REVIEW PAPER

ARTIFICIAL INTELLIGENCE TOOLS FOR MITIGATING BURNOUT LEVELS AMONG ROMANIAN HEALTHCARE PROFESSIONALS: A SCOPING REVIEW

Codruța Cornelia Dura[1(A,C,E)], **Loredana Chițoiu**[1(B,D,F)]

[1]Department of Economics, University of Petrosani, Petroșani, Romania

Address for correspondence: Codruța Cornelia Dura, Department of Economics, University of Petrosani, Str. Universității, nr. 20, 332006, Petroșani, Hunedoara, Romania, e-mail: codrutadura@upet.ro

Summary

Burnout syndrome (BOS) is increasingly recognized as a critical occupational phenomenon with profound effects on healthcare workers. Frontline practitioners are especially vulnerable, experiencing emotional exhaustion and depersonalization due to long working hours, continuous patient care, high mortality rates, family demands for counseling, administrative burdens, and unstable working environments. These stressors compound to heighten the risk of BOS, particularly in critical care units. In response, this paper conducts a scoping review to highlight emerging tools capable of mitigating BOS, with a focus on artificial intelligence (AI) applications. Specifically, AI offers several practical contributions: rapid data collection for designing personalized treatment plans, development of deep learning algorithms to support clinical decision-making, deployment of wearable devices and medical equipment to monitor patient conditions, and generative solutions aimed at easing administrative workloads. Collectively, these technologies can both reduce stressors and enhance job satisfaction among healthcare professionals. However, for such benefits to be realized, healthcare personnel must demonstrate openness to training and continuous learning, which are essential for the effective integration of AI tools into routine emergency medicine practice.

Keywords: burnout syndrome, scoping review, artificial intelligence, healthcare workers, healthcare

Introduction

In recent decades, burnout syndrome has become a central topic in occupational health and work psychology, amid its rising incidence across various professions. In Romania, evidence increasingly confirms this trend. For instance, a study of emergency department staff in Galati, Romania, found that 36.25% of medical personnel are at high risk of burnout, with emotional exhaustion tied to workload, interpersonal relations, and reward systems [1]. Internationally, burnout has assumed elevated importance. However, comparative surveys in Southeast Europe reveal that Romanian health workers report somewhat lower levels of emotional exhaustion than peers in neighboring countries, but the overall patterns confirm shared regional pressures associated with job demands and resource constraints [2].

The concept of burnout was first introduced in the 1970s, but its classical and most widely used formulation in academic literature belongs to Maslach [3], who identified three essential dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment. This

conceptualization laid the foundation for the development of the Maslach Burnout Inventory (MBI), considered the most widely used tool for assessing burnout globally [4].

Burnout not only affects individual well-being but also professional performance and the quality of services provided. The emergence of this syndrome can be attributed to several factors, including increased workplace pressures, intensified professional demands, and an imbalance between personal and professional life [5]. Furthermore, Montero-Marín et al. [6] brought a new perspective to the definition of burnout. Building on the personality typology model proposed by Farber, they suggest that this syndrome can manifest in different forms depending on an employee's personality and the resources available to them, both personally and within the organization. Thus, some individuals may feel simply disengaged, losing enthusiasm for their work, while others may reach a state of extreme physical and emotional exhaustion [7].

Another important aspect worth discussing is how we perceive burnout: is it a standalone condition or merely a form of depression. Bianchi et al. [8] argue that it should be considered a disease distinct from depression, given the overlapping symptoms but also the significant differences between the two. According to them, if this distinction is not clearly made, we risk underestimating the severity of burnout, which could lead to inadequate treatments and less effective occupational health policies. The same concern was previously expressed by Korczak et al. [9], who pointed out the lack of a clear consensus on diagnostic criteria and proposed the consideration of psychological and clinical indicators to differentiate burnout from other psychiatric disorders.

Aim of the work

Based on these ideas and the urgent need to find solutions to support medical personnel, especially frontline workers, this research aims to provide a broad perspective on the phenomenon of burnout. Moreover, the paper explores how modern technologies and artificial intelligence can become important allies in the prevention and management of this increasingly widespread syndrome.

Methods

Given the dynamic and fast-paced development of AI, a scoping review was undertaken to systematically explore the range of existing AI tools, their areas of application, and the gaps present

in the current body of research. This review offered a broad and structured understanding of how AI is being utilized within the Romanian healthcare sector and served as an evidence base to inform recommendations, particularly in identifying tools that demonstrate effectiveness, scalability, and adherence to ethical standards.

The scoping review was carried out in alignment with the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), as recommended by Moher et al. [10] and adopted in studies such as Garvey et al. [11] and Kirubarajan et al. [12]. Given the wide scope of the topic and the considerable variability across literature, the scoping review methodology was deemed more suitable than a traditional systematic review. Accordingly, we adhered to the four core stages of the scoping review process: (1) identification of relevant literature, (2) application of inclusion and exclusion criteria, (3) analysis of extracted data, and (4) presentation of findings. Each of these steps is described in detail in the subsequent sections.

The literature search was conducted using the Scopus database, which is widely regarded as a credible and comprehensive source for peer-reviewed academic publications. Given the objective of this study, which is to provide a broad and systematic overview of AI tools applied in the Romanian healthcare sector to address burnout, the search strategy was carefully designed to include relevant keywords. These included terms such as *artificial intelligence*, *AI*, *burnout*, *healthcare*, and *Romania*, which were combined to form the final search string used in the review ("artificial intelligence" OR "AI" OR "burnout" OR "healthcare" OR "Romania").

Given the objectives of the study, specific inclusion and exclusion criteria were applied to guide the selection process. As illustrated in Figure 1, an initial pool of 485 articles was retrieved from the Scopus database. Of these, 462 records were excluded as they fell outside the scope of healthcare professionals, focusing instead on unrelated disciplines. One additional article was excluded based on document type, as this review considered only peer-reviewed publications.

To ensure breadth, no restrictions were placed on the source titles. However, to align with the study's focus on the Romanian healthcare context, only studies relevant to Romania were retained, while those related to other countries were excluded. Ultimately, 21 articles met the criteria and were included in the final review.
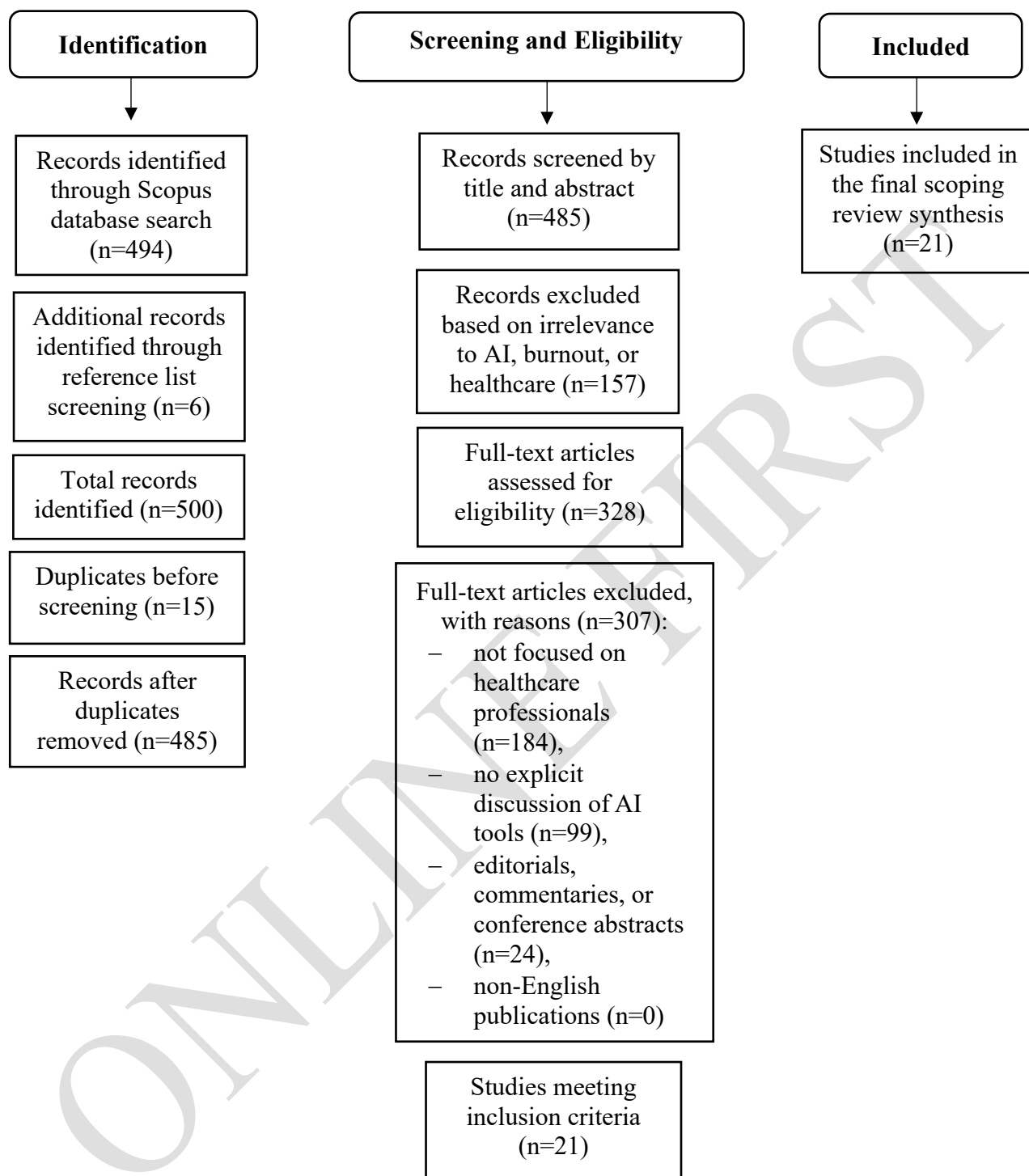
Identification

Records identified through Scopus database search (n=494)

Additional records identified through reference list screening (n=6)

Total records identified (n=500)

Duplicates before screening (n=15)

Records after duplicates removed (n=485)

Screening and Eligibility

Records screened by title and abstract (n=485)

Records excluded based on irrelevance to AI, burnout, or healthcare (n=157)

Full-text articles assessed for eligibility (n=328)

Full-text articles excluded, with reasons (n=307):
- not focused on healthcare professionals (n=184),
- no explicit discussion of AI tools (n=99),
- editorials, commentaries, or conference abstracts (n=24),
- non-English publications (n=0)

Studies meeting inclusion criteria (n=21)

Included

Studies included in the final scoping review synthesis (n=21)

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta Analyses Extension for Scoping Reviews (PRISMA-ScR) flowchart

Literature review results

Analysis of extracted data

The final dataset, exported in CSV format, was analyzed using Microsoft Excel to examine publication characteristics such as document type, publication year, and author contributions. The distribution of document types within the final dataset indicates a strong predominance of original research, with 20 out of 21 publications classified as journal articles. This pattern suggests that scholarly engagement with AI tools in healthcare, particularly regarding burnout mitigation, has largely centered on empirical exploration and conceptual development rather than evidence synthesis. The presence of only one review article underscores a notable gap in cumulative analyses, reinforcing the need for integrative studies such as the present one to consolidate fragmented insights and provide a comprehensive understanding of the field.

A closer examination of publication trends (Figure 2) reveals a progressive increase in research output over the past five years, indicating growing scholarly recognition of AI's potential role in addressing healthcare workforce well-being. However, the distribution also reflects episodic publication surges, typically coinciding with post-pandemic digital transformation efforts and the heightened global discourse on healthcare resilience. This temporal clustering suggests that interest in AI-based burnout mitigation is reactive and event-driven rather than embedded as a sustained research trajectory.

As shown in Figure 2, the publication trend over time reveals a growing scholarly interest in the use of AI tools to address burnout in healthcare. This upward trajectory indicates that researchers are increasingly recognizing the potential of artificial intelligence to support psychosocial well-being and workforce resilience in healthcare settings. The growth is particularly noticeable after 2020, likely reflecting the heightened awareness of burnout following the COVID-19 pandemic and the parallel acceleration of digital health transformation. Such temporal clustering suggests that academic interest in AI-based burnout mitigation has been stimulated by global health crises and technological advancements rather than by long-term strategic research agendas. This pattern also implies that the field is still in its formative stage, characterized by exploratory studies aimed at defining conceptual boundaries, testing tools, and identifying ethical or practical constraints. Going forward, a more

sustained and cumulative research effort, supported by cross-disciplinary collaboration and stronger empirical designs, will be essential to move the field to explanatory insights.
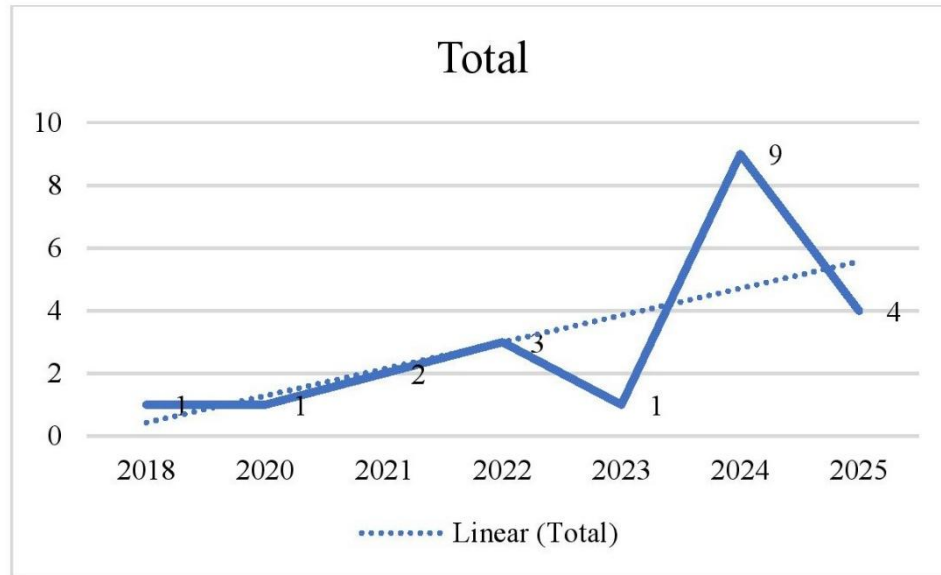

Figure 2. Publication by year

Initial attention to the topic was limited, with only one article each published in 2018 and 2020. A modest increase followed in 2021 and 2022, with two and three articles respectively, indicating a gradual rise in awareness and exploration of this area. However, a significant surge occurred in 2024, which saw the highest number of publications (n=9), followed by a strong continuation in 2025 (n=4), despite it being a partial year at the time of analysis. This temporal pattern indicates a shift from sporadic to consistent scholarly engagement, reflecting a transition from exploratory interest to formalized research agendas on AI-based burnout mitigation. The surge in 2024 coincides with a broader global uptick in digital health research, likely driven by accelerated post-pandemic investments in healthcare technologies and a policy emphasis on mental health and workforce well-being. This sharp increase in recent years reflects both the rapid advancement of AI technologies and the mounting urgency to address healthcare workforce challenges, including burnout. The data suggest that scholarly interest in AI's role in healthcare is not only technologically motivated but also socially responsive, emerging as a direct reaction to systemic strain, ethical concerns, and resource shortages in the health sector. The upward trend underscores a shifting research priority toward digital and AI-driven solutions in healthcare settings and justifies the need for a comprehensive scoping review to

synthesize emerging insights and guide further inquiry. This evolution also signals the formation of a distinct research niche at the intersection of artificial intelligence, mental health, and occupational well-being, an area that has been underrepresented in mainstream digital health literature.

The body of literature identified in this scoping review reflects a diverse range of scholarly contributions addressing various healthcare challenges, particularly within the Romanian context. As presented in Table 1, a majority of the included studies were published in *Healthcare* (Switzerland), a peer-reviewed, open-access journal with a strong interdisciplinary focus on public health and clinical care, indicating a consistent platform for research dissemination in this field. The concentration of publications in a single journal may also reflect a regional or thematic clustering effect, where authors seek venues known for interdisciplinary and digital health research, thus contributing to the consolidation of a specialized body of knowledge.

Several studies, such as Miftode et al. [13] and Popescu et al. [14], focused on the impact of the COVID-19 pandemic, highlighting socioeconomic influences, treatment delays, and system-level responses. These works have garnered moderate citation counts (11 and 7 citations, respectively), suggesting their relevance in capturing the pandemic's ripple effects on both cardiovascular and oncological care pathways. These studies not only document systemic disruptions but also illustrate how AI-enabled data analytics and predictive models can support resilient health system responses in times of crisis.

Other authors, including Tarcoveanu et al. [15], contributed to technological applications in diagnostics, with their work on classification algorithms in glaucoma progression attracting the highest number of citations (n=14), reflecting growing interest in AI's potential for predictive health monitoring. This pattern suggests that clinical applications of AI continue to outpace psychosocial or organizational use cases, highlighting a gap in research that links technological innovation with human-centered outcomes such as burnout mitigation. Similarly, Dumitrache et al. [16] and Brinzaniuc et al. [17] tackled vulnerable populations and health equity, addressing barriers faced by asylum seekers and maternal smoking behaviors, respectively. These studies extend the conversation toward social determinants of health and their policy implications. Their inclusion demonstrates that AI research is gradually expanding beyond purely clinical applications to incorporate ethical, equity-driven, and behavioral dimensions of healthcare delivery.

Moreover, recent contributions [18,19] explore mental health, education, and work-related stress, signaling a shift in research priorities toward well-being in professional and educational settings,

particularly in the post-pandemic recovery phase. Despite several of the 2024 and 2025 publications having low citation counts (some with zero), this is expected given their recency. However, their focus on digital tools, burnout, and health system reform positions them as important contributions that may gain traction as these issues remain at the forefront of global health discourse. The low citation rates also reflect the nascent stage of this research area, which is still in the process of establishing its conceptual frameworks and evidence base.

Overall, the wide thematic spread demonstrates the multifaceted nature of AI and healthcare research, reinforcing the value of this scoping review in identifying trends, gaps, and potential areas for future inquiry. Beyond mapping existing literature, these findings also invite a critical reflection on the direction of future research, urging a shift from descriptive studies toward analytical, comparative, and impact-oriented research that can inform policy and practice in digital health and occupational well-being (Table 1)

Table 1. Romanian authors contributing to the development of BOS literature

Author(s)	Research title	Source title	Cited by
Miftode et al. [13]	The influence of socioeconomic status on the prognosis and profile of patients admitted for acute heart failure during the COVID-19 pandemic: overestimated aspects or a multifaceted hydra of cardiovascular risk factors?	Healthcare (Switzerland)	11
Girvalaki et al. [20]	Current practices and perceived barriers to tobacco-treatment delivery among healthcare professionals from 15 European countries. The EPACTT Plus project	Tobacco Prevention and Cessation	13
Cernega et al. [21]	The predictability of the dental practitioner in a volatile healthcare system: a 25-year study of dental care policies in Romania (1999–2023)	Healthcare (Switzerland)	0
Popescu et al. [14]	COVID-19 pandemic impact on surgical treatment methods for early-stage cervical cancer: a population-based study in Romania	Healthcare (Switzerland)	7
Dima et al. [22]	Article perceptions of Romanian physicians on lockdowns for Covid-19 prevention	Healthcare (Switzerland)	7
Bacoanu et al. [23]	Therapeutic obstinacy in end-of-life care—a perspective of healthcare professionals from Romania	Healthcare (Switzerland)	1
Dumitrache et al. [16]	Experiences and perceived barriers of asylum seekers and people with refugee backgrounds in accessing healthcare services in Romania	Healthcare (Switzerland)	11

Gruescu et al. [24]	A cross-sectional assessment of parental concerns in the pediatric surgery department during the COVID-19 pandemic	Healthcare (Switzerland)	1
Crișan et al. [25]	Unveiling health inequalities: exploring metabolic dysfunction in rural Roma communities	Healthcare (Switzerland)	1
Pana et al. [26]	Utility and utilization of patient-reported experience measures for the supplementary COVID-19 protective actions at the Ovidius clinical hospital in Romania	Healthcare (Switzerland)	0
Berei et al. [18]	Academics on professional helpers' education: how do they perceive the work-related challenges?	Education Sciences	0
Cioclu et al. [27]	Tackling cardiovascular care deserts in Romania: expanding population access in underserved areas	Healthcare (Switzerland)	0
Munteanu et al. [28]	The family doctor in the "COVID-19 Era"	Healthcare (Switzerland)	0
Gómez-Bravo et al. [29]	The use of COVID-19 mobile apps in connecting patients with primary healthcare in 30 countries: Eurodata study	Healthcare (Switzerland)	0
Zamfir et al. [30]	Trends in coronary artery anomalies detection by coronary computed tomography angiography (CCTA): a real-life comparative study before and during the COVID-19 pandemic	Healthcare (Switzerland)	1
Tarcoveanu et al. [15]	Classification algorithms used in predicting glaucoma progression	Healthcare (Switzerland)	14
Huțu et al. [31]	The impact of moral hazard on healthcare utilization in public hospitals from Romania: evidence from patient behaviors and insurance systems	Healthcare (Switzerland)	0
Brinzaniuc et al. [17]	Smoking and quitting smoking during pregnancy: a qualitative exploration of the socio-cultural context for the development of a couple-based smoking cessation intervention in Romania	Tobacco Prevention and Cessation	6
Apostol et al. [19]	From pandemic to COVID-19 endemic: mental health impact, psychological and social well-being among social work students—implications for the healthcare system	Healthcare (Switzerland)	0
Irsay et al. [32]	Exploring the connections between medical rehabilitation, faith, and spirituality	Healthcare (Switzerland)	0
Perpelea et al. [33]	Exploring the threefold viewpoint on children's oral health in a cross-sectional study	Healthcare (Switzerland)	1

It can be deduced from Table 1 that most of the studies identified did not focus directly on the use of AI tools to mitigate burnout but rather examined broader healthcare system stressors, pandemic impacts, and organizational or social determinants of health. This finding indicates that the field is still in its formative stage, where researchers are exploring the contextual foundations of burnout and systemic inefficiencies before advancing to targeted AI-based interventions. However, some emerging themes and technologies imply the use of AI tools (Table 2), particularly in diagnostics, patient experience tracking, and predictive analytics, which indirectly contribute to burnout reduction by:

1. reducing workload,
2. automating administrative tasks,
3. improving diagnostic efficiency,
4. enhancing decision support.

These themes suggest that AI's contribution to burnout mitigation is primarily indirect, functioning through system optimization rather than psychological intervention. This pattern echoes global findings across multiple healthcare systems, where AI-enabled tools have been recognized as organizational levers for efficiency, quality improvement, and clinical well-being [34-40]. This insight underscores the need for future research to move beyond descriptive applications and investigate the causal relationships between specific AI interventions, organizational contexts, and psychosocial outcomes.

Table 2. AI-related burnout studies

Author(s)	Title summary	Implied AI tool/use	Burnout mitigation contribution
Tarcoveanu et al. [15]	Predicting glaucoma progression using classification algorithms	AI-based predictive modeling / machine learning algorithms	Supports clinical decision-making, reducing cognitive load and improving efficiency
Cioclu et al. [27]	Expanding access in underserved areas	Geospatial and predictive planning tools	Enhances resource allocation, reducing staff burden in high-demand areas
Zamfir et al. [30]	Real-life comparative study using coronary CTA	AI-assisted imaging (CCTA)	Faster, more accurate diagnosis reduces pressure on radiologists and clinicians
Pana et al. [26]	Use of patient-reported experience measures (PREMs)	AI-enhanced sentiment / experience analysis	Helps organizations monitor burnout risk factors from patient feedback and streamline responses
Gómez-Bravo et al. [29]	Mobile health apps for patient-primary care connection	mHealth apps, AI-integrated communication platforms	Improves patient triage and communication, easing clinicians' administrative burden

Key issue arising from the scoping review – limited direct focus on burnout: an important research gap

Although AI has gained significant traction in healthcare, it is evident from this scoping review that only a limited number of studies explicitly explore AI tools in the context of mitigating burnout among Romanian healthcare professionals. Most existing literature concentrates on clinical applications, such as diagnostics, treatment planning, and health service delivery, rather than the well-being of the workforce delivering these services.

This highlights a critical research gap: the potential of AI to directly address occupational stressors and burnout in healthcare remains largely underexplored and underutilized.

Conclusions

This scoping review sheds light on a growing but underdeveloped intersection between AI and occupational health, specifically, the use of AI tools to mitigate burnout among healthcare professionals. Internationally, there has been increasing recognition of AI's potential to transform healthcare delivery and workforce management, with applications ranging from predictive analytics for workload monitoring to intelligent scheduling systems and AI-driven mental health support platforms. Evidence from high-income contexts indicates that targeted AI interventions can reduce administrative workloads, improve clinical decision-making, and enhance early detection of psychological distress [41-45]. However, research in Eastern Europe, including Romania, remains scarce and fragmented. This disparity underscores the need to contextualize global advancements within local healthcare systems, where structural challenges, limited resources, and differing organizational cultures may influence both the adoption and effectiveness of AI-driven interventions for occupational well-being.

The review reveals that few studies have explicitly addressed burnout reduction as a primary objective, highlighting a clear and urgent research gap. By mapping the existing landscape, this review identifies early-stage and indirect uses of AI, such as decision-support systems, workflow optimization tools, and data-driven diagnostics, that possess promising implications for alleviating burnout triggers like cognitive overload, administrative burden, and emotional exhaustion. These findings align with

global evidence showing that AI's impact on well-being is most pronounced when technology is integrated into organizational strategies that prioritize human factors and ethical safeguards [46,47]. However, this review also recognizes significant implementation and ethical challenges that affect the generalizability of AI solutions. These include data privacy and confidentiality concerns, algorithmic bias, limited interoperability of digital systems, and the risk of technological overdependence. In addition, resource-constrained health systems often lack the digital infrastructure, governance frameworks, and training programs necessary to ensure equitable and safe AI deployment [48].

Therefore, this study demonstrates that AI can offer a double-edged impact: while it holds promise for relieving workload pressures, poorly implemented systems can introduce new stressors through technological complexity, loss of professional autonomy, or data overload. Consequently, the adoption of AI for burnout mitigation must be guided by both technical feasibility and ethical responsibility, ensuring that innovation enhances rather than undermines clinician well-being.

Future research should therefore focus on the intentional, evidence-driven design and evaluation of AI systems that support workload balancing, real-time stress monitoring, task automation, and emotional well-being tracking. Such research should also explore cross-national comparisons to understand how different institutional and cultural contexts shape the implementation and impact of AI-based well-being solutions. Stronger collaboration between computer scientists, clinical leaders, and ethicists is essential to ensure that future AI tools are human-centered, equitable, and adaptable to varied healthcare settings. In doing so, not only can AI contribute to safer and more efficient healthcare delivery, but it can also foster sustainable, compassionate, and ethically grounded working environments that support healthcare professionals' resilience and patient care quality alike. This review thus positions AI not merely as a technological solution but as a catalyst for reimagining occupational well-being in global healthcare systems.

Disclosures and acknowledgements

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