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Bibliometric computational analysis of the scientific literature on burnout and its effect on health and safety of employees

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Abstract

Background: The main theme of research literature on burnout has yet to be investigated. Aims: This bibliometric study evaluated the research literature on burnout and health, indexed in Web of Science (WoS), to reveal its expansion and the most prolific authors, institutions, countries, journals, and journal categories. The recurring themes of the literature were also identified.

Methods: In December 2023, the WoS Core Collection database was queried with: TS = [("burnout*" OR "burnout*" OR "burn-out*") AND ("health*" OR "illness*" OR "disease*" OR "well-being*" OR "wellbeing*")]. The search yielded publications with these words presented in their title, abstract, or keywords. No filter was placed to restrict the search. Publication and citation counts were recorded directly from the database, whereas subsequent analyses were performed with VOSviewer.

Results: The search yielded 26,492 publications. The literature has been growing steadily in the 2000s and more quickly in the 2010s. Nearly one-third of the publications had contributions from the United States. The most prolific journals involved some open-access mega-journals and journals from psychology, medicine, and nursing. Depression and anxiety associated with burnout were recurring themes in the

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literature. The research community has been explaining burnout by the highly cited Job Demands-Resources (JD-R) model.

Discussion: This work demonstrated the usefulness of a bibliometric analysis to identify key stakeholders and major themes of burnout research.

Keywords

Digital technology, burnout, health, psychology, public health, bibliometric

Introduction

The rapid pace of scientific and technological advancement, the increasing demands of modern life, economic and political crises, and the occurrence of both natural and man-made disasters may have contributed to burnout [1]. These stressors have a particularly pronounced psychological impact on professionals that involve direct interpersonal interactions, such as those in the fields of psychology, education, and medicine [2–4]. In addition to the above factors, the work of medical professionals in particular is associated with emotional saturation, psychophysical tension, increased responsibility for the lives and health of people, conflict situations, and the need for quick decision-making in conditions of risk. Consequently, representatives of the medical profession are threatened by burnout syndrome [5]. The term "professional burnout" was first introduced by the American psychologist Herbert Freudenberger in 1974 [1]. Models of burnout syndrome are reflected in numerous works by previous researchers [2, 5, 6]. Today, burnout syndrome is defined in the International Classification of Diseases 11th Revision (ICD-11) as a syndrome resulting from chronic stress in the workplace that has not been successfully managed. The syndrome is associated with three components: 1) feelings of energy depletion or exhaustion; 2) increased mental distance from one's job, or feelings of negativism or cynicism related to one's job; and 3) a sense of ineffectiveness and lack of accomplishment [7].

Compared to other categories of specialists, doctors and nurses had increased risks of developing burnout syndrome [8]. A sense of empathy for medical staff is a necessary professional quality. However, perceiving patients' problems on a personal level and continuously being exposed to negative emotions such as suffering, pain, despair, and irritation can lead to excessive fatigue and contribute to burnout. Organizational causes of burnout syndrome in doctors and nurses are significant workload, difficulties, and responsibility in the workplace, lack of social support from colleagues and management, insufficient remuneration for work, a high degree of uncertainty in the assessment of the work performed, and decision-making under conditions of high risk [9, 10]. Meanwhile, the occurrence of burnout may be influenced by individual differences in personality, as well as biological and socio-demographic factors such as age, gender, duration of work, and so on. Thus, a higher rate of burnout was usually observed in women and young doctors [10–12].

There are three groups of burnout consequences: physical, psychological, and professional [13]. Notable physical consequences of burnout include constant fatigue, headaches, physical exhaustion, and insomnia. Some psychological consequences of burnout include apathy, depression, irritability, pessimism, alcohol abuse, and heavy cigarette smoking. Professional consequences manifest in various ways, such as a sense of burden associated with performing routine tasks, indifference towards the work outcomes, and social isolation. The literature has suggested that burnout is associated with structural and functional changes of the brain, systemic inflammation, immunosuppression, and possibly metabolic syndrome, cardiovascular disease, and premature death [14]. Hence, burnout is an important research topic.

Having burnout among medical professionals might lead to an increase in medical errors and a decrease in the quality of medical care. Correlations were found between the severity of burnout, staff productivity, the quality of care, and patient safety [15–17]. Moreover, burnout among doctors became a source of additional costs and reputational losses for healthcare systems and medical institutions [18]. Suicidal thoughts were also reported in some doctors with burnout [19]. Not only medical professions, but

other professions may also seriously suffer from safety issues associated with burnout. For example, data from firefighters showed that burnout could be related to work stress and work-family conflict modulated by emotional intelligence [20], and burnout negatively affected compliance with personal protective equipment, adherence to safety work practices, and safety reporting [21]. Besides, studies on forest industry employees found that burnout increased the risk of absences from work due to physical or mental illnesses, and increased the risk of hospitalization due to mental and cardiovascular disorders [22, 23].

The aforementioned factors have led researchers to maintain a sustained focus on the issue of burnout. However, further research is needed to explore burnout in professionals and to systematize both the risk factors and protective factors associated with this phenomenon. With a substantial volume of existing literature on burnout, researchers may find it challenging to efficiently navigate through it and identify key themes in this field. Bibliometric analysis has proven to be an appropriate tool to evaluate specific scientific areas and entire fields of study, yielding thereby valuable insights [24–27]. Hence, the aim of this study is to conduct a bibliometric analysis of scientific literature pertaining to burnout syndrome in healthcare, identify the most prolific entities of the burnout literature, synthesize a summary of research findings, and discuss perspectives on burnout prevention and intervention.

Materials and methods

In December 2023, the electronic Web of Science (WoS) platform was accessed, and its Core Collection database was queried with the following search string: TS = [("burnout*" OR "burn out*" OR "burn-out*") AND ("health*" OR "illness*" OR "disease*" OR "well-being*" OR "wellbeing*")]. This search string searched for these words in the titles, abstracts, and keywords fields of the publications indexed in WoS. No other aspects, such as publication year or language, were used to restrict the search. Therefore, publications published between 1956–2023 were included, per the subscription plan of the affiliation of the first author. The search was not limited to publications from particular countries. All publications resulted from the search were included regardless of the document types. This ensured a comprehensive coverage of the literature indexed by WoS. Though both WoS and Scopus provide comprehensive and accurate data for bibliometrics, WoS was used because it had a longer history and was more popular than Scopus in the bibliometric field [28]. The basic publication and citation metrics could be directly extracted from the WoS platform. As the count for the United Kingdom was not directly available, counts from England, Scotland, Northern Ireland, and Wales were merged to represent the United Kingdom. Self-citation rate of the most prolific authors was calculated by dividing (Total citations - Without self-citations) by Total citations. These numbers were obtained directly from the Citation Report function in WoS after getting the search results. The search yielded 26,492 publications for the analysis. To generate visualization maps, the complete records of the publications were exported into VOSviewer (Centre for Science and Technology Studies, Leiden University, version 1.6.20) [29, 30] and its default parameters were applied to data processing. The term map visualized the recurring terms ($n \ge 265$, 1% of 26,492 papers) from the title and abstract of the papers. The procedure was as follows: Create a map based on text data \rightarrow Read data from WoS files \rightarrow Extract terms from title and abstract fields (choose to ignore structured abstract labels and copyright statements) \rightarrow Choose binary counting \rightarrow Keep all terms that passed the 1% threshold mentioned above. Each term was represented by a node. The node size was an indication of its publication count, whereas the node color indicated the citations per publication (CPP), and the inter-node distance indicated their cooccurrence. The top 10 most cited papers were searched in Scite, an AI-driven online database that collated and categorized citing statements into supporting, mentioning, and contrasting contexts [31]. Figure 1 shows a flow diagram of the bibliometric workflow. Ethical approval was not applicable to this study, as this study did not involve human or animal subjects or data generated from them.

Results

The search yielded 26,492 publications and the analyses were based on this number of publications. Most of the publications were original articles (n = 22,988, 86.8%, CPP = 22.1), whereas reviews were more cited in general (n = 1,916, 7.2%, CPP = 43.0). Following these two most common document types were editorial



Figure 1. Flow diagram showing the bibliometric workflow

material (n = 671, CPP = 10.4) and proceeding paper (n = 571, CPP = 17.1). Publications written in English represented 94.2% of the analyzed dataset, followed by Spanish (1.8%) and German (1.2%). Other languages represented < 1% of the dataset each. Table 1 lists the most prolific authors, institutions, countries, journals, and journal categories. Meanwhile, Figure 2 shows the cumulative publication count of the literature on burnout and health. In the 2000s the literature was growing steadily. The growth seemed to be exponential since the 2010s.

The most prolific author was Professor Wilmar B. Schaufeli affiliated with Utrecht University (Netherlands) and KU Leuven (Belgium). His most highly cited paper in the analyzed dataset was a 25-page narrative review paper that provided a historical overview of the research on occupational burnout beginning in the mid-1970s; defined the assessment, theoretical framework, and dimensions of burnout; elaborated on where burnout usually occurred and who experienced it; and summarized possible interventions to manage burnout [32] (7,861 citations). He teamed up with international collaborators to develop the Burnout Assessment Tool (BAT) [33] (153 citations, classified as a highly cited paper according to WoS).

Meanwhile, the top 4 most prolific journals were open-access journals. In terms of open-access journals, PLOS One was initially the preferred journal for publication at the end of the 2000s and early 2010s, but it was eventually superseded by International Journal of Environmental Research and Public Health (IJERPH) and Frontiers in Psychology (Figure 2). Of note, the growth of burnout literature published in IJERPH seemed to decrease sharply in 2023. Both IJERPH and Frontiers in Psychology had similar CPPs, whereas the only hybrid journal among the top 5, Journal of Advanced Nursing, had the longest publication history on burnout and the highest CPP on the list.

The recurring terms in the title and abstracts of the analyzed literature are visualized in Figure 3. It seemed that survey was a popular study type, as survey (n = 5,368, CPP = 21.8) and questionnaire (n = 5,941, CPP = 20.5) were two recurring terms. COVID (COVID-19) was also a recurring term (n = 3,628, CPP = 12.1). Burnout papers frequently mentioned depression, and the latter was also a recurring term (n = 2,862, CPP = 26.9). Intervention was also a recurring term (n = 1,039, CPP = 19.1) had a lower CPP than the former.

Table 2 lists the top 20 most recurring author keywords. Burnout seemed to be frequently mentioned together with job satisfaction (n = 1,154, CPP = 22.4), depression (n = 1,040, CPP = 26.0), and anxiety (n = 650, CPP = 19.6), mindfulness (n = 553, CPP = 22.2) and social support (n = 406, CPP = 27.3). COVID-19 (n = 1,973, CPP = 13.6) was frequently mentioned by burnout papers, and nursing (n = 701, CPP = 24.4) seemed to be a profession where burnout was frequently investigated.

Entity	Number of publications (% of 26,492)	Citations per publication (CPP)
Author (h-index within the dataset, self-citation rate)		
Schaufeli, Wilmar B. (67, 1.4%)	128 (0.5)	297.2
Shanafelt, Tait D. (59, 3.2%)	106 (0.4)	172.3
Bakker, Arnold B. (64, 1.1%)	94 (0.4)	345.9
Dyrbye, Liselotte N. (47, 2.6%)	83 (0.3)	176.9
West, Colin P. (28, 2.7%)	66 (0.3)	128.4
Institution		
University of California System	707 (2.7)	40.0
Harvard University	681 (2.6)	24.3
University of London	451 (1.7)	28.9
University System of Ohio	436 (1.6)	31.2
University of Toronto	363 (1.4)	25.8
Country		
United States	8,455 (31.9)	27.2
United Kingdom	2,149 (8.1)	26.6
Australia	1,661 (6.3)	23.7
Canada	1,649 (6.2)	34.2
China	1,579 (6.0)	15.9
Journal (impact factor 2022)		
International Journal of Environmental Research and Public Health (0)	791 (3.0)	15.7
Frontiers in Psychology (3.8)	557 (2.1)	13.4
PLOS One (3.7)	355 (1.3)	25.4
BMJ Open (2.9)	260 (1.0)	17.1
Journal of Advanced Nursing (3.8)	240 (0.9)	52.3
Journal category		
Public Environmental Occupational Health	3,937 (14.9)	19.6
Nursing	3,202 (12.1)	23.1
Psychiatry	2,445 (9.2)	22.2
Medicine General Internal	2,329 (8.8)	27.3
Psychology Multidisciplinary	1,990 (7.5)	22.1

Please note that authorship was counted irrespective of the position in the author list



Figure 2. The cumulative publication count of the literature on burnout and health. IJERPH: International Journal of Environmental Research and Public Health



Figure 3. Term map showing the recurring terms in the title and abstracts of the analyzed literature. Each term was represented by a node. The node size was an indication of its publication count, whereas the node color indicated the citations per publication (CPP), and the inter-node distance indicated their co-occurrence

The top 10 most cited papers are listed in Table 3. Instead of being old papers published decades ago, all but one were published since 2000. Data from Scite demonstrated that most of the citation statements they received were mere mentioning in nature. There were usually many more supporting statements than contrasting ones, implying that researchers generally agreed with them instead of finding contradictory evidence.

Discussion

This bibliometric analysis on burnout research analyzed 26,492 publications. Nearly one-third of them had contributions from the United States. The most prolific journals involved some open-access mega-journals as well as journals from psychology, medicine, and nursing. Survey was a term for study type among the most recurring terms in the titles and abstracts. Depression and anxiety were mentioned frequently in the burnout literature. This work should supplement existing bibliometric analyses on burnout in specific groups, including nurses [43, 44], teachers [45], and radiologists [46]. As listed in Table 1, this analysis found that the United States was the most prolific country, similar to a recent bibliometric analysis on occupational stress [47].

Depression was found to be a recurring term in the analyzed dataset, as shown in Figure 3 and Table 2. The research community had a long debate on whether burnout is a precipitating factor for depression or if burnout is identical to depression. A recent review paper has noted that research has demonstrated that

Table 2	Тор	20 most	recurring	author	keywords
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Author keyword	Number of publications	Citations per publication (CPP)	
Burnout	7,315	23.7	
Stress	2,094	24.4	
COVID-19	1,973	13.6	
Mental health	1,776	15.1	
Well-being	1,189	25.9	
Job satisfaction	1,154	22.4	
Depression	1,040	26.0	
Nurses	1,028	21.8	
Resilience	873	17.2	
Nursing	701	24.4	
Work engagement	668	42.8	
Anxiety	650	19.6	
Emotional exhaustion	602	22.6	
Mindfulness	553	22.2	
Occupational health	536	15.7	
Occupational stress	524	19.7	
Compassion fatigue	494	24.8	
Social support	406	27.3	
Quality of life	383	15.5	
Coping	362	27.5	

Table 3. The top 10 most cited papers in the analyzed literature

Rank	C Paper	Citation count from Web of Science	Citation statements (supporting: mentioning: contrasting) from Scite
1	Job burnout [32]	7,861	298:9,460:54
2	The Job Demands-Resources model of burnout [34]	6,036	394:8,637:27
3	Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study [35]	4,726	356:5,819:23
4	The influence of culture, community, and the nested-self in the stress process: Advancing Conservation of Resources theory [36]	3,699	446:6,483:15
5	UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure [37]	2,810	86:2,865:9
6	Job Demands-Resources Theory: Taking Stock and Looking Forward [38]	2,095	254:3,773:12
7	Burnout and Satisfaction With Work-Life Balance Among US Physicians Relative to the General US Population [39]	1,983	89:2,102:22
8	From Triple to Quadruple Aim: Care of the Patient Requires Care of the Provider [40]	1,761	15:1,657:1
9	Linking Job Demands and Resources to Employee Engagement and Burnout: A Theoretical Extension and Meta-Analytic Test [41]	1,614	137:2,097:13
10	Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students [42]	1,526	8:49:0

Web of Science and Scite counted citation numbers differently, and therefore the numbers of the last two columns did not match each other. Besides, Scite evaluated citation statements, so that one citing paper could contribute to multiple citation statements

burnout is job-related and situation-specific, but depression is more general and free of context [48]. A study in the past has validated the MBI (Maslach Burnout Inventory) and Burnout Measure (BM) in a clinical sample and showed that burnout could be partially differentiated from other mental syndromes such as depression and anxiety [49]. Moreover, a 3-year longitudinal study of 2,555 dentists found that job demands predicted burnout over time, which, in turn, predicted future depression; simultaneously, job resources also led to burnout [50]. Hence, this study tested and supported the Job Demands-Resources (JD-

R) model [34] (the model introduced by the 2nd most cited paper in Table 3). Meanwhile, other experts argued that these conditions highly overlap with each other, as a cross-sectional survey of 1,386 school teachers demonstrated that burnout score had a monotonic increase with depression severity in a strong correlation [51]. As our results found that mindfulness was among the most recurring author keywords, prior studies have investigated its effect on reducing burnout such as for pediatric emergency department staff [52].

In the academic literature, it was found that burnout is biologically associated with sustained activation of the autonomic nervous system, dysfunction of the sympathetic adrenal medullary axis, and changes in cortisol levels [14]. Meanwhile, situational characteristics were found to cause burnout, including excessive workload, insufficient control, inappropriate reward, lack of community or social support, unfairness, and misalignment of personal values and work [53]. Another study also found that occupational factors such as number of working hours, percentage of stressful clients, ethical compromises, and stressful workplace could significantly correlate to burnout [54]. For socioeconomic factors, age, sick-leave, financial strain, medication, work demands, depression, and somatic ailments were found to be independently associated with high burnout [55].

Regarding the JD-R model, the original version adopted a more top-down perspective of the working environment, and hence job demands and resources would have a causal effect on employees' well-being. Later on, the proposers of JD-R model recognized reversed causal effects observed in newer studies, so that engaged employees would create their own resources (e.g., autonomy, feedback, support) over time from a bottom-up approach, otherwise known as job crafting and gain spirals; and vice versa as self-undermining and loss spirals [38]. Particularly in this digital age, information and communication technology could be either a job resource or a job demand, depending on its strategic planning and usage within an organization [56].

COVID-19 was another recurring term (Figure 3 and Table 2). COVID-19 pandemic was a period when many health workers had burnout. Approximately half of the 2014 frontline nurses surveyed in a Chinese study reported moderate to high burnout [57]. A meta-analysis of 16 studies including 18,935 nurses found that the prevalence of emotional exhaustion, depersonalization, and lack of personal accomplishment were 34.1%, 12.6%, and 15.2%, respectively [58]. Surely, COVID-19 is a highly infectious disease that would impose additional job demands and health risks for health workers. Meanwhile, the meta-analysis also found some generic risk factors that increased the burnout of nurses, such as younger age, reduced social support, and inadequate material and human resources [58]. The lack of resources was especially true during the disease's first wave, as the public actively searched for face masks and other disinfection products for fear of getting infected with the new virus [59]. To alleviate burnout, a meta-analysis concluded that organization (company)-directed interventions were more effective than individual-based interventions, in the case of physicians [60]. In order to preserve the potential of healthcare, it is relevant to develop and implement approaches to prevent and correct burnout among medical staff.

Modern psychologists and doctors have developed many techniques and programs of psychological self-regulation [61–63]. These include auto-training techniques, personal development programs, psychotherapeutic methods (such as art therapy, and music therapy), and many others. It is important for researchers and clinicians to evaluate the efficacy of these interventions and identify the effective ones. Approaches to prevent burnout syndrome could be divided into organizational and individual levels, with relational factors taking an intermediate position [64]. Individual approaches for the prevention of burnout syndromes include self-knowledge, self-care, a realistic vision of one's work, optimism, empathy, and a healthy lifestyle, etc. [64–66].

Relevant to the JD-R model (identified in Table 3), one of the key resources possessed by employees is emotional intelligence [67]. The basis for considering emotional intelligence in the prevention of occupational burnout syndrome is the hypothesis that people with a high level of emotional intelligence achieve optimal balance relative to the positive and negative emotional processes. The concept of "emotional intelligence" was proposed by Salovey and Mayer [68] in 1990, who defined it as a form of social

intelligence, including the ability to monitor and distinguish between one's own and others' emotions and to use this information to manage one's thoughts and actions. Physicians with high emotional intelligence more often experience positive emotions, good relations with patients, and a sense of success in their work [69]. An important aspect of emotional intelligence in the context of its connection with the prevention of professional burnout syndrome is the regulation and control of emotions. The ability to successfully maintain, change, and modify emotions, both one's own and those of others, is considered an important factor because both too high and too low levels of expression of negative emotions can destructively affect professional activity.

Thus, it is relevant to further study of the adaptive and stress-protective functions of emotional intelligence in doctors under conditions of burnout in order to choose flexible and adaptive strategies for overcoming stressful situations. Emotional intelligence, endurance in relation to the possession of their emotions, moods, and actions, and self-management contribute to the prevention of burnout syndrome. There is no doubt that prevention and correction of burnout in medical staff will contribute to increased patient safety, improved quality of medical care, and reduced costs in healthcare.

This bibliometric study had inherent limitations. For example, WoS Core Collection contained very limited data regarding the abstract, author keywords, and keywords plus information [70] prior to the publication year of 1991, so the search could only identify a few publications published before 1991 [71]. Besides, publications not indexed by WoS would be missed in this study. The use of multiple databases would provide a broader coverage, but data merging would be challenging given that each database counted number of citations differently. Meanwhile, the stance of citations given by Scite (support, mention, vs contrast) is based on AI model, which may not be completely accurate. Thematic clustering could be potentially better analyzed and visualized by other software packages such as Biblioshiny, which allows visualization of a thematic map that plots density against centrality.

Based on the findings of this work, it could be suggested that future research on burnout can consider the evaluation of more personalized interventions, recruiting more diverse populations to draw conclusions, and how artificial intelligence is relevant in alleviating burnout.

To conclude, about one-third of the publications on burnout had contributions from the United States. The most prolific journals involved some open-access mega-journals as well as journals from the areas of psychology, medicine, and nursing. Survey was one of the most common terms in the analyzed articles. Depression and anxiety associated with burnout were recurring themes in the literature. The research community has been explaining burnout by the highly cited JD-R model.

Abbreviations

CPP: citations per publication

IJERPH: International Journal of Environmental Research and Public Health

JD-R: Job Demands-Resources

WoS: Web of Science

Declarations

Author contributions

AWKY: Conceptualization, Data curation, Formal analysis, Writing—original draft. OL: Writing—original draft. MM, MEM, MKP, HW, and TWT: Writing—review & editing. AGA: Conceptualization, Project administration, Writing—review & editing.

Conflicts of interest

Andy Wai Kan Yeung who is the Editorial Board Member and Atanas G. Atanasov who is the Editor-in-Chief of Exploration of Digital Health Technologies had no involvement in the decision-making or the review process of this manuscript. The other authors declare that they have no conflicts of interest.

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Not applicable.

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