. *BMC Public Health* 2022; 22: 1778. https://doi.org//10.1186/s12889-022-13943-x

[41] Nicholls H, Nicholls M, Tekin S, et al. The impact of working in academia on researchers' mental health and well-being: A systematic review and qualitative meta-synthesis. *PLOS ONE* 2022; 17: e0268890. https://doi.org//10.1371/journal.pone.0268890

[42] Hodkinson A, Anli Zhou, Johnson J, et al. Associations of physician burnout with career engagement and quality of patient care: systematic review and meta-analysis. *BMJ* 2022; 378: e070442. https://doi.org//10.1136/bmj-2022-070442

[43] Li LZ, Yang P, Singer SJ, et al. Nurse Burnout and Patient Safety, Satisfaction, and Quality of Care: A Systematic Review and Meta-Analysis. *JAMA Netw Open* 2024; 7: e2443059. https://doi.org//10.1001/jamanetworkopen.2024.43059

[44] Kakemam E, Chegini Z, Rouhi A, et al. Burnout and its relationship to self-reported quality of patient care and adverse events during COVID-19: A cross-sectional online survey among nurses. *J Nurs Manag* 2021; 29: 1974–1982. https://doi.org//10.1111/jonm.13359

[45] Gasciauskaite G, Lunkiewicz J, Braun J, et al. Burnout and its determinants among anaesthesia care providers in Switzerland: a multicentre cross-sectional study. *Anaesthesia* 2024; 79: 168–177. https://doi.org//10.1111/anae.16171

[46] 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: e2028111. https://doi.org//10.1001/jamanetworkopen.2020.28111

[47] Zhu H, Yang X, Xie S, et al. Prevalence of burnout and mental health problems among medical staff during the COVID-19 pandemic: a systematic review and meta-analysis. *BMJ Open* 2023; 13: e061945. https://doi.org//10.1136/bmjopen-2022-061945

[48] Machaj D, Płaczek A, Cyboran K, et al. Generalized Anxiety Disorder, panic disorder - diagnosis and treatment. *J Educ Health Sport* 2022; 12: 780–783. https://doi.org//10.12775/JEHS.2022.12.07.077

[49] Kaisti I, Kulmala P, Hintsanen M, et al. The effects of mindfulness-based interventions in medical students: a systematic review. *Adv Health Sci Educ* 2024; 29: 245–271. https://doi.org//10.1007/s10459-023-10231-0

[50] Bennett-Weston A, Keshtkar L, Jones M, et al. Interventions to promote medical student well-being: an overview of systematic reviews. *BMJ Open* 2024; 14: e082910. https://doi.org//10.1136/bmjopen-2023-082910

[51] Worsley JD, Pennington A, Corcoran R. Supporting mental health and wellbeing of university and college students: A systematic review of review-level evidence of

interventions. *PLOS ONE* 2022; 17: e0266725. https://doi.org//10.1371/journal.pone.0266725

[52] Yogeswaran V, El Morr C. Effectiveness of online mindfulness interventions on medical students' mental health: a systematic review. *BMC Public Health* 2021; 21: 2293. https://doi.org//10.1186/s12889-021-12341-z

[53] Eslamimoghadam F, Abedini Z, Khoramirad A. The mental health of nursing students during the COVID-19 pandemic: Beneficial effects of mindfulness-based stress reduction. *Heliyon* 2024; 10: e32986. https://doi.org//10.1016/j.heliyon.2024.e32986

[54] Liu D, Sun F, Zhu Y, et al. Fitness Dance Counteracts Female Ph.D. Candidates' Stress by Affecting Emotion Regulation. *Int J Environ Res Public Health* 2022; 19: 14627. https://doi.org//10.3390/ijerph192214627

[55] Cohen C, Pignata S, Bezak E, et al. Workplace interventions to improve well-being and reduce burnout for nurses, physicians and allied healthcare professionals: a systematic review. *BMJ Open* 2023; 13: e071203. https://doi.org//10.1136/bmjopen-2022-071203

[56] Haslam A, Tuia J, Miller SL, et al. Systematic Review and Meta-Analysis of Randomized Trials Testing Interventions to Reduce Physician Burnout. *Am J Med* 2024; 137: 249-257.e1. https://doi.org//10.1016/j.amjmed.2023.10.003

[57] Shah HP, Salehi PP, Ihnat J, et al. Resident Burnout and Well-being in Otolaryngology and Other Surgical Specialties: Strategies for Change. *Otolaryngol Neck Surg* 2023; 168: 165–179. https://doi.org//10.1177/01945998221076482

[58] Fainstad T, Mann A, Suresh K, et al. Effect of a Novel Online Group-Coaching Program to Reduce Burnout in Female Resident Physicians: A Randomized Clinical Trial. *JAMA Netw Open* 2022; 5: e2210752. https://doi.org//10.1001/jamanetworkopen.2022.10752

[59] Palamara K, Chu JT, Chang Y, et al. Who Benefits Most? A Multisite Study of Coaching and Resident Well-being. *J Gen Intern Med* 2022; 37: 539–547. https://doi.org//10.1007/s11606-021-06903-5

[60] Solms L, Vianen A van, Koen J, et al. Turning the tide: a quasi-experimental study on a coaching intervention to reduce burn-out symptoms and foster personal resources among medical residents and specialists in the Netherlands. *BMJ Open* 2021; 11: e041708. https://doi.org//10.1136/bmjopen-2020-041708

[61] Kiser SB, Sterns JD, Lai PY, et al. Physician Coaching by Professionally Trained Peers for Burnout and Well-Being: A Randomized Clinical Trial. *JAMA Netw Open* 2024; 7: e245645. https://doi.org//10.1001/jamanetworkopen.2024.5645

[62] Nelson V, Dubov A, Morton K, et al. Using nominal group technique among resident physicians to identify key attributes of a burnout prevention program. *PLOS ONE* 2022; 17: e0264921. https://doi.org//10.1371/journal.pone.0264921

[63] Mete M, Goldman C, Shanafelt T, et al. Impact of leadership behaviour on physician well-being, burnout, professional fulfilment and intent to leave: a multicentre cross-sectional survey study. *BMJ Open* 2022; 12: e057554. https://doi.org//10.1136/bmjopen-2021-057554

[64] Chacón-Docampo M, Asensio-Martínez Á, Rodríguez-Pastoriza S, et al. Factors associated with burnout among Family and Community Medicine and Nursing residents: secondary analysis of a multicentre study. *BMC Nurs* 2025; 24: 1331. https://doi.org//10.1186/s12912-025-03956-3

[65] Linzer M, O'Brien EC, Sullivan E, et al. Burnout in modern-day health care: Where are we, and how can we markedly reduce it? A meta-narrative review from the EUREKA* project. *Health Care Manage Rev* 2025; 50: 57. https://doi.org//10.1097/HMR.0000000000000433