

Burnout, wellbeing and resilience of healthcare workers in the post-COVID world

Edited by

Mansoor Malik, Kim Walker and Kristina R. Weeks

Coordinated by

Tanvi Bafna and Mohua Chakraborty Choudhury

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Burnout, wellbeing and resilience of healthcare workers in the post-COVID world

Topic editors

Mansoor Malik — The Johns Hopkins Hospital, Johns Hopkins Medicine, United States

Kim Walker — University of Aberdeen, United Kingdom

Kristina R. Weeks — Johns Hopkins University, United States

Topic coordinators

Tanvi Bafna — University of Miami, United States

Mohua Chakraborty Choudhury — Johns Hopkins University, United States

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EDITED AND REVIEWED BY
Jacqueline G. Bloomfield,
The University of Sydney, Australia

*CORRESPONDENCE
Mansoor Malik
✉ mmalik4@jhmi.edu

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Editorial: Burnout, wellbeing and resilience of healthcare workers in the post-COVID world

Mansoor Malik^{1*}, Kristina Weeks², Tanvi Bafna³,
Mohua Choudhury⁴ and Kim Walker⁵

¹The Johns Hopkins Hospital, Johns Hopkins Medicine, Baltimore, MD, United States, ²Johns Hopkins University, Baltimore, MD, United States, ³The Ohio State University, Columbus, OH, United States, ⁴Indian Institute of Science Department of Electrical Engineering, Bengaluru, India, ⁵University of Aberdeen, Aberdeen, United Kingdom

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Editorial on the Research Topic

Burnout, wellbeing and resilience of healthcare workers in the post-COVID world

This editorial synthesizes key themes from the Frontiers in Medicine Research Topic, Burnout, wellbeing and resilience of healthcare workers in the post-COVID world, highlighting critical challenges and evidence-based solutions. The studies included in this Research Topic explore the evolving nature of burnout, the structural factors exacerbating distress, and innovative strategies to support HCWs in rebuilding a sustainable healthcare workforce.

The COVID-19 pandemic was an unprecedented global crisis that placed extraordinary demands on healthcare workers (HCWs). Long hours, moral distress, resource shortages, and the fear of infection contributed to widespread burnout, anxiety, and depression among clinicians, nurses, and allied health professionals. As we transition into a post-pandemic world, the toll on HCWs' mental health persists, necessitating urgent systemic interventions to restore wellbeing and foster resilience.

Burnout, a syndrome characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment, was endemic in healthcare even before COVID-19 (1). However, the pandemic amplified its severity. Studies indicate that nearly 50-70% of HCWs experienced burnout during peak COVID-19 surges with many reporting persistent symptoms long after the acute crisis subsided (2).

The 18 studies in this Research Topic represent a diverse global perspective on healthcare worker burnout, with research teams from at least 8 different countries contributing data and analysis. The majority of studies originate from middle income countries including China, Jordan, United Arab Emirates and Iran. Several studies originated from high income countries such as the United States, United Kingdom, Sweden and Spain.

These studies paint a concerning yet actionable picture of healthcare worker wellbeing in the post-pandemic era. Across multiple countries and healthcare settings, researchers found persistently high rates of burnout and mental health challenges among healthcare professionals. Nurses and frontline workers were particularly vulnerable, with moral injury

and lasting psychological scars. Several studies highlighted how systemic issues like chronic understaffing, excessive workloads, and inefficient systems (especially electronic health records) exacerbated these problems. Importantly, the research demonstrates that burnout is not simply an individual failing but rather the consequence of structural deficiencies in healthcare systems worldwide. Too often burnout interventions only target the individual factors and ignore the systemic issues.

This Research Topic includes a diverse set of healthcare workers, highlighting that burnout research must expand beyond physicians to include nurses, allied health professionals, and support staff. Understanding burnout across all healthcare workers is critical, as their wellbeing directly impacts patient care quality, team dynamics, and workforce retention. Tailored interventions are needed to address role-specific challenges and sustain the entire healthcare ecosystem.

Current conceptual frameworks distinguish wellbeing, resilience, and burnout as interrelated yet distinct factors in psychological adaptation and stress management. Wellbeing is defined by dimensions of purpose, autonomy, and personal growth; resilience is characterized as positive adaptation to adversity; and burnout is linked to emotional exhaustion and depersonalization arising from stressors. The National Academy of Medicine's conceptual model of clinician wellbeing and resilience identifies three core interconnected components that collectively influence health professionals' experiences. First, the external environment encompasses broader societal and systemic factors, including healthcare policies, regulatory requirements, and public expectations that shape workplace demands. Second, the work environment focuses on organizational and team-level elements such as workplace culture, administrative burdens, leadership practices, and clinical workflow inefficiencies that directly impact daily experiences. Third, individual factors account for personal characteristics like resilience, coping mechanisms, and life circumstances outside of work that mediate how clinicians respond to stressors. Critically, the model emphasizes the dynamic interactions between these components, illustrating how systemic pressures trickle down to affect individuals while individual wellbeing reciprocally influences organizational performance. By framing clinician wellbeing as a multi-level issue requiring coordinated solutions, the model moves beyond blaming individuals and instead highlights actionable leverage points across healthcare systems to foster sustainable resilience (3).

The Research Topic identifies several promising interventions to support healthcare workers' wellbeing. Mindfulness training, peer support groups, and gratitude practices all showed measurable benefits in reducing stress and burnout symptoms. Gao et al. showed that an online multimodal psychological support program effectively enhanced the psychological wellbeing and sleep quality of new ICU staff demonstrating the potential of off-line training in managing stress and improving health outcomes during crises. Similarly, Yang et al. showed that multi-media health education could reduce nurses' workload and enhance patient satisfaction but not increase complications. The findings of this study emphasize the importance of accessible, flexible psychological support, especially in high-stress environments such as ICUs during pandemics, natural disasters, and other emergencies.

Many studies emphasized individual level resilience building and coping. Positive religious coping was associated with reduced post-traumatic stress disorder symptoms and enhanced professional quality of life among nurses (Shiri et al.), however the systematic review by Bafna et al. and the rapid review by Frias et al., both highlight the need to target institutional culture and policy changes. Previous studies on workplace culture revealed that empathetic leadership and positive team environments significantly improve retention and job satisfaction. Practical solutions like optimized scheduling, telehealth integration, and AI-assisted documentation have emerged as effective ways to reduce administrative burdens. However, we caution that individual-level interventions alone are insufficient; the most effective approaches combine personal resilience-building with organizational changes especially in their culture. In an insightful study, included in this Research Topic, Zhang et al. identified power imbalance in the hospital dual management system as the main contributor of staff turnover. This finding is important as previous studies have calculated that nurse turnover costs hospitals ~\$50,000 per replacement, making wellbeing initiatives not just ethical but financially prudent investments (4).

Similarly, a more nuanced and targeted approach to different components of burnout may be needed. Gil-Almagro et al. showed that emotional exhaustion is one of the dimensions affected in the short term and intervention programs aimed at reducing anxiety and depression at times of acute stress (onset of the COVID-19 pandemic), including thought management, seem fundamental. However, depersonalization and decreased self-fulfillment do not seem to respond to the same pattern. They seem to be a long-term result of poor management of emotional exhaustion and environmental challenges (Gil-Almagro et al.).

Looking forward, this Research Topic of evidence points to several critical needs for sustaining the healthcare workforce. There is a strong consensus that policy-level changes are required, such as changes on organizational culture to prioritize safe staffing ratios, invest in team-based care models to distribute workloads, foster supportive leadership that promotes psychological safety and open communication and ensures access to mental health care. Policy-level changes, such as fair reimbursement and regulations limiting excessive work hours, are equally critical along with establishing national/international wellbeing standards. The studies also highlight important disparities, with low-resource settings facing greater challenges due to limited infrastructure. As healthcare systems continue to recover from the pandemic shocks, this Research Topic makes clear that prioritizing worker wellbeing isn't optional, it's fundamental to delivering quality patient care. The findings collectively argue for a new paradigm where healthcare worker wellbeing is embedded in institutional operations rather than treated as an afterthought.

Author contributions

MM: Writing – original draft. KWe: Writing – original draft. TB: Resources, Writing – review & editing. MC: Writing – review & editing. KWA: Conceptualization, Supervision, Writing – review & editing.

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EDITED BY

Kim Walker,
University of Aberdeen, United Kingdom

REVIEWED BY

Abdul Haeba Ramli,
Universitas Esa Unggul, Indonesia
Osnat Bashkin,
Ashkelon Academic College, Israel

*CORRESPONDENCE

Virginia Trigo
✉ virginia.trigo@iscte-iul.pt
Le Li
✉ 1521340097@qq.com

[†]These authors share first authorship

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Power imbalance in hospital dual management system and its impact on turnover

Manli Zhang^{1†}, Qianqian Guo^{1†}, Janak L. Pathak¹, Vian Ou²,
Le Li^{1*} and Virginia Trigo^{3*}

¹School and Hospital of Stomatology, Guangdong Engineering Research Center of Oral Restoration and Reconstruction, Guangzhou Medical University, Guangzhou, China, ²School of Health Management, Southern Medical University, Guangzhou, China, ³ISCTE University Institute of Lisbon, Lisbon, Portugal

Introduction: With the deepening of the healthcare reform in China, the competition in the sector is becoming fiercer leading to several unintended consequences such as talent turnover, which highly affect hospital development. Taking the case of a specialized university-affiliated stomatology hospital in Guangzhou, this thesis aims to analyze the main factors that contribute to talent turnover in this type of hospitals. The loss of talents in the field of stomatology is not unique to China and represents a significant problem in both developed and developing countries.

Methods: The data for the study were collected from *post facto* live interviews conducted with 21 resigners to understand their feelings and motivations after the passage of time. The data were coded and concepts refined using MAXQDA software to form 18 sub-categories and six aggregate dimensions leading to the construction of two theoretical models.

Results: The balance of power embedded in the dual leadership system characteristic of Chinese organizations and corresponding leadership style and behavior, deeply affect the turnover of talents. The more unbalanced the power, the greater the impact on turnover.

Conclusion: Based on the situation studied, a power imbalance allowed for individual behaviors that determined the development of the hospital and directly affected institutional fairness, culture, working atmosphere and ultimately led to turnover.

KEYWORDS

hospital dual management, power imbalance, turnover, grounded theory, empirical research

Introduction

In recent years, the relationship between doctors and patients has become increasingly tense, with frequent incidents of medical disputes, resulting in a declining sense of professional security among doctors. The continuous departure of medical personnel has further strained the already scarce human resources in health care, and has become one of the important factors restricting the development of health care in less developed areas (1). Excessive brain drain will lead to imbalance in the echelon structure, increase the replacement cost, and affect

the level and quality of medical services. With the full implementation of hierarchical diagnosis and treatment and multi-practice system, the channels for medical talents to choose employment and career are more open and diversified, and the free flow of talents has become a “new normal” in today’s society (2). If the medical industry wants to be invincible in the fierce competition, it all depends on whether the hospital has a highly competitive professional talent and an efficient and reasonable medical talent ladder. University-affiliated hospitals are affiliated with universities and are responsible for medical care, teaching and research (3). University-affiliated specialty hospitals are generally the hospitals with the highest level of specialty care in the region, and are a talent-intensive organization. University-affiliated specialized stomatology hospitals are generally managed as stomatology hospitals, schools of stomatology, and institutes of oral diseases, and are responsible for stomatology work, teaching, postgraduate training, and scientific research. This study takes university-affiliated stomatology specialty hospitals as the research object, and combines relevant actual cases to conduct a grounded theoretical and empirical study.

Research about turnover started to appear more consistently in the 1960s and 1970s with its determinants being the most concerned topic (4), specifically the factors leading to voluntary turnover. Early research by March (1958) indicated two factors (5)—turnover intention and the ease of turnover—followed by the psychological changes proposed by Mobley (6) and the unfolding model of voluntary turnover proposed by Lee (1996, 1999), along with social capital theory or cultural factors (7). Generally speaking, scholars have achieved remarkable achievements in the field although there is still not a consistent agreement about why employees leave the organization voluntarily and the discussion continues.

The study of turnover started late in China and is still a relatively weak field. Chinese scholars have mainly analyzed the issue from quantitative and qualitative aspects. In terms of quantitative studies, scholars discuss the issues from two perspectives: one is the study of the effect of demographic and career variables on turnover, verified in specific groups; the other is to explore the applicability of Western models among Chinese employees, and then revise the model based on research results. In turn, qualitative research in China reviews the mainstream models and theories done by Western scholars and puts forward relevant suggestions and measures. Chinese scholars’ research on turnover was mainly focused on reviewing mainstream Western turnover models. After 2005, Chinese scholars began to discuss the applicability of mainstream Western turnover models to Chinese organizations and to conduct endogenous empirical studies.

Grounded theory, as an inductive qualitative method, allows researchers to identify the main concerns of a group of subjects and the behaviors used to address them (8). It enables researchers to have a deeper understanding not only of the main concerns but also of accumulated concerns experienced by participants and possibly to develop a theory that captures their behavior (8).

The General Office of the CPC Central Committee issued the Opinions on Strengthening Party Building in Public Hospitals in 2018 (9). The opinions made it clear that the president of a public hospital takes responsibility under the leadership of the Party committee, and, in the case of a grade 2 hospital or above, he or she cannot concurrently serve as the Party secretary. To integrate the leadership of the Party in hospital governance, the president and the secretary of the Party committee shall be two people respectively, one in charge of hospital

administration and the other in charge of hospital Party organization leadership.

If we compare the hospital to a ship, the Party committee is the helmsman of the ship, and the president sails the ship. The division of labor is clear: the helmsman directs the ship and keeps it on the right course; the rowers are responsible for keeping the boat powered. The president’s responsibility system under the leadership of the Party committee should be well implemented so that the Party committee and the president cooperate closely and complement each other. On the contrary, if any one of the parts is missing, the ship will fail to sail in the right direction. This system highlights the centralized discussion by the Party committee and the combination of collective leadership and individual responsibility, which avoids personal preference and favors “one word” in the decision-making of major issues.

Based on reviewing the existing qualitative interview and grounded theory literature on the influencing factors of employee turnover intention in the medical and health industry, this paper aims at understanding and uncover the causes of brain drain and find the related concepts and categories to construct a theoretical model.

Methods

This study takes the case of one specific hospital in Guangzhou to examine the research problem: the brain drain that is afflicting Chinese hospitals in general, and Chinese stomatology hospitals in particular. The study follows a case study approach and adopts qualitative methods to analyze and explore the influencing factors that affect the brain drain in the hospital. Data were collected from interviews and analyzed with the help of grounded theory. Twenty one interviews were selected among the 237 leavers who quit the hospital from 2013 to 2020. They are the talents who are the subject of this thesis that is professionals and managers with MSc or Ph.D. degrees from different positions, titles, and ranks.

The research object

Since the reform and opening up of China, with the growing demand for oral healthcare services among Chinese nationals, dental hospitals across China have developed rapidly. The mode of coexistence of public stomatology hospitals, Chinese-foreign joint venture hospitals, private hospitals and individual medical institutions with various modes of operation has gradually taken shape, and this mode is dominated by public stomatology hospitals. Public stomatology hospitals, with public welfare as their purpose, are the main concentration of medical resources such as medical technology, equipment, and talents, and have strong comprehensive advantages in the treatment of difficult diseases, medical research, and education and training, and are able to provide a full range of medical services.

The hospital under study is a municipal tertiary-level A-class dental specialty hospital integrating medical treatment, teaching, research, prevention and health care. The hospital is ranked in the upper-middle level in the 2023 Chinese National Performance Assessment for Tertiary Public Hospitals, which is universally representative.

The hospital lost a total of 237 people in 8 years from January 2013 to December 2020, with senior titles, formal staffing and young and

middle-aged talents as the main targets of loss, and the talent loss showed an increasingly serious trend.

Research process

As this study seeks to understand the full range of factors that influence dental talent turnover and the grounded theory provides a good method to explore the field of healthcare, this thesis follows this approach. In a grounded theory approach, the researcher first asks a specific question, which leads to the development of other concepts in the research topic. Specifically, the researcher asked dental professionals how they felt about leaving, and then, building on their answers, came up with more ideas and topics. This means that research questions are asked and answered with a focus on specific situations of specific people at specific times and places, based on participant data.

Research design

The subject of this study lost 237 talents during the period from January 2013 to December 2020. As this study focuses on the departure factors of high-level talents, the researcher selected the exit interview data of 83 leavers, that is all those with MSc degrees or above among the 237 professionals who left the hospital during that period.

To gain a deeper understanding of the real reasons why high-level talents leave their jobs, in-depth interviews need to be carried out with the goal of theoretical saturation. In 2022, a second round of face-to-face interviews was conducted with 21 high-level talents out of the initial group of 83. Based on the principle of information saturation, the richer and more diverse the information is evaluated, the more information each person represents, and the fewer in-depth interviewees are needed (10). Theoretical saturation is reached when every code in the group is observed at least once (11). Similarly, qualitative inquiries are sufficient to meet the needs of the research topic through generalization as long as the “maximum variance information saturation” is relatively achieved (12).

The study conducted in-depth interviews with people in different positions, job titles, and ranks to achieve information saturation after initial analysis of textual information from exit interviews with 83 people. The final number of in-depth interviews was 21.

The in-depth interview data of 21 people were used as the core data of this study for coding analysis and theoretical exploration research. The interviews were conducted from 5 December to 30 December 2021, at the case hospital. The average age of the interviewees was 42.6 (age span of 32–56) and some of the interviewees had been working in the hospital for several years, especially some who had been in management positions for up to 10 years and had a better understanding of the deeper issues in hospital management. This paper used MAXQDA20.0 for coding and qualitative data management and analysis of the collected interview records and materials. The data obtained from the interviews were loaded into MAXQDA software.

The first step was open coding to conceptualize and scope of the data to obtain the initial concepts or categories; the second step was axial coding to classify, compare and extract different concepts or categories so as to obtain the main themes. In the third step, selective coding was carried out to extract the core categories that could unify

all concepts by continuously comparing the relationships between different main concepts or categories.

Analysis of the coding process and results

The interview notes were arranged and imported into MAXQDA software for coding resulting in a total of 113 open coding that were collated and refined to form 18 sub-categories. At the end of the three levels of coding, six categories were finally formed (see Figures 1, 2). These categories all point to the factors of brain drain that is the subject of this research as it is detailed below.

Category 1: personal factors

Analyzing the data, the four categories “financial stress,” “emotional factors,” “family responsibilities” and “pursuit of self-worth” were aggregated into the main category (theme) “personal factors” (see Figure 3). “Financial pressures,” “emotional factors,” and “family responsibilities” are the result of individual decisions and events that surround the individual. The “pursuit of self-worth” is related to self-awareness, which is the basic intrinsic drive for self-actualization in most people (13).

From Figure 4, it can be concluded that the pursuit of self-worth is mentioned as 100% of the personal factors showing that high-level talents are particularly focused on this pursuit which includes many aspects. Young doctors who have just joined the profession are highly educated, have strong personalities, are free-spirited, face up to injustices and grievances, complain when they are unfairly treated, and seek to achieve self-fulfillment by changing their work environment to one of greater possibilities of development (14).

Category 2: hospital culture

It can be concluded that when discussing hospital culture, 100% of the departed employees mentioned work atmosphere, and 71.4% mentioned work pressure.

Respondents perceived the working atmosphere in the hospital as oppressive. The ability of employees to express their opinions and participate freely and forcefully in the management decision-making process and the ability of the organization to create a good organizational climate for decision-making activities are important prerequisites for reducing employees' willingness to leave (7, 15). The work atmosphere affects employees' creative energy and commitment to work. A depressing work atmosphere can cause a constant brain drain and affect the stability of the workforce (Figures 5, 6).

Category 3: hospital system

From Figures 7, 8 it can be seen that, according to the interviewees, the hospital system is mainly influenced by three sub-categories: system fairness, organizational support and promotion opportunities. Of the 21 departed employees who were interviewed in depth, 82.4% mentioned system fairness, 52.9% mentioned organizational support,

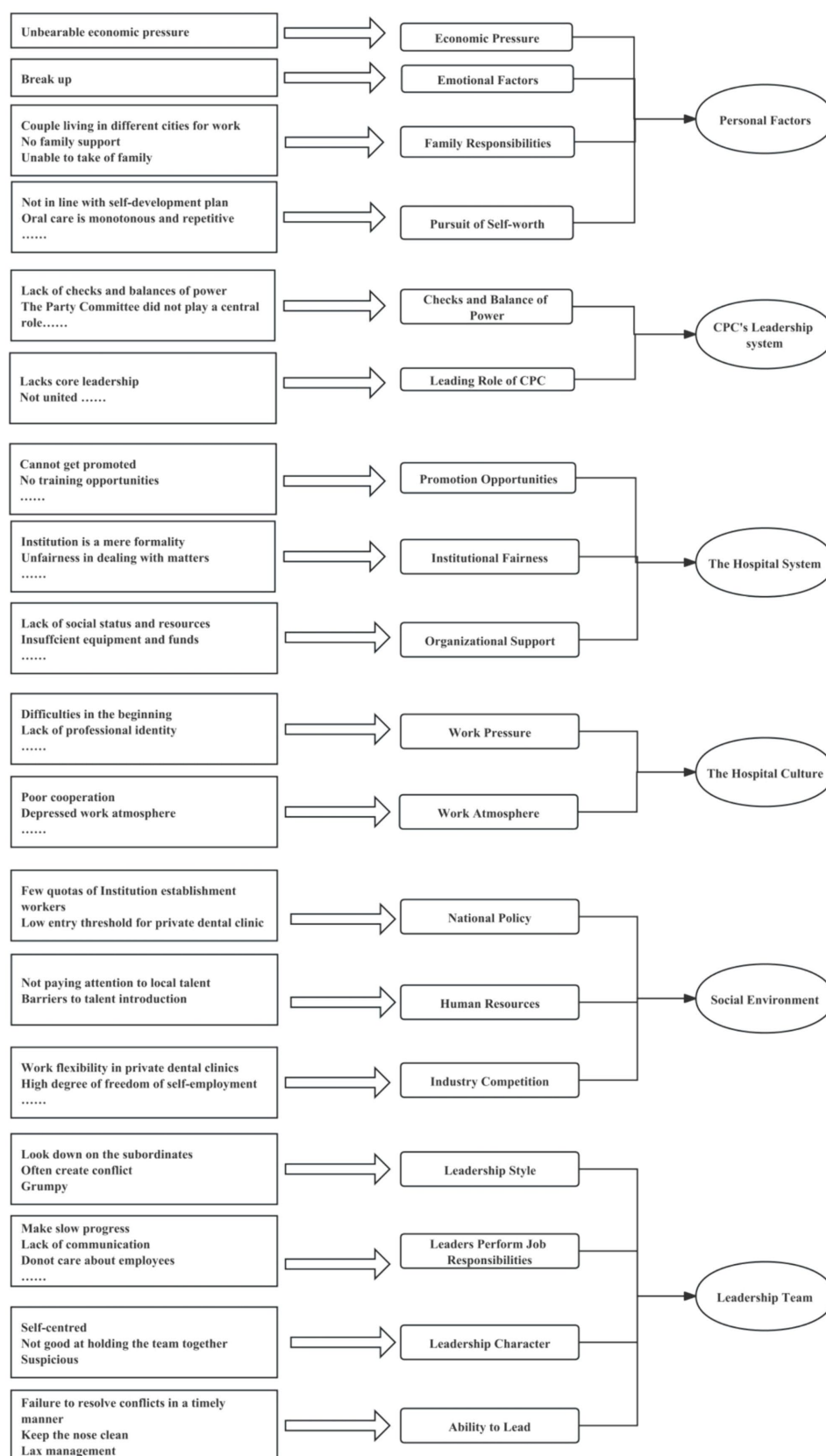
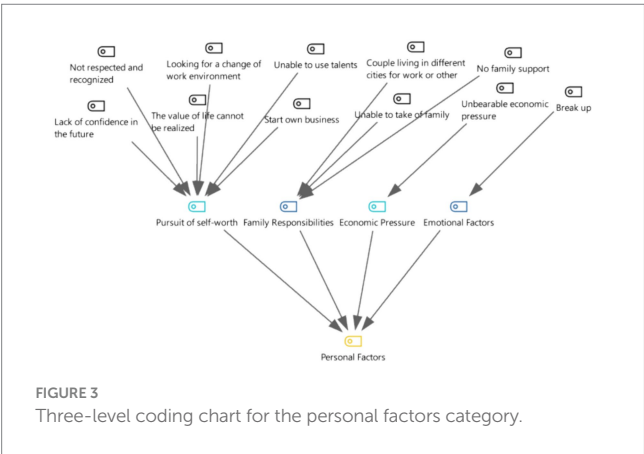
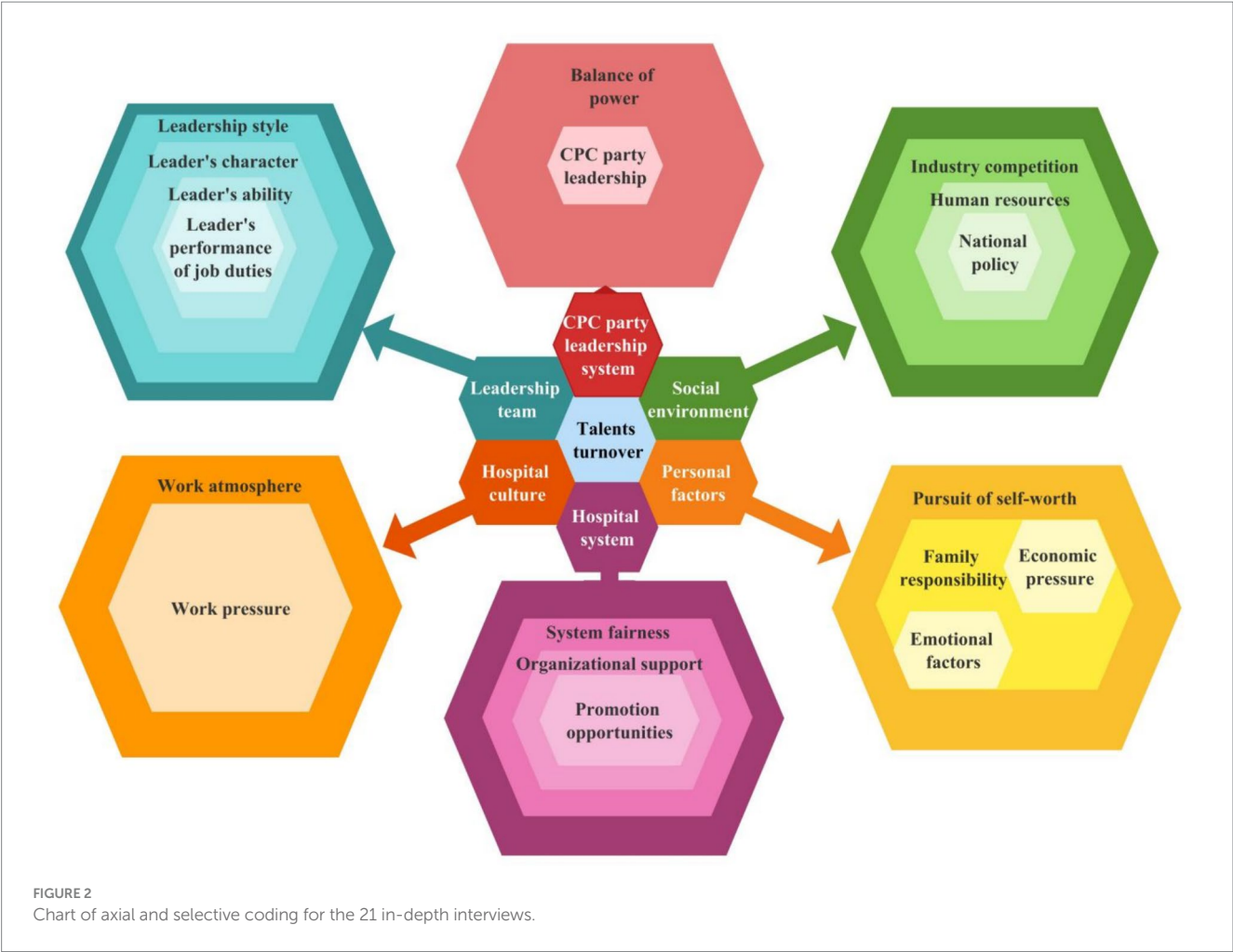


FIGURE 1
Three-level coding chart for 21-person in-depth interview data.



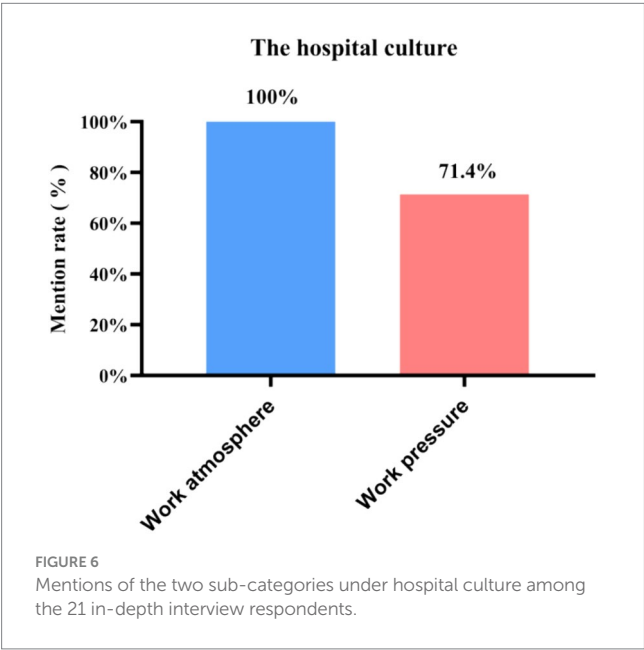
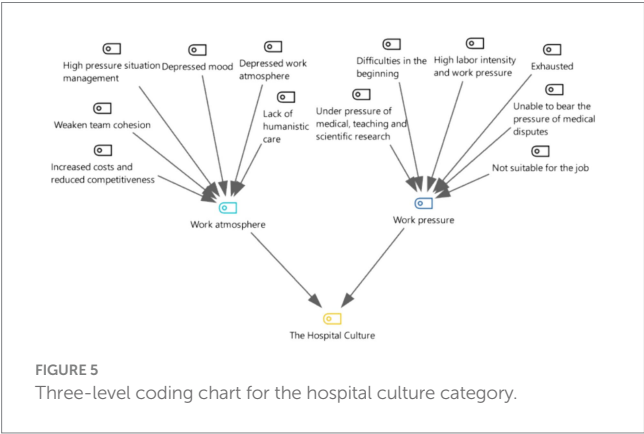
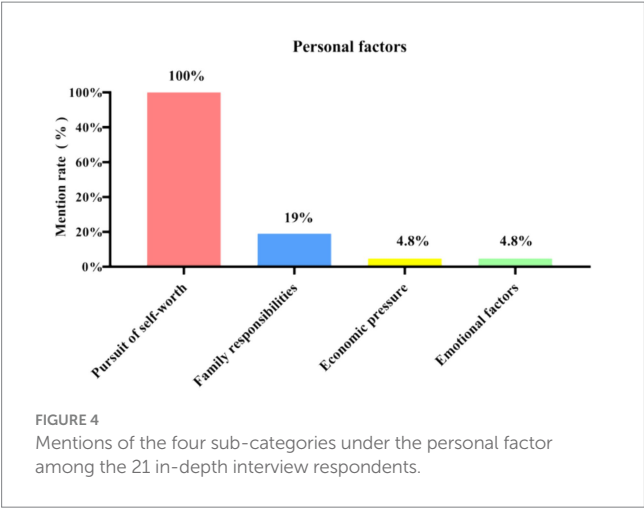
and 35.3% mentioned promotion opportunities as the main sub-categories within the hospital system.

A lack of fair trust in an organization can lead to lower job satisfaction and willingness to leave (16). Respondents mentioned that the implementation of a system in the case hospital is just a formality, which hurts the relationship between the hospital and employees, and is one of the important reasons for the brain drain.

Category 4: social environment

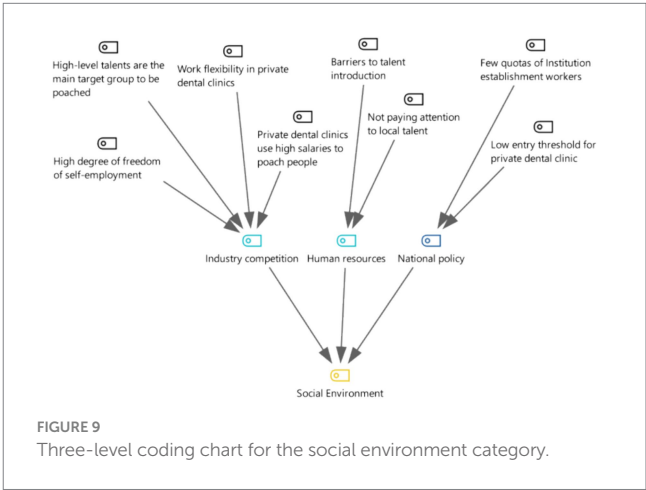
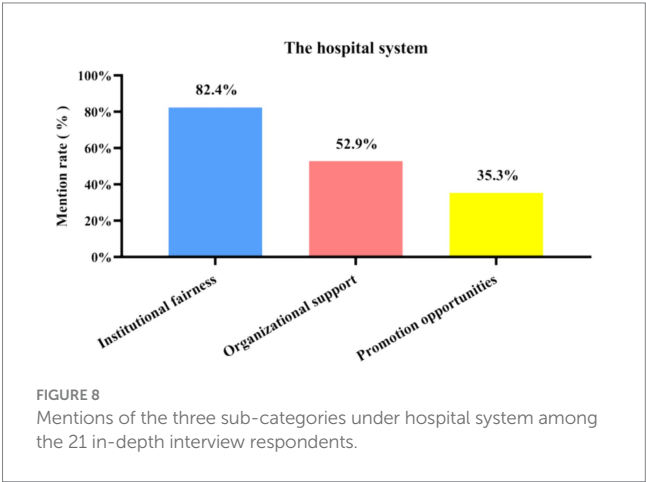
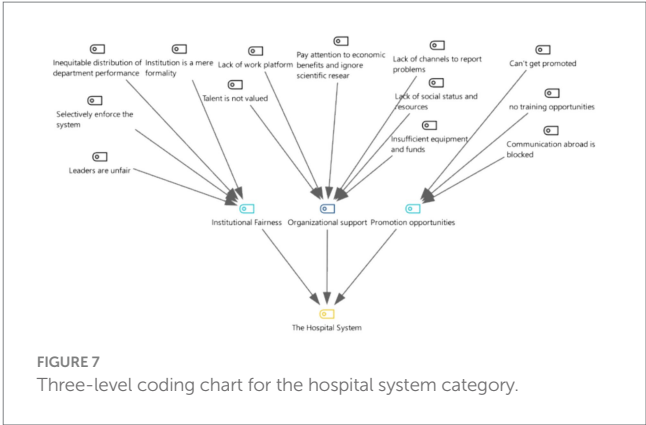
Departures are closely related to the number of existing firms outside the organization and that the more competitors and opportunities there are in the industry, the more likely it is for employees to leave (5, 17). Industry competition and the introduction of national policies will affect the loss of talent to a certain extent.

From Figures 9, 10, it can be concluded that the main factors affecting the departure of high-level talents in the social environment are industry competition (81.3% of mentions), human resources (31.3%), and national policies (12.5%). Industry competition means the threat that private dental clinics pose to public dental hospitals. On the one hand, private dental clinics have better working conditions; on the other hand, they tend to use high salaries to poach high-level talents from public dental hospitals. The sub-category “human resources” indicates that, according to the interviewees, the hospital did not pay attention to local talents and set obstacles to bringing in new talents. In turn, interviewees also mentioned that national policies contributed to the social environment by restricting quotas for tenured employees at public hospitals and lowering the requirements for the establishment of private dental clinics.



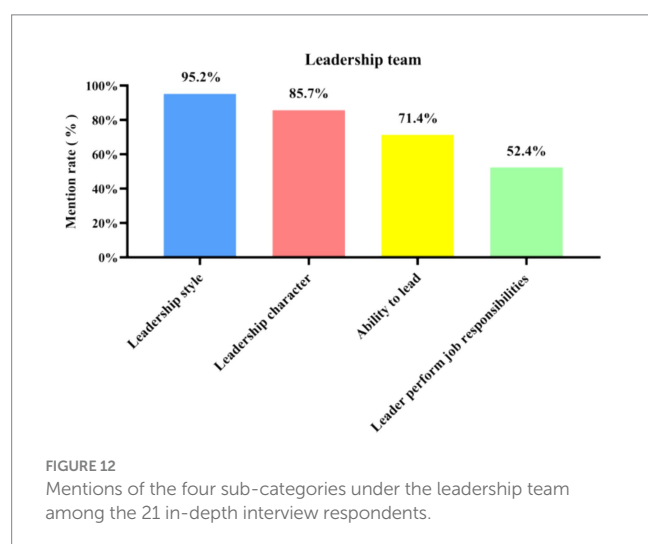
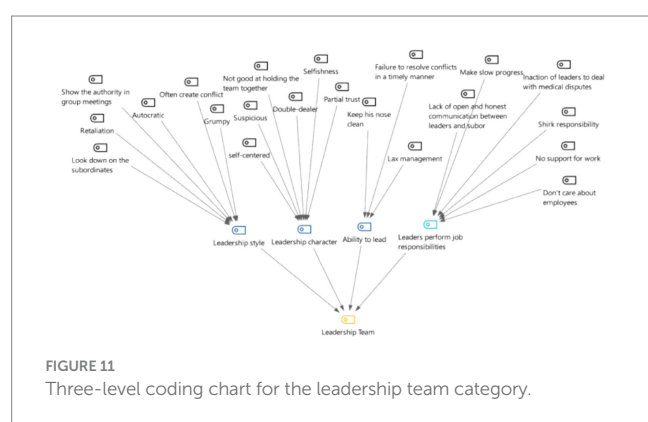
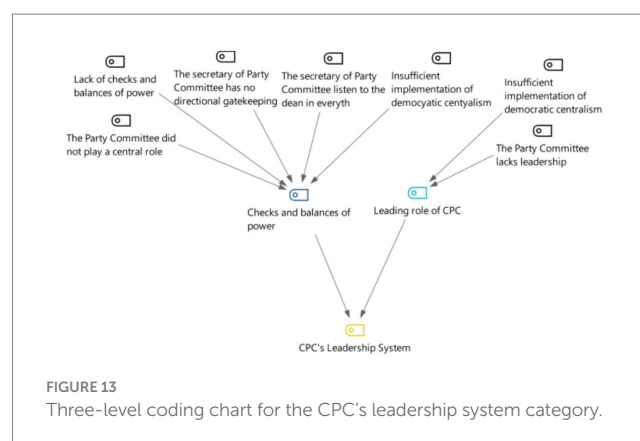
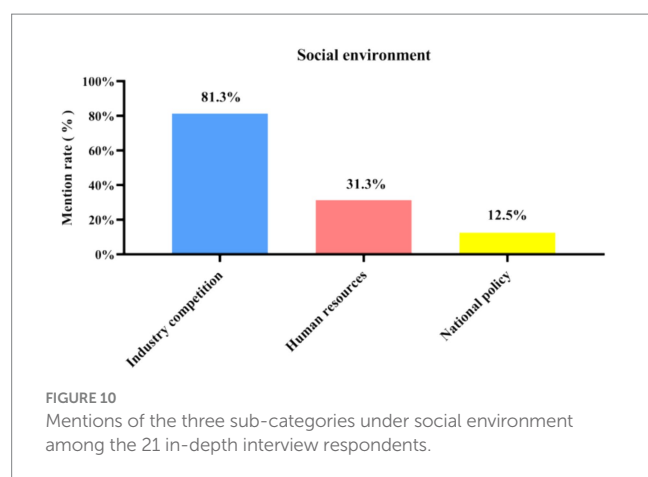
Category 5: leadership team

Ineffective leadership can lead to job dissatisfaction and negativity, which in turn can spur turnover. In the medical sector, the management



style is also directly related to patient outcomes, regardless of work experience (18). The mission of managers is to develop employees and build effective teams, rather than imposing their work on themselves, overstepping their responsibilities, and participating in everything (19). Instead, they should motivate employees to participate in the management of enterprise objectives so that employees can be most motivated toward reaching the same goal (20).

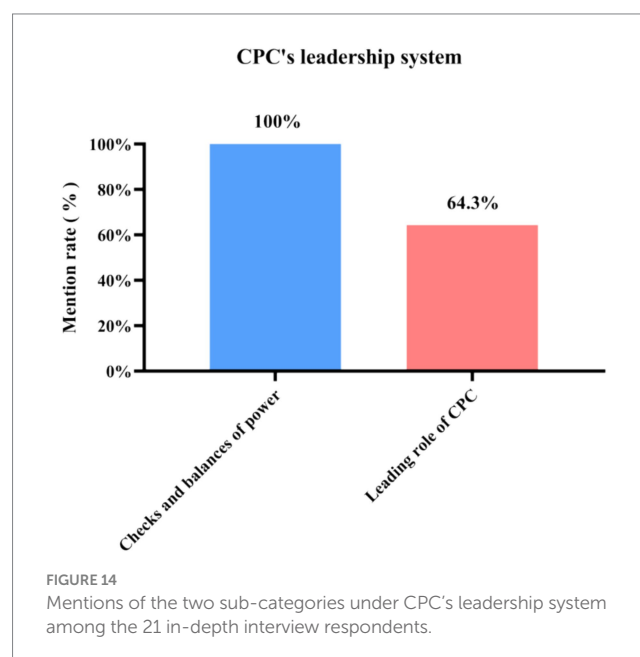
From Figures 11, 12, it can be concluded that, according to the interviewees, the influencing factors in the leadership team are



leadership style (95.2% of mentions), leadership character (85.7%), leader's ability (71.4%), and leader's performance of job responsibilities (52.4%).

Category 6: CPC's leadership system

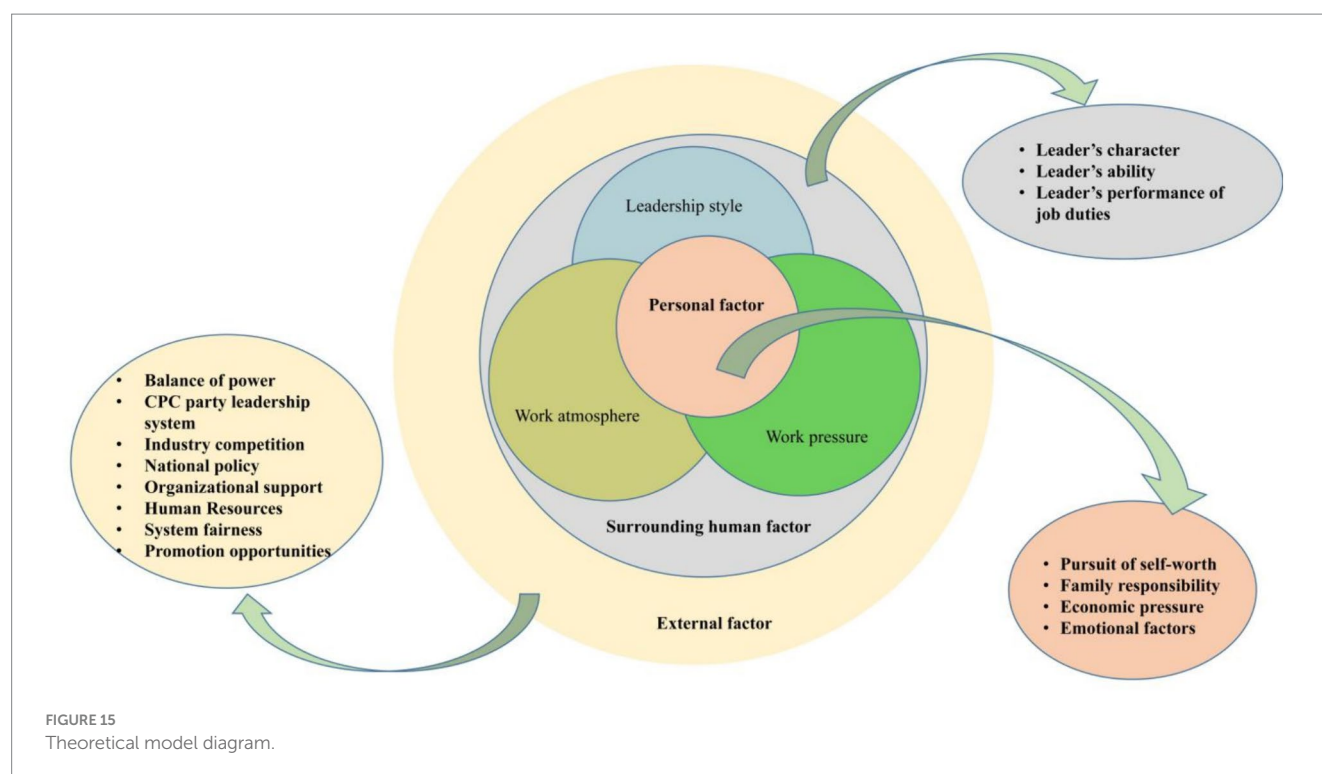
From Figures 13, 14, it can be concluded that the influencing factors in the party's leadership system are power checks and



balances and the leading role of CPC. In the interviews, “checks and balances” were mentioned 100%, and the leading role of CPC was mentioned 64.3%. In terms of the leading role of the CPC, respondents mainly cited the lack of leadership of the Party committee and the disunity of the leadership teams in the hospital studied. In terms of checks and balances of power, the interviewees mentioned that the Secretary of the Party committee followed all the instructions from the President and did not play the role of gatekeeper and supervisor. The dual management system did not follow the principle of democratic centralism and lacked checks and balances of power.

Discussion

The importance of different categories was compared and explored and finally divided into six categories (aggregate dimensions): “personal factors,” “hospital culture,” “hospital system,” “social environment,” “leadership team,” and “CPC leadership system.” These categories were derived from the relationships among the factors mentioned by the interviewees that



first generated key sub-categories and, after further coding, gave way to the main categories above.

The relationship among these categories was analyzed as the theoretical basis for this study and divided into the following three parts (Figure 15).

- External factors are represented in the external ring of the figure and relate to the system and environment (national policy and industry environment); the Party leadership system (checks and balances of power and leadership); and the social environment (fairness and organizational support).
- Surrounding factors are represented in the middle ring and concern the leadership team and hospital culture, namely work pressure and work atmosphere.
- Personal factors are shown in the internal ring and include the pursuit of self-worth, family responsibility as well as other personal and economic factors that interact with one another.

External factors directly influence surrounding factors, which in turn affect the hospital system. The hospital system and the social environment also directly affect personal factors, which interact with the leadership of the Party system. If there is a mismatch between the core of personal factors and the feedback from other factors, this will directly lead to personnel turnover.

In the above 18 categories, the mentioned rate of power checks and balances in the interview is 100%, the mentioned rate of leadership style is 95.2%, the mentioned rate of system fairness is 82.4%, the mentioned rate of work pressure is 100%, and the mentioned rate of work atmosphere is 71.4%. As a key factor in the model, the relationship between key factors will be explored by combining the expression relationship between relevant factors in relevant literature and interview materials, and the relationship structure of demission

factors. In this study, through in-depth communication with the respondents, it can be concluded that the imbalance of power in the dual management system leads to the overbearing personal style of the leaders, which affected the working atmosphere of the hospital and led to great pressure on the employees and to the high turnover of talents. This suggests that there is a close relationship between the right balance and leadership style, between leadership style and job stress, between leadership style and system fairness, between work stress and achieving personal self-worth, and between the working atmosphere and employee turnover. Through detailed analysis, the relationship among different factors is hereafter discussed.

The balance of power and leadership style

The “checks and balances of power” category is layered down from five initial concepts in the 21 in-depth interviews represented by statements such as: “the Party secretary has no checks on the power of the president,” “the Party secretary has not used his power well,” “the Party committee failed to play a central role,” “the principle of democratic centralism was not implemented,” and “the power of checks and balances is lacking.” The idea of checks and balances of power was born in the works of the Greek historian Polybius (c. 200 – c. 118 BC), evolved into the theory of the “separation of powers” in the Middle Ages, continued through the Renaissance, and into the Western bourgeois revolution, and played an important role in promoting the progress of human political civilization. Excessive concentration of power will inevitably lead to the formation of absolute power lacking necessary supervision and restriction, which makes the abuse of power uncontrolled, and the internal governance easily taken over by individuals or a few people (21). The system of checks and balances avoids power concentration and abuse and fully

reflects the existence of harmonious leadership behavior in a dual management system.

Some scholars have raised the question of whether the checks and balances of power can be used in the case of senior executives to restrain the power of the CEO and prevent the execution of risky projects for personal interests that may damage corporate value. For example, the stronger the balance of power of the management, the more it can prevent the abuse of power of the chairman or general manager and further optimize the investment decisions of enterprises. There is a direct causal relationship between the balance of power as a system and the leader's behavior, and the imbalance of power is more likely to lead to the abuse of power.

The category "leadership style," also frequently mentioned by respondents, refers to the unique and habituated behavior formed by leaders after long-term leadership practice and is closely related to the ruling environment of leadership. Besides internal factors, the formation of a leadership style is also related to the institutional environment.

In China, the president's responsibility system under the leadership of the Party committee is implemented as a dual management system, and the authority of the president and the secretary of the Party committee is divided. The president's responsibility system means that not all the power is concentrated in the president's hands. The Party organization is the "core of leadership" and the one that discusses and makes decisions on major issues. Once the leadership of the Party organization is weak, the power of the president will expand rapidly creating internal deficiencies. Then, the president's responsibility system will become "the president's system" and the leadership style of the president will be more and more arbitrary and overbearing. Therefore, power imbalances can lead to changes in leadership styles.

Leadership style and work stress

According to the interviewees, the leadership style in the case hospital at the time of their tenure is one of the 18 sub-categories extracted from the 21 in-depth interviews. Leadership has different standards and characteristics including the abusive leadership style that matches the concepts raised by the interviewees (22). As they described, in abusive leadership styles, employees are often subjected to malicious verbal attacks and non-verbal behavior from their leaders. It is a typical negative leadership behavior, which brings a series of negative effects, including a significant negative impact on employees' daily work and family life. On this basis, emotional management and emotional guidance to reduce employees' work stress are proposed to solve the adverse effects caused by abusive leadership styles (23).

As an important factor of organizational characteristics and the main source of employees' emotions, in the process of getting along with their subordinates, too strong a leadership style as well as the arbitrary exercise of power through aggressive attitudes to impose their will on employees, will affect their emotions and work enthusiasm. In this environment, employees are always in a tense state and the communication between superiors and subordinates is not smooth leading to high work pressure. Sincere leadership style and empathy are moderating factors in the effect of work stress on work quality, and help to alleviate negative impacts.

Leadership style and institutional fairness

Institutional fairness is a sub-category that emerged from the 21 in-depth interviews and contributes to the aggregate dimension (category) designated as "hospital system." We understand it as a kind of organizational justice from the perspective of individuals. Organizational justice refers to the perception of fairness created by rules, regulations, basic policies, and effective measures in the organizational structure of a social group. To some extent, ensuring organizational justice is the result that all social organizations should strive to achieve. Specifically, the building of organizational justice comes from three sources: institutional fairness, distributional fairness, and communication fairness. The leader's impartiality, recognition, attention, and respect for subordinates can enable employees to maximize their release of energy.

The hospital system is the code of conduct of all staff and the embodiment of hospital management philosophy, thoughts, and mode, which will be related to the rise and fall of hospital survival. Every regulation needs to be established based on equal treatment, everyone is equal before the system, which is conducive to the healthy development of the hospital. If the leadership style is dictatorial, it will destroy the fairness of the system to safeguard the interests of one individual or small groups. An abusive leadership style will destroy communication fairness and, if in the process of work communication, the leader abuses the authority role to put pressure on the subordinate, he or she does not give basic respect to the subordinate. Likewise, in the process of information transmission, if the information is not balanced enough and is selectively delivered to specific groups, this will affect the employees' sense of fairness. The above concepts reflect the unfair implementation of the main leadership system in the case hospital, which is conducive to a lack of fairness in the system.

Work stress and personal self-worth

Work stress is a sub-category resulting from 10 initial concepts in the 21 in-depth interviews: "profession and post do not match," "working the night shift is difficult," "entrepreneurial hardships," "labor intensity and working pressure," "medical treatment, teaching, scientific research, and comprehensive development create high pressure," "poor conditions," "occupational identity is not strong," "exhaustion of body and mind," "cannot adapt to work," and "difficult to face medical disputes under pressure." As employees pay more attention to their career success and the realization of their value, related studies have shown that work stress is negatively correlated with professional identity and that individual components of work stress such as organizational management, career interest, and career development are also negatively correlated with professional identity (23).

The rationality of the organizational system has a great influence on the professional identity and turnover intention of clinicians and unreasonable management often reduces their job satisfaction. In addition, an incomplete cognition of a career, vague direction, or lack of interest in career development will lead to low professional identity. This was particularly sensed during the interviews when one department director said that he felt that going to work was like going to prison, an everyday struggle under huge working pressure. He had to leave to get out of trouble. Those

employees interviewed both in the exit and post-facto interviews confessed to having faced great work pressure, and physical and mental exhaustion. Under the dual role of work pressure and psychological intolerance, employees lacked a sense of belonging, felt lonely and dissatisfied, and lacked security, all of which inevitably produced corresponding value judgments that manifested in new career choices.

The working atmosphere and talent turnover

The category working atmosphere emerges from 14 initial concepts in the 21 in-depth interviews: “creates feelings of loss,” “interpersonal complexity,” “weakens team cohesion,” “shakes people up,” “affecting the stability of the team,” “poor image of the hospital,” “increasing costs,” “reduced competitiveness,” “depressed working atmosphere,” “depressed mood,” “restrictions,” “lack of humanistic care,” “lack of cohesion and centripetal force,” “marginalized,” “forced resignation,” and “high-pressure situation management.” To a large extent, work atmosphere refers to the psychological environment of organization members, which is the consensus generated by most people after internalizing the same type of environment. The work atmosphere is a hidden soft power that can make people happy or unhappy and affect work efficiency. A bad working atmosphere makes people feel depressed, and emotionally exhausted, with a lack of belonging those results in job burnout, turnover intention, and eventually in turnover.

When members trust their team, they will have positive expectations about the attitude and behavior of others in the team, and then feel secure (24). On the contrary, if team members generally have low trust in the team, they will become depressed due to a lack of security. When the work atmosphere is negative, employee mentality and team spirit are inevitably passive. The interviewees fully reflected the dull atmosphere in the hospital: they had no sense of belonging and pride, lost confidence in the future, and finally chose to leave.

From these five relationships, it is concluded that: power checks and balances affect the leadership style, the leadership style affects leadership behavior, and leadership behavior affects employee turnover. The more imbalance of power, the more prominent the personal style of the leader, and if the personal style is tyrannical, the greater the impact on employee turnover.

The balance of power in the case hospital affected leadership style, and the leadership style affected the leadership behavior, which in turn affected employee turnover. In a dual management system, the more unbalanced the power, the more prominent a leader's style is. If the personal style is bossy, the greater the impact on employee turnover.

Based on the Chinese context, in a dual management system characterized by the general responsibility of the director under the leadership of the Party committee, there is a great possibility of power division between the Party affairs and administrative leaders. Checks and balances refer to the existence of forces within or outside public political power that counterbalance the subject of power. Such forces often determine the leadership team's ability to take the overall situation and seek development. If there is a power imbalance, the leadership team may have a situation in which individual behavior determines the development of the organization. In this case, the

personal style of the leader directly determined the institutional fairness, hospital culture, and working atmosphere of the hospital, and these factors directly affect the overall demission of talented hospital staff.

The case of the hospital studied reflects the conclusion of the above empirical research. Because the Party committee did not play a central role, the power imbalance between the Party secretary and the president occurred affecting the hospital culture and leading to brain drain.

Conclusion and suggestions

Upon the results of previous research and the analysis of this thesis, it can be concluded that the most important factors affecting the demission of employees are organizational factors. In the case hospital, only by optimizing the related system of the organizational structure, can we further reduce the demission rate. Although there are various reasons for the problem, both the data and the literature point out the failure of checks and balances of power which directly leads to feelings of insecurity and chaos (25). The key to an effective balance of power lies in the separation of powers in a legitimate way, to balance power with power, and safeguard rather than damage the legitimate interests of the people.

In organizations in China, the dual management system, comprising the President's responsibility system under the leadership of the Party Committee, is meant to prevent the abuse of power sustained by a solid ideological and moral defense line. The most fundamental ideological requirement for the realization of checks and balances of power is to adhere to the concept that “power is granted by the people and used by the people.”

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by Medical Ethics Committee of the Affiliated Stomatological Hospital of Guangzhou Medical University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MZ: Data curation, Investigation, Writing – original draft, Writing – review & editing. QG: Methodology, Visualization, Writing – original draft, Writing – review & editing. JP: Conceptualization, Formal Analysis, Writing – original draft. VO: Resources, Writing

– review & editing. LL: Methodology, Software, Writing – review & editing. VT: Conceptualization, Data curation, Methodology, Resources, Supervision, Writing – original draft, Writing – review & editing.

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Conflict of interest

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Ruth Strudwick,
University of Suffolk, United Kingdom

*CORRESPONDENCE

Ali Ibrahim Shorbagi
✉ ashorbagi@sharjah.ac.ae

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Promoting resilience among medical students using the Wadi framework: a clinical teacher's perspective

Ali Ibrahim Shorbagi*

Department of Clinical Sciences, College of Medicine, University of Sharjah, Sharjah, United Arab Emirates

Resilience is essential for medical students to navigate the challenges of their education and future careers. Defined as the ability to adapt well in the face of adversity, resilience can be learned and is critical for maintaining mental health. Medical educators play a pivotal role in fostering resilience by integrating it into both formal and informal curricula, including the hidden curriculum, which can significantly influence students' coping strategies. Research highlights the importance of resilience training in reducing depression and anxiety among students, underscoring its necessity as a core component of medical education. This essay presents the Systematic Assessment for Resilience (SAR) framework, which provides a comprehensive approach to promoting resilience through four key constructs: self-control, management, engagement, and growth. Practical strategies for each construct are discussed, including assessment mapping, time management, and the use of formative assessments to enhance students' preparedness and self-control. Engagement is fostered through collaborative assessments, open book exams, and regular formative feedback, while growth is encouraged via self-reflection and faculty development. Implementing the SAR framework has shown positive outcomes, with students reporting reduced anxiety and improved performance. However, further exploration and institutional support are needed to fully integrate these strategies into medical education. The SAR framework offers a feasible and effective method for cultivating resilience, contributing to students' mental well-being and equipping them to face future challenges in their medical careers. Continued refinement and broader institutional adoption will be crucial to sustaining the impact of resilience training in medical education.

KEYWORDS

SAR framework, resilience, health professions education, test anxiety, student wellbeing

Introduction

Resilience is defined as the process of adapting well in the face of adversity, trauma, tragedy, threats, or even significant sources of stress (1), and has been described in health professions education as the ability to cope with adversity that can be learned (2). Recent studies suggest that medical educators have a unique role in fostering resilience by integrating it into both formal and informal curricula (3). Furthermore, the hidden curriculum, which includes the unspoken or implicit messages conveyed through the learning environment, can significantly influence students' resilience (4). Integrating resilience training into the medical curriculum can help students develop the necessary coping strategies to navigate the pressures of medical education (5).

The role of resilience in managing mental health among medical students is particularly important, as highlighted by cross-sectional studies showing that resilient students report

lower levels of depression and anxiety (6). These findings underscore the need for resilience training to be a core component of medical education programs.

As an educator deeply invested in the holistic development of medical students, I recognize the immense pressures they face and the critical need for resilience in navigating these challenges. The Systematic Assessment for Resilience (SAR) framework developed by Wadi et al. (7) offers a comprehensive approach to fostering resilience by enhancing self-control, management, engagement, and growth among students (Figure 1). A practical guide to using the SAR framework is depicted in Table 1. This essay outlines my perspective on promoting resilience using the SAR framework, drawing from practical strategies I have implemented and insights gained from the framework's application (8).

Self-control: empowering students to govern themselves

The first construct of the SAR framework, self-control, emphasizes students' ability to govern themselves and face adversity. To promote

self-control, it is essential to create an environment where students feel supported and empowered. Here are some strategies:

- 1 Assessment Mapping and Blueprinting:** Sharing detailed assessment maps and blueprints helps students understand the scope and expectations of their evaluations. As the coordinator of the Internal Medicine clerkship, I have ensured that blueprints for written exams and rubrics for clinical assessments are readily available on the Learning Management System (LMS), Blackboard Ultra. This guides students to focus on core topics and prepare effectively. Using course booklets and electronic platforms, I have made assessment rubrics available and directed students to these resources during orientation sessions.
- 2 Time Management and Study Skills:** Providing resources on time management and effective study techniques is crucial. I have shared links to relevant YouTube videos and conducted academic advising sessions to support students with low performance, helping them develop better study habits and manage their time efficiently. Platforms like WhatsApp have been useful for sharing text advice and resources. I have also

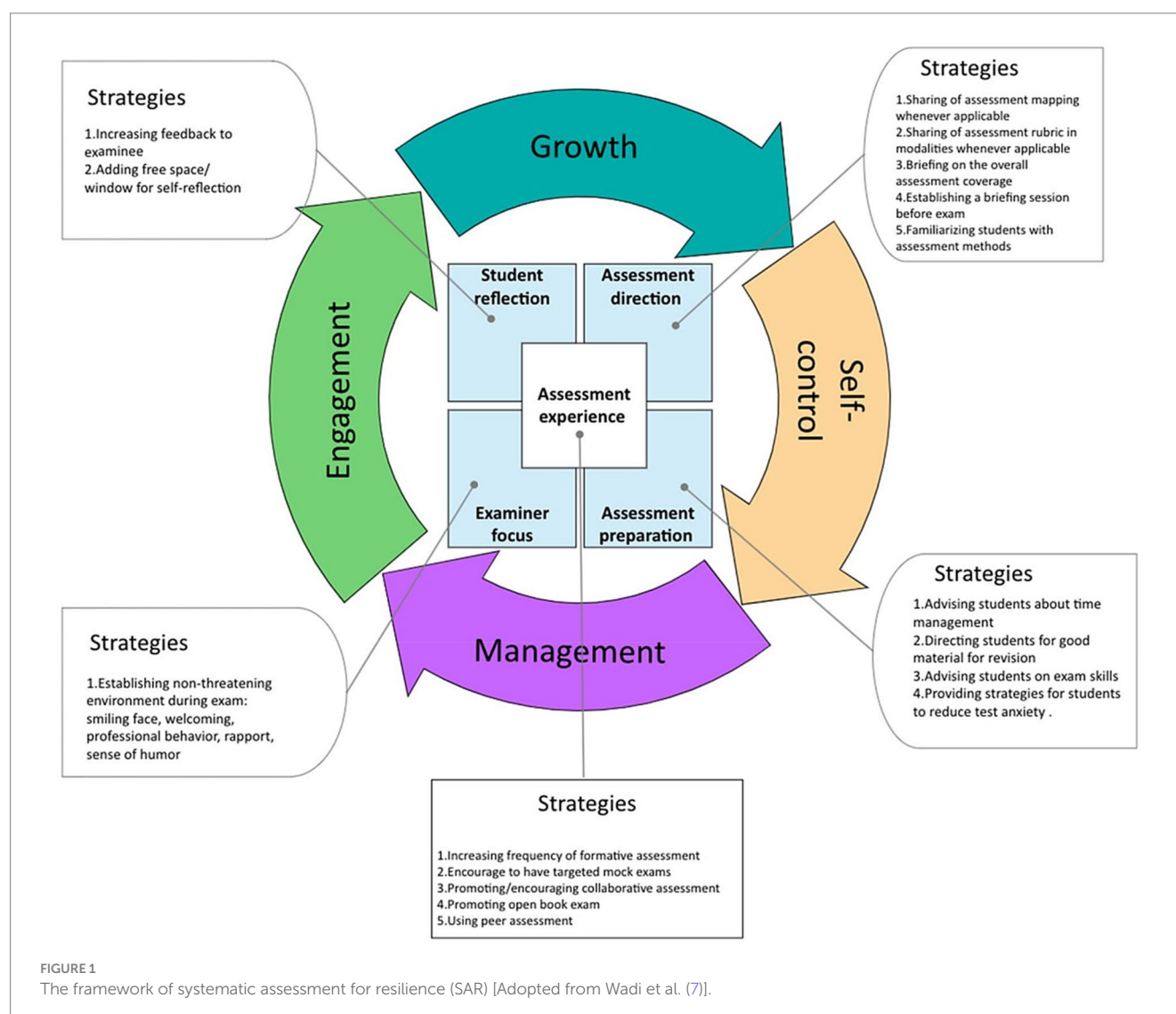


TABLE 1 Using systemic assessment to promote resilience (SAR): a practical guide.

Assessment phase		Resilience strategies	Example	Methods of sharing/distribution
Pre - course	Assessment direction	• Sharing of assessment mapping/ blueprinting whenever applicable	• General blueprint	• Course booklet • Electronic platform (e.g., LMS)
		• Sharing of assessment rubric in modalities whenever applicable	• Rubric	• Course booklet • Electronic platform (e.g., LMS)
		• Briefing on the overall assessment coverage	• Overall assessment briefing	• Course booklet • Electronic platform (e.g., LMS)
		• Establishing a briefing session before exam	• Before exam briefing	• Class session • Electronic platform (e.g., LMS)
		• Familiarizing students with assessment methods	• Familiarizing assessment methods	• Class session • Electronic platform (e.g., LMS)
	Assessment preparation	• Advising students about time management and study skills	• Links to relevant materials • (YouTube, Websites ... etc) • Discussion or webinar • https://youtu.be/MR7e1kPp_ys	• Electronic platform (e.g., LMS) • Text advice through WhatsApp
		• Directing students for good material for revision	• Good handouts for revision • Concise reference books	• • Electronic platform (e.g., LMS)
		• Advising students on exam skills	• Links to relevant materials (YouTube, Websites ... etc) • Discussion or webinar	• Electronic platform (e.g., LMS) • Text advice through WhatsApp
		• Providing strategies for students to reduce test anxiety	• Advice about personal/selfcare • (nutrition, sport, sleep) • Advice about relaxation techniques • (deep breathing) • Discussion about these strategies • https://youtu.be/4PgEilewf7Y	• Electronic platform (e.g., LMS) • Text advice through WhatsApp
During - course	Assessment experience	• Increasing frequency of formative assessment	• More formative assessment	
		• Encourage to have targeted mock exams	• Mock exam	
		• Promoting/encouraging collaborative assessment	• Collaborative assessment https://youtu.be/RNOC2OHP6Vs	• Class session • Electronic platform (e.g., LMS)
		• Promoting open book exam	• Open book exam • https://youtu.be/-xVwAdCgdlQ	• Class session • Electronic platform (e.g., LMS)
		• Using peer assessment	• Peer assessment • https://youtu.be/2hRu5i-gfXo	• Class session • Electronic platform (e.g., LMS)
		• Introducing progress testing	• Progress test • https://youtu.be/Mc_-fVmEf1M	• Class session • Electronic platform (e.g., LMS)
On exam day	Examiner focus	• Establishing non-threatening environment during exam	• Smiling face • Welcoming • Professional behavior • Rapport • Sense of humor	• On the exam day
	Student reflection	• Increasing feedback to examinee	• https://youtu.be/s8Jl-8JLxdo	• On the exam day
		• Sharing the key answer if applicable		• On the exam day
		• Adding free space/window for self-reflection	• https://youtu.be/SntBj0FIapw	• On the exam day

conducted webinars on time management and study skills, with links shared via LMS and emails.

3 Reducing Test Anxiety: Addressing test anxiety through discussions on personal self-care, relaxation techniques, and

exam skills can significantly enhance self-control. While I have yet to implement formal sessions on these topics, I plan to create videos and conduct webinars to guide students on reducing test anxiety. Sharing advice about nutrition, sports,

sleep, and relaxation techniques via electronic platforms will be part of this strategy.

Management: utilizing resources effectively

Effective management of available resources is vital for overcoming obstacles. The SAR framework encourages students to leverage these resources efficiently:

- 1 Familiarizing Students with Assessment Methods:** Conducting on-campus workshops and formative assessments helps students become familiar with different evaluation methods. I have organized workshops on procedural skills and case-based discussions, simulating the format of summative assessments and providing formal feedback to enhance student preparedness. Using electronic platforms, I have shared formative assessment methods and resources to aid in student understanding.
- 2 Providing Good Study Materials:** Sharing concise reference materials and recommended textbooks on the LMS ensures students have access to high-quality revision resources. Highlighting these resources during orientation sessions further directs students to reliable study materials. Lists of good handouts for revision and links to concise reference books have been made available to students electronically.
- 3 Mock Exams and Formative Assessments:** Increasing the frequency of formative assessments and organizing mock exams can significantly boost students' confidence and performance. While I have incorporated formative assessments, I aim to introduce targeted mock exams to provide more comprehensive preparation. Promoting open book exams and collaborative assessments through class sessions and electronic platforms are future goals to enhance the learning experience.

Engagement: commitment and perseverance

Engagement, the third construct, focuses on students' commitment to pursuing challenges with perseverance. Strategies to enhance engagement include:

- 1 Collaborative and Peer Assessment:** Encouraging collaborative assessments and peer feedback can foster a supportive learning environment. Although I have limited experience with these methods, I recognize their potential and plan to explore their applicability in future assessments. I will use on-campus sessions and online resources to implement peer assessment practices.
- 2 Promoting Open Book Exams:** While not currently part of our undergraduate assessment strategies, introducing open-book exams for certain assignments can encourage deeper learning and resourcefulness among students. Sharing resources and guidelines for open book exams on platforms like Blackboard will be an essential step.

- 3 Formative Feedback:** Providing regular, constructive feedback is essential for continuous improvement. I have emphasized formal feedback in formative assessments, and I aim to incorporate more opportunities for students to receive and reflect on feedback. Encouraging weekly formative assessments with formal feedback in hospitals is part of this strategy.

Growth: ongoing development

The final construct, growth, focuses on students' continuous development to face future challenges. Promoting growth involves:

- 1 Student Reflection:** Encouraging self-reflection through written reflections and surveys helps students evaluate their performance and identify areas for improvement. Incorporating reflection within e-portfolio submissions has been a step in this direction, but I plan to create more structured reflection sessions. Adding free space for self-reflection during assessments can also aid in this process.
- 2 Faculty Development:** Training faculty members to create a non-threatening exam environment and provide effective feedback can significantly impact students' growth. Conducting faculty development meetings on good clinical teaching practices has been beneficial, and I will continue to emphasize the importance of fostering a supportive academic culture. Encouraging examiners to establish a welcoming and professional behavior during exams is crucial.

Implementing the SAR framework: practical insights

Based on my experience with the SAR framework, several key insights have emerged:

- 1 Feasibility and Practicality:** The SAR guidelines are practical and can be seamlessly integrated into daily educational practices. The framework's checklists and resources make it easy for educators to implement resilience-promoting strategies.
- 2 Positive Student Feedback:** Students have responded positively to the SAR framework, reporting reduced anxiety, improved performance, and greater enjoyment of their rotations. These outcomes highlight the framework's effectiveness in enhancing resilience and overall well-being.
- 3 Challenges and Future Directions:** While the SAR framework has shown promise, certain strategies, such as collaborative assessments and progress testing, require further exploration and institutional support. It is crucial to engage curriculum committees and seek official approval for broader implementation.

Discussion

The SAR framework has demonstrated promising results in fostering resilience among medical students. However, it is essential to consider the broader context in which resilience is cultivated.

Integrating resilience training into the medical education continuum is crucial for supporting students' mental health and well-being (1). Medical educators must critically reflect on how their conceptualizations of resilience influence their approach to teaching and supporting learners.

The literature suggests that resilience is not solely an individual trait but a dynamic process influenced by the learning environment, social support, and institutional culture (2). Studies show that medical students who develop resilience through structured programs are better equipped to manage stress and avoid burnout, which is critical for maintaining mental health throughout their education and careers (6). By fostering a culture of resilience through formal, informal, and hidden curricula, medical schools can better support students in developing the skills needed to manage stress and thrive in their careers (5).

While the SAR framework provides a comprehensive approach to fostering resilience in medical students and demonstrates practical applications in a tutor-led environment, it is equally critical to extend the discussion to include the clinical setting, where students face significant emotional and psychological challenges. Clinical placements offer unique and essential opportunities for developing resilience by allowing students to apply theoretical concepts to real-life patient care, manage uncertainty, and cope with the pressures of medical practice (7).

Resilience in the clinical environment

Clinical environments are inherently unpredictable, presenting medical students with emotionally charged situations such as difficult patient interactions, high-stakes decision-making, and exposure to suffering and death. These settings require students to develop coping mechanisms that enable them to adapt to high-pressure situations and maintain emotional equilibrium. Research supports the idea that students who develop resilience in these environments are better prepared to manage stress and avoid burnout (6). For example, a study by Bird et al. (2) found that medical students who participated in resilience training during clinical rotations reported reduced anxiety, greater emotional regulation, and improved coping strategies for handling difficult patient interactions.

Resilience in clinical settings is often fostered through a combination of exposure to challenging experiences and structured reflective practice. By navigating the complexities of patient care, students learn to tolerate uncertainty and develop emotional regulation skills. Research highlights that structured debriefing sessions during clinical rotations help students process these experiences and develop the emotional fortitude necessary for future medical practice (5). Reflective practices, such as guided reflection and journaling, have been shown to enhance students' ability to understand their emotional responses, ultimately contributing to improved resilience (9).

Mentorship and peer support

Mentorship from experienced clinicians is another crucial component in developing resilience in clinical settings. Mentors provide not only clinical guidance but also emotional support, helping students navigate difficult situations. Mentors can model how to cope with the pressures of clinical practice, such as managing patient loss,

balancing personal and professional demands, and maintaining mental well-being in a demanding environment (3). In one study, students who engaged in mentor-guided reflective sessions reported higher levels of emotional resilience and improved coping mechanisms (5). Structured mentorship programs, where students are encouraged to reflect on their experiences and discuss strategies for emotional resilience, can significantly enhance their ability to cope with stress (9).

Peer support also plays a vital role in resilience-building. Students benefit from discussing their clinical experiences with peers, sharing coping strategies, and providing mutual support. Peer reflection groups, where students can debrief and process their emotions together, foster a supportive community that is crucial for resilience-building. Research indicates that students who participate in regular peer reflection sessions are more likely to develop positive coping strategies and resilience in the face of adversity (6).

Practical strategies for resilience training in clinical settings

While the SAR framework offers a robust structure for resilience-building in theoretical settings, it is equally applicable to clinical contexts. Practical strategies for integrating the SAR framework into clinical rotations include:

- 1 Resilience Workshops:** Implementing workshops at the beginning of clinical placements that focus on stress management, emotional regulation, and coping strategies for high-pressure situations. These workshops can equip students with the tools they need to navigate the challenges of clinical practice, such as managing uncertainty, patient suffering, and complex decision-making. Research has shown that students who attend resilience workshops during clinical rotations experience reduced burnout and increased emotional regulation (2).
- 2 Reflective Debriefing Sessions:** Structured debriefing sessions after particularly challenging clinical encounters, such as dealing with patient deaths or difficult diagnoses, provide students with the opportunity to reflect on their emotional responses. These sessions help students process their experiences, develop emotional regulation skills, and prepare for future challenges (5). Studies have shown that such reflective practices contribute to improved emotional resilience and reduced levels of stress and anxiety (3).
- 3 Formative Feedback on Emotional Resilience:** Feedback during clinical rotations should extend beyond clinical competence to include emotional and psychological well-being. Supervisors can provide formative feedback on how students handle stress, interact with patients, and manage emotionally challenging situations. This feedback helps students develop self-awareness and emotional resilience, essential components of professional development in healthcare (9).
- 4 Peer Support Systems:** Incorporating peer support structures within clinical rotations allows students to share experiences and coping strategies. Peer reflection groups or regular check-ins where students discuss their clinical encounters provide a sense of community and shared understanding, which is critical for resilience (6).

The importance of institutional support

While the SAR framework and associated strategies can help develop individual resilience, institutional support is critical for sustaining these efforts. Medical schools should prioritize resilience training by integrating it into the curriculum and ensuring that students have access to mental health resources, counseling, and structured mentorship programs (9). Institutional culture plays a significant role in fostering resilience, as students who feel supported by their academic and clinical environments are more likely to thrive. Promoting a culture of openness, where students are encouraged to discuss their emotional challenges, can also reduce the stigma associated with stress and mental health issues in the medical profession (2).

Conclusion

The SAR framework offers a structured approach to promoting resilience in medical students, focusing on self-control, management, engagement, and growth. While it has shown success in theoretical settings, its application to clinical environments is essential for fully preparing students for the demands of medical practice. By incorporating resilience training into clinical rotations—through mentorship, peer support, and reflective practices—medical educators can help students develop the coping mechanisms needed to navigate the complexities of patient care. Institutional support is equally important in creating a culture that prioritizes mental well-being and resilience, ultimately ensuring that students are prepared for the emotional and psychological challenges of their future careers in medicine.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

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EDITED BY

Carla Viegas,
Instituto Politécnico de Lisboa, Portugal

REVIEWED BY

Semra Bulbuloglu,
İstanbul Aydın University, Türkiye
Xutong Zheng,
China Medical University, China

*CORRESPONDENCE

Juan Jesús García-Iglesias
✉ juanjesus.garcia@dstso.uhu.es
Juan Gómez-Salgado
✉ salgado@uhu.es

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Stress in novice nurses in new work environments: a systematic review

Ángela Narbona-Gálvez¹, Juan Jesús García-Iglesias^{2*},
Diego Ayuso-Murillo³, Guadalupe Fontán-Vinagre⁴,
Juan Gómez-Salgado^{2,5*}, Regina Allande-Cussó⁶,
Javier Fagundo-Rivera⁷, Israel Macías-Toronto⁸ and
Carlos Ruiz-Frutos^{2,5}

¹School of Doctorate, University of Huelva, Huelva, Spain, ²Department of Sociology, Social Work and Public Health, Faculty of Labour Sciences, University of Huelva, Huelva, Spain, ³General Nursing Council of Spain, Madrid, Spain, ⁴Spanish Institute for Nursing Research, Madrid, Spain, ⁵Safety and Health Postgraduate Programme, Universidad Espíritu Santo, Guayaquil, Ecuador, ⁶Department of Nursing, Faculty of Nursing, Physiotherapy and Podiatry, University of Seville, Sevilla, Spain, ⁷Centro Universitario de Enfermería Cruz Roja, Sevilla, Spain, ⁸Department of Rehabilitation, FREMAP Huelva, Huelva, Spain

Background: Inexperienced nursing care can compromise the quality of care and the well-being of patients. The aim of this study was to assess the main sources of stress encountered by nurses and novice nurses in a setting not previously experienced.

Methods: A systematic review was conducted following the PRISMA format in Pubmed, Scopus, Web of Science, and CINAHL electronic databases in March 2024. A total of 395 studies were identified, of which 16 met the inclusion criteria. Selection was made on the basis of topic relevance and methodological quality, assessed using the critical tools of the Joanna Briggs Institute (JBI).

Results: A total of 16 studies were included in this review. Of the 16 selected, 10 were cross-sectional studies, 3 were cohort studies, 2 were qualitative, and 1 was a systematic review. The studies revealed that the main stressors for novice nurses included time management, workload, and interpersonal relationships. The results underline that organizational factors, such as lack of support and high work demands, play a key role in generating stress.

Conclusion: Identifying and addressing the key challenges faced by novice nurses, such as workload, adjustment to the environment, professional expectations, and interpersonal relationships, is crucial to sustain their professional engagement and ensure the quality of health care. This understanding is essential for creating efficient policies and practices that enhance the occupational well-being and stability of nurses in the workforce.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024520651, CRD42024520651.

KEYWORDS

nurses, occupational stress, professional burnout, psychological adaptation, mental health, clinical competence

Introduction

The nursing profession is an essential part of the health care system, but faces significant challenges that threaten its stability, such as work-related stress, high staff turnover, and the complexity for newly graduated nurses in adapting to the workplace. These problems need to be urgently explored and addressed (1).

Stress among nursing staff is a widespread phenomenon that affects not only the physical and mental health of professionals, but also the quality of the care they provide (2). This is compounded by high expectations, overwhelming responsibilities, and limited empowerment in their daily work (3). Alarming, attrition rates in nursing are more than twice as high as in other health professions, which represents a significant gap (3).

The transition of newly graduated nurses from the academic environment to the world of work is a difficult process that brings mental and psychological pressures (4). Upon entering clinical practice, these professionals experience strains ranging from difficulty in communication to ethical dilemmas and overwhelming workloads (5). Lack of adequate skills and guidance contribute to increased stress and often to the onset of emotional exhaustion and burnout (4).

The COVID-19 pandemic has worsened the existing human resource shortage in the nursing profession and has increased the pressure on novice nurses, who face a more demanding and challenging work environment (6). It is crucial to understand how job stress during the first year of employment impacts on nurses' health and on the quality of patient care. This study seeks to relate the results obtained to organizational and environmental factors that may intensify or reduce stress, with the aim of providing a deeper insight into how these factors influence the adaptation of novice nurses.

Recently, the study of job stress in nursing has gained more importance, especially through Bakker and Demerouti's Job Demands-Resources model (7). This theory analyses how the specific demands of nursing work, such as emotional distress and its intensity, are related to the resources available to cope with these demands. Understanding this makes it possible to identify the causes of work-related stress in nursing, highlighting the importance of managing these demands and promoting resources that enhance nurses' well-being (7). This theoretical approach will serve as a basis for exploring how the demands and available resources may influence the experience of novice nurses when entering the workplace, which is one of the main objectives of the study. In this regard, another possible problem for newly graduated nurses is the gap that may exist between the theoretical contents learnt so far at university and the reality shock that, in some cases, comes with the need to carry out a task in a short period of time (8).

The theory by Benner (9) on Nursing Competence Development highlights that as nurses gain experience and skills, they are faced with increased responsibilities, which can in turn raise their stress levels. The transition from novice to expert nurse involves taking on more complex roles and making important decisions, which adds to the emotional and psychological burden. Therefore, strategies to manage stress and provide support during their career are essential (9).

Lack of nursing experience can affect both the quality of care and the well-being of patients. Novice nurses often find it difficult to handle complex situations or to deal with patients with pathologies they are unfamiliar with or have not dealt with before, which can affect their decisions and their performance. In addition, unfamiliarity with the hospital environment and protocols generates anxiety and

uncertainty, further complicating their work. It is essential to provide training and mentoring programs to support nurses as they move into more specialized roles (10).

Newly graduated nurses may experience insecurities related to their lack of experience, difficulties in integrating into work teams, and in understanding their professional role (11). These factors can make nurses more vulnerable and turn them into "second victims" after an adverse patient care event, a term coined by Wu (12) which describes the emotional distress suffered by health professionals after experiencing such a situation. It is estimated that almost half of them could go through this experience at some point in their careers, which seriously compromises their well-being and job performance (13).

The specific aim of this study is to investigate the relationship between stressors affecting novice nurses and their transitions in various work settings. In doing so, it seeks to provide a holistic view of the factors that increase vulnerability to stress, and also to identify possible interventions to facilitate a smoother transition and minimize the negative effects of stress on the quality of care provided to patients.

Overall, this study represents an analytical journey aimed at assessing the main sources of stress experienced by nurses and novice nurses in a setting new to them. The objective of this review is to provide a comprehensive and detailed overview of the challenges faced in the nursing profession by exploring different approaches and perspectives, with a view to providing valuable insights that will contribute to the formulation of more effective policies and practices that focus on the well-being of professionals and the quality of patient care.

Methods

Study design

A systematic review was conducted following the guidelines of the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta-Analyses) (14).

Databases and search strategy

The search was carried out in the Pubmed, Scopus, Web of Science, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) electronic databases on the basis of the key words that the research question yielded, following the CoCoPop strategy (15) (Table 1). These databases were selected on the basis of their relevance and wide recognition in the field of health sciences and Nursing, thus ensuring a comprehensive and representative review.

The Medical Subject Headings (MeSH) thesaurus was consulted using these keywords, yielding the descriptors Disabled Persons, Barriers, and Universities. To improve the search strategy and ensure relevant

TABLE 1 CoCoPop format: keywords (Spain, 2024).

Condition	Stress
Context	Working in settings not previously experienced
Population	Novice nurses/nurses
Research question	<i>What is the prevalence of stress in novice nurses and nurses working in a new setting not previously experienced?</i>

TABLE 2 Search strategy used for each database (Spain, 2024).

Database	Search strategy	Results
Pubmed	(novice nurs*[Title/Abstract] OR newl* graduate nurs*[Title/Abstract] OR junior nurs*[Title/Abstract] OR newl* nurs*[Title/Abstract]) AND (Psychological Stress[Title/Abstract] OR Life Stress[Title/Abstract] OR Psychological Distress[Title/Abstract] OR Emotional Distress[Title/Abstract] OR Emotional Stress[Title/Abstract] OR Job stress[Title/Abstract] OR Occupational Stress[Title/Abstract] OR Work-related Stress[Title/Abstract] OR Workplace Stress[Title/Abstract] OR Professional Stress[Title/Abstract] OR Job-related Stress[Title/Abstract]) Filters: from 2014–2024	109
Scopus	(TITLE-ABS-KEY (“novice nurs*” OR “new* graduated nurs*” OR “junior nurs*” OR “new nurs*”) AND TITLE-ABS-KEY (“Psychologic* Stress*” OR “Life Stress*” OR “Psychological Distress” OR “Emotional Distress” OR “Emotional Stress*” OR “Job stress*” OR “Occupational Stress*” OR “Work-related Stress*” OR “Workplace Stress*” OR “Professional Stress*” OR “Job-related Stress*”)) AND PUBYEAR >2013 AND PUBYEAR <2025	101
Web Of Science	“novice nurs*” OR “new* graduated nurs*” OR “junior nurs*” OR “new nurs*” (Topic) AND “Psychologic* Stress*” OR “Life Stress*” OR “Psychological Distress” OR “Emotional Distress” OR “Emotional Stress*” OR “Job stress*” OR “Occupational Stress*” OR “Work-related Stress*” OR “Workplace Stress*” OR “Professional Stress*” OR “Job-related Stress*” (Topic) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 (Publication Years)	136
CINAHL	AB (“Psychologic* Stress*” OR “Life Stress*” OR “Psychological Distress” OR “Emotional Distress” OR “Emotional Stress*” OR “Job stress*” OR “Occupational Stress*” OR “Work-related Stress*” OR “Workplace Stress*” OR “Professional Stress*” OR “Job-related Stress*”) AND AB (“novice nurs*” OR “new* graduated nurs*” OR “junior nurs*” OR “new nurs*”). Filters: from 2014 to 2024	49
Total		395

studies were captured, synonymous terms were also included using Boolean operators *AND* and *OR*. [Table 2](#) shows the search strategy applied during the search process performed on 02 March 2024 for each of the above databases. The search strategy was limited from 2014 to 2024.

3 Certain types of publications, such as opinion articles, editorials, and letters to the editor were excluded, as these types of articles do not provide empirical data that conforms to the objectives of this review.

Selection criteria

The following criteria were used to select the articles:
Inclusion criteria:

- 1 Language: Only original articles published in English, Spanish, French, or Portuguese.
- 2 Type: original articles, meta-analysis, systematic reviews, short communication, and case reports.
- 3 Population: nurses and novice nurses facing situations not previously experienced, considering novice nurses as those with less than 1 year of nursing work experience.
- 4 Articles measuring any of the following values and/or effects:

- Stress level of nurses and novice nurses in situations they have not experienced before.
- Stressors inherent to the nursing practice.

Exclusion criteria:

- 1 Studies that were classified as being of low scientific-technical quality after application of the quality assessment tool were excluded. This assessment was carried out by two reviewers independently, both of whom determined the methodological quality of the selected studies.
- 2 Articles that did not directly address the research question and those that were not related to the objectives of the review were excluded, ensuring that all included studies made a meaningful contribution to understanding the stress of novice nurses in new work settings.

Data collection and extraction

Two researchers conducted independent searches, eliminated duplicate studies, and selected articles for inclusion based on previously established criteria after reading the abstract and title. Subsequently, the full text of potentially eligible studies was reviewed by the same two authors, and decisions to include or exclude studies were made by consensus. Any discrepancies were resolved by a third author.

Methodological quality assessment

The methodological quality of the selected studies was independently determined by two reviewers by using the Critical Appraisal Tools for Trials of the Joanna Briggs Institute (JBI) at the University of Adelaide (16). These tools enable the assessment of a study’s methodological quality and the identification of any potential bias in its design, conduct, and/or analysis. To ensure consistency and reliability in the assessment, the reviewers met before starting the process to discuss and unify criteria. The versions for quantitative cross-sectional studies (8 items), qualitative studies (10 items), systematic reviews (11 items), and cohort studies (11 items) were used, with a cut-off point of 6 for the first two and 8 for the last two to accept their inclusion in this review. This evaluation process is detailed in the [Supplementary material](#), which also includes a table summarizing the quality scores for each included study.

Results

A total of 395 references were identified by applying the initial search strategies, which were then screened according to the topic of

this review. Finally, 16 studies were selected (Figure 1), of which 10 were descriptive cross-sectional studies, 3 were cohort studies, 2 were qualitative studies, and 1 was a systematic review.

Four articles were found to have been conducted in China (1, 3, 17, 18), 2 in Taiwan (6, 19), 1 in the UK (2), 1 in the Netherlands (20), 1 in Oman (4), 1 in the United States (5), 1 in South Korea (21), 1 in Brazil (13), 2 in Canada (22, 23), 1 in Denmark (24), and 1 in Jordania (25).

In 10 of the 16 selected studies (1, 3, 5, 6, 13, 17, 19–21, 24), the sample consisted of newly graduated nurses, while in 1 of the selected studies (17) the sample consisted of nurses with 1 year of experience. In another selected article the sample consisted of novice nurses at the beginning of their career, at 6 months, and at 12 months. In another study, the sample consisted of nurses with less than 2 years of experience (22), and another study involved nurses with less than 3 years' experience (23). The last article to be included (4) was an integrative review including 21 review articles.

Among the interventions, the NSS scale was used (1–3), and also the PSS (17, 18) in some of the studies, while self-structured questionnaires were utilized in other investigations (3, 6, 13, 19, 21, 25). Another study used both the PSS questionnaire and the CD-RISC-25 (25). The NWI-R (23) and CERQual (24) questionnaires were also used in other articles.

The JBI critical appraisal tool was used to assess the included studies, which scored medium-high for both cross-sectional observational studies and qualitative studies.

Table 3 shows the characteristics of each of the 16 studies included in this review. The studies were classified by their authors, year of publication, country, design and objective, participants, instrument, and main results. Additionally, the results of the JBI critical appraisal tool were included.

Discussion

In various studies, such as the one by Fang et al. (3), multiple stages in which new nurses experience varying levels of work-related stress have been identified. Prominent factors include time management, workload, and interpersonal relationships. These findings are consistent with previous research, such as the one conducted by Feeg et al. (5), which emphasizes the significance of time management and adaptation to the work environment as sources of stress. The analysis highlights the inherent complexity of the nursing work environment, where time management, management skills, and interpersonal relationships play a crucial role in emotional well-being and professional performance (5). This approach is consistent with the stress model proposed by Lazarus and Folkman (26), which suggests that the way people view work demands and their ability to cope with those demands are key to understanding how they deal with stress (26). Therefore, understanding these factors is essential in order to develop effective support and training strategies to help new nurses face and overcome challenges throughout their careers (5).

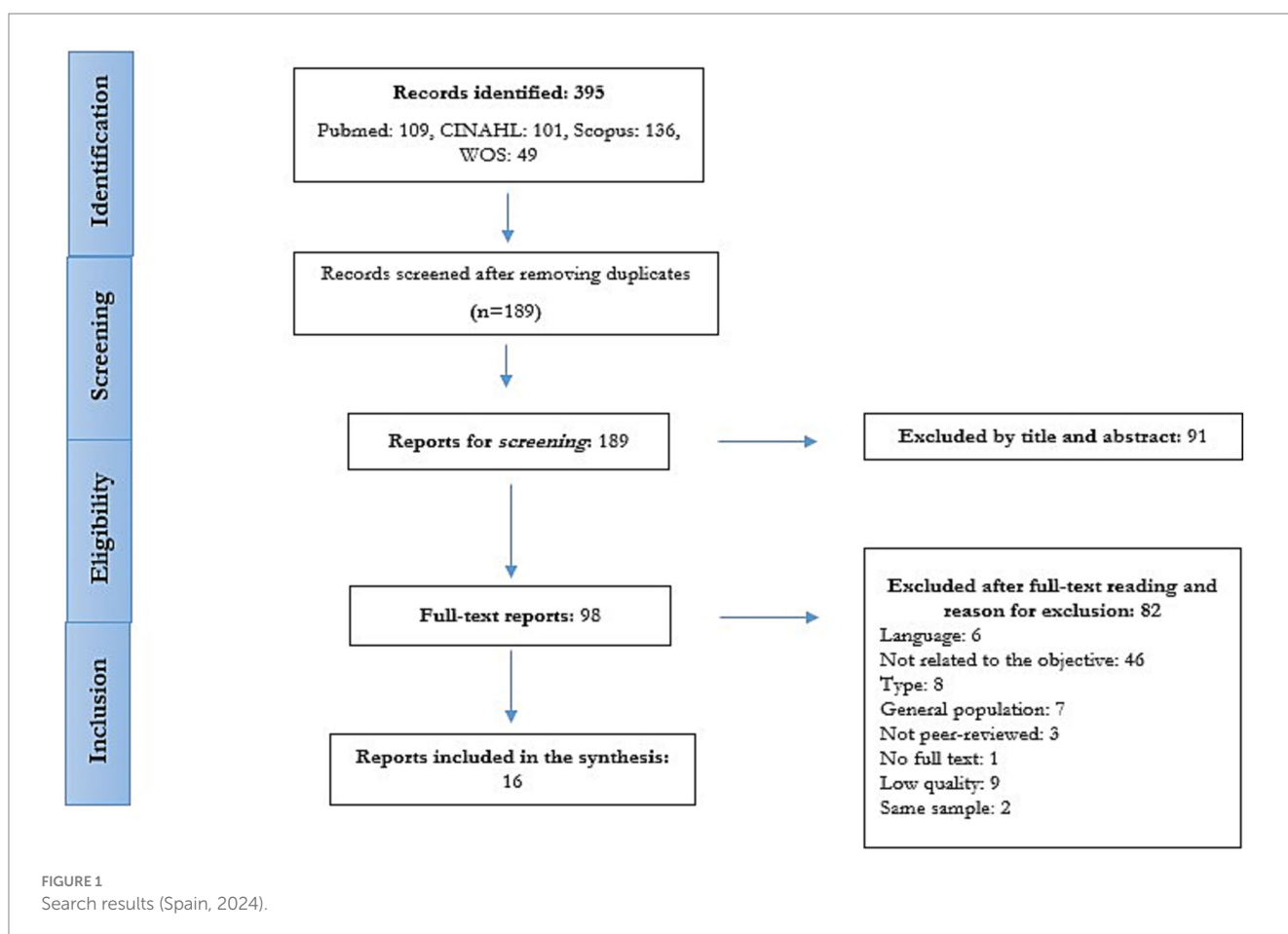


TABLE 3 Characteristics of the studies included in the systematic review (Spain, 2024).

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
Fang et al. (3)	Fujian (China)	To analyze changes in occupational stress in new nurses during the first year of employment	Analytical study	Recruited new nurses ($n = 127$)	NSS Chinese version	The results showed that new nurses had moderate to high levels of stress in all four stages, with the highest stress level at 4 and 8 months of employment and the lowest stress level at 12 months; the differences in stress scores at different time points were statistically significant (). The trends in each stressor dimension varied across different periods. The highest scores were for pressure caused by “time allocation and workload,” which peaked in month 8. The same trend was observed for stress from “patient care” and “work environment and equipment.” “Management and interpersonal relationships” scored the highest overall stress score at the start of employment before declining. The lowest stress score was from “work environment and equipment” at the start of employment, and the lowest was from “management and interpersonal relationships” from month 4 onward	6/8
Halpin et al. (2)	London (United Kingdom)	To investigate transition in newly qualified nurses through an exploration of their stressors and stress experiences during their first 12 months post-qualifying	Cohort study	Newly graduated nurses: at the time of qualification ($n = 288$), 6 months later ($n = 107$) and 12 months later ($n = 86$)	NSS	Workload was consistently the highest reported stressor with inadequate staffing and managing multiple role-demands given as explanations. Incivility within the workplace was a noted stressor. Conversely, being part of “a good team” provided a civil, supportive, facilitative work environment. Entering nurse education with previous healthcare experience had a mediating effect on the reported frequency of stressors	8/11
Hoeve et al. (20)	Groningen (The Netherlands)	Getting insight in the most crucial organizational job stressors for novice nurses’ professional commitment and whether the job stressors are mediated through negative emotions	Cohort study	Novice nurses ($n = 18$)	Semi-structured electronic diary that assesses: 1. Organizational job stressors 2. Emotions 3. Work commitment: measured using the scale (RECS-E)	Path modeling revealed that lack of support from colleagues, negative experiences with patients and confrontations with existential events were most strongly negatively related to professional commitment through negative emotions. Other indirectly and negatively related organizational job stressors to commitment were complexity of care, lack of control and work-life imbalance; only conflicting job demands, and lack of control related to professional commitment directly	8/11
Labrague and McEnroe-Petitte (4)	Mascate (Oman)	To appraise and synthesize evidence relating to new nurses’ stress experiences during the transition period	Systematic review	21 review articles	PRISMA	New nurses perceived low to moderate levels of stress mainly from heavy workloads and lack of professional nursing competence. Individual and organizational factors that might contribute to their stress experiences were rarely explored	9/11

(Continued)

TABLE 3 (Continued)

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
Zhang et al. (1)	Shanghai (China)	To determine differences in occupational stress levels of newly graduated nurses at different time points during the first 3 years of practice; to identify potential subgroups of nurses who perceive different occupational stress levels over time; and to evaluate differences in identified subgroups based on demographic and work-related characteristics	Analytical study	Newly graduated nurses with no experience ($n = 152$)	NSS	The entire sample of newly graduated nurses experienced a significant decrease in occupational stress during the first 3 years. The best-fitting group-based trajectory model described three distinctive trajectories: low occupational stress (19.1% of sample); medium occupational stress (67.1%) and high occupational stress (13.8%). The low occupational stress subgroup had a higher proportion of nurses from Shanghai, and the majority were employed as contact-based nurses. In comparison, the high occupational stress subgroup had the largest proportion of nurses from other provinces (outside of Shanghai), almost half of participants were employed as “bianzhi” nurses, and the majority reported to be assigned preceptor by shift	6/8
Feeg et al. (5)	New York (United States)	To understand the experiences of new nursing graduates in their work environment and the perceived stressors during their transition to the role of a competent nurse	Qualitative study	Newly graduated nurses ($n = 1,456$)	NSNA survey	Respondents felt that a high nurse/patient ratio was not safe for the patients under their care. Respondents also felt that they could not provide complete care to their patients. Respondents felt that there was not enough time to complete patient care After the first categorical analysis, the researchers elaborated on how individual items revealed meaningful statements or how new graduates were trying to find “balance” in their work, their expectations, and their interactions with others. The topics that emerged related to respondents’ overall “balance,” reflecting environmental stress (“My workload is higher than I expected”); expectations about oneself (“I do not know everything I need to know”); and interactions with others that affected them (“My relationships with others are difficult”)	9/10
Zhu et al. (18)	Shanghai, Hong Kong and Taipei (China)	to explore and compare stress, coping, professional identity and work locus of control of new graduate nurses among Shanghai, Hong Kong and Taipei.	Analytical study	Nurses with 1-year experience in the hospital ($n = 591$)	• PSS Questionnaire • Chinese trait coping style questionnaire • Nurse professional identity scale • Work locus of control scale (Chinese version)	The newly graduated nurses in Shanghai had significantly lower ($p < 0.05$) work stress score (2.65 ± 0.67) compared with their counterparts in Hong Kong (2.99 ± 0.69) and Taipei (2.94 ± 0.60). Newly graduated nurses in Shanghai tended to choose positive coping to deal with stressful situations, whereas those in Hong Kong would be more likely to adopt negative attitudes ($p < 0.05$). The newly graduated nurses in Taipei had the lowest level of professional identity (3.25 ± 0.55 , $p < 0.05$), and their work control tended to be external (46.13 ± 6.20). In contrast, those in Shanghai (52.75 ± 6.04) and Hong Kong (59.41 ± 7.29) tended to be controlled internally	6/8

(Continued)

TABLE 3 (Continued)

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
An et al. (21)	Gwangju (South Korea)	To examine turnover intention levels and identify the factors affecting turnover intention of new Generation Z nurses, focusing on job stress and sleep disturbance	Analytical study	New nurses ($n = 133$)	Structured questionnaire including data on job stress, sleep disturbance, and turnover intention	Most nurses were women (91.7%) and approximately two-thirds worked in the surgical ward ($n = 61$, 45.9%). Turnover intention was 12.8%, average job stress was 40.11 ± 90.7 , and average sleep disturbance was 42.39 ± 15.27 . New graduate nurses' turnover intention was associated with job stress ($OR = 1.07$, 95% $CI = 1.02-1.12$) and sleep disturbance ($OR = 1.19$, 95% $CI = 1.05-1.35$), and this model explained 47.7% of the variance. Study findings determine that job stress and sleep disturbance were significant predictors of turnover intention in new nurses at the eighth week after joining the hospital	8/8
Zhou et al. (17)	Jiangsu, Zhenjiang (China)	To investigate some possible job stress factors that could influence newly recruited nurses' behavior to either continue or discontinue their job with their organization	Analytical study	Novice nurses in 20 Chinese hospitals ($n = 564$)	PSS Questionnaire.	The effects of six job stressors from the perceived stress scale were estimated. The results showed that four stressors, stress from taking care of patients ($\beta = 0.111$, $p < 0.01$), stress from roles and workload ($\beta = 0.129$, $p < 0.001$), stress from co-workers and daily life ($\beta = 0.323$, $p < 0.001$) and stress from lack of professional knowledge and skills ($\beta = 0.137$, $p < 0.001$), from the perceived stress scale had a significant impact on turnover intention among nurses	8/8
Chen et al. (19)	Keelung (Taiwan)	To develop an Objective Structured Clinical Exam (OSCE) to evaluate novice nursing practitioners' clinical competency, work stress, professional confidence, and career satisfaction	Quasi-experimental study	Novice nurses ($n = 55$)	Pre-post questionnaire (modified from a Nursing Competency Questionnaire, a Stress scale, and Satisfaction with Learning scale)	Among the novice nursing practitioners, 41 of them (74.5%) passed the exam with a mean score of 61.38 ± 8.34 . There was a significantly higher passing rate among nurses who were working in medical-surgical wards (85.7%) and the intensive care unit-emergency department (77.8%) compared to novice nursing practitioners working in other units. All the novice nursing practitioners at Station A had poor performance in assessing patients with a fever. OSCE performance was more associated with educational attainment and work unit, rather than the gender. Finally, the participants showed statistically significant increases in their clinical competency, confidence in their professional competence, satisfaction with the clinical practice, and decreased work stress after the OSCE	9/9

(Continued)

TABLE 3 (Continued)

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
Chen et al. (6)	Chang Gung, Chiayi (Taiwan)	To explore registered nurses' competence in nursing care and their intention to stay in their current workplace	Analytical study	Novice nurses (n = 333)	Structured questionnaire to assess factors related to nursing competence based on the essentials of baccalaureate education for professional nursing practice	The results of the present study revealed that the majority of the novice nurses' workplaces varied significantly among the transition shock. The novice nurses had the competence to provide quality care related to patient ethics, end-of-life care, and risk prevention. However, the novice nurses had the lowest average score in "utilization of care models, implementation, and leadership in the team," indicating a lack of adequate practicum experience in leading care teams. The results indicated that the novice nurses who took infection care related courses in baccalaureate nursing programs were more familiar with relevant concepts and had greater awareness of care related concepts. The results indicated that the participants were willing to stay in their current nursing workplace and that care competence was positively correlated with intention to stay. Intention to stay was negatively correlated with clinical stress. The stepwise regression analysis revealed the following significant predictors of intention to stay: clinical stress, frequency of caring for infectious patients in the workplace, receiving nursing courses in the work field, and the frequency of care for patients in professional nursing careers	7/8
Alevi et al. (13)	São Paulo (Brazil)	To describe the prevalence of newly graduated nurses as second victims of adverse events and to know the conditions of support received in health institutions	Analytical Study	Nurses (n = 138)	Online questionnaire on the characteristics of the participants, the institution, and adverse events	A total of 240 responses were obtained, of which 138 were considered for analysis. Most of the participants were women, recent nursing graduates. A significant percentage had worked as nursing assistants or technicians before graduating. Many were studying in specialization or professional residency. Most of them had no institutional onboarding training when hired and did not know the term "second victim." Around 27% had been involved in adverse events, mainly related to medication. After these events, the majority reported negative feelings and insecurity, but only 59.5% felt they had received support. Some participants had received punishment. No significant differences were found between those who had received feedback on their training and recruitment period and those who had not, in terms of being involved in adverse events	6/8

(Continued)

TABLE 3 (Continued)

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
Dames (22)	Canada	To analyse how life experiences and university education influence newly graduated nurses' ability to manage stress, maintain emotional congruence, and thrive in their work, to reduce the risk of burnout and achieve career success	Qualitative study	Female nurses under the age of 40, with less than 2 years of work experience, in British Columbia, Canada ($n=8$)	Three 60-90-min interviews with each participant. The first two interviews were conducted 1–2 weeks apart, and the third interview, 3–4 weeks later	The most influential themes that emerged from the undergraduate factors, which interplay to impact congruence and one's ability to thrive in their novice nurse role were frequent self-care, receiving practicum and job placement advice that promoted congruence and identity formation, curriculum components that felt personally and professionally relevant. The importance of setting authentic goals, the ability to act as change agents and the development of self-compassion were also highlighted. However, self-care was perceived as a symbolic rather than a practical concept, and some participants felt pressure to follow career paths that did not align with their preferences, leading to stress and dissonance. Emotional management and personal-professional congruence emerged as key elements in mitigating burnout	8/10
Laschinger et al. (23)	Canada	To investigate factors influencing new graduate nurses' successful transition to their full professional role in Canadian hospital settings and to determine predictors of job and career satisfaction and turnover intentions over a one-year time period in their early employment	Cohort study	Newly graduated nurses in Canada with less than 3 years of experience ($n=406$)	NWI-R	Authentic leadership, perceptions of structural empowerment, and person-job fit were moderate at both time points, decreasing significantly over time. At both time points, new graduates felt that their work environment was supporting, maintaining high rates of job and career satisfaction, as well as low turnover intentions. Significant correlations were found between person-job fit and psychological capital (Pscap) with job satisfaction. In addition, cynicism and Pscap were identified as significant predictors of job satisfaction and turnover intentions	7/11
Al Hadid et al. (25)	Salt (Jordanian)	To examine the impact of caring for patients with COVID-19 on career decisions, resilience, and perceived self-efficacy among newly hired nurses in Jordan. It also tested whether stress, resilience, and other factors would predict intentions to stay among new nurses who care for patients with COVID-19	Analytical study	Newly hired nurses ($n=300$)	- Demographic characteristics - PSS - CD-RISC-25	most newly hired nurses reported low to moderate levels of occupational stress, and only around half of them showed low to moderate resilience. In addition, the majority picked nursing as their preferred job, expressing a high level of autonomy in decision-making as well as existing work conditions that were unfavorable and as a result affected their decision to continue in nursing. Only financial return was a significant predictor to stay in nursing among nurses in this study. Examining the influence of caring for COVID-19 patients on newly hired nurses' career decisions is suggested as well as the development of interventional programs to improve their well-being	7/8

(Continued)

TABLE 3 (Continued)

Studies	Context	Study objective	Type of study	Participants	Methods	Main findings	Quality of studies
Kaldal et al. (24)	Aalborg (Denmark)	To summarize existing research syntheses reporting newly graduated registered nurses' experiences of providing direct care in hospital settings, in order to develop evidence-based recommendations for clinical practice and research	Analytical study	44 review articles	CERQual	Newly graduated registered nurses face multiple challenges in the transition from student nurse to practicing nurse. Many experience a marked lack of competence in areas such as communication with patients and colleagues, leading to insecurity and stress. They also suffer from emotional distress and low self-confidence, which affects their ability to provide adequate care. The need for support is crucial to their professional development, as they rely on colleagues and mentors to acquire skills and manage stress. However, the work culture can negatively influence their experience, with judgmental behaviors limiting their willingness to seek help. The review emphasizes the urgency of implementing educational and organizational strategies that address these needs, as well as the importance of considering the professional identity of these nurses, as this impacts on the quality of patient care and on their job satisfaction	6/8

NSS, The Nursing Stress Scale; RECS-E, Repeated Exploration and Commitment Scale in the domain of Education; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; NSNA, National Student Nurses' Association; PSS, Perceived Stress Scale; OSCE, Objective Structured Clinical Examination; NWI-R, Nursing Work Index - Revised; CD-RISC-25, The Connor-Davidson Resilience Scale.

Feeg et al. (5) and Chen et al. (19) address the stress derived from professional expectations among newly graduated nurses, highlighting the feeling of “not knowing everything they should know” as a significant source of stress. This pressure reflects the challenging transition from formal education to clinical practice, with resulting insecurities and anxieties. According to Benner’s transition model (1984) (9), novice nurses go through different phases in their professional development, and their sense of lack of competence is greatest in the early stages. This has been supported by recent research highlighting the importance of adequate training (9). Lack of experience, identified by Halpin et al. (2), also contributes to initial stress. However, the research by Chen et al. (19) showed that stress levels decrease with training and experience, highlighting the significance of continuous training and professional development to mitigate stress and enhance adaptation to work challenges for newly graduated nurses.

The research by Halpin et al. (2) highlighted lack of experience as a stressor in nurses, emphasizing the importance of previous experience in health care in adapting to work stress. Experienced professionals show greater confidence and effectiveness in difficult situations, which reduces their vulnerability to stress. These findings emphasize the importance of experience and ongoing education in reducing work-related stress among nurses. They also highlight the need to manage professional expectations appropriately to promote well-being and effectiveness in the clinical setting.

Hoeve et al. (20) and Zhou et al. (17) explored different stressors in the nursing work environment. Hoeve et al. (20), on the one hand, highlighted the importance of sharing experiences among newly graduated nurses and belonging to a collaborative team to reduce stress (17). The social support theory by Uchino (27) backs up this idea, indicating that support networks can help reduce the impact of work-related stress on the mental health of professionals. Underpinning this idea, Uchino’s social support theory indicates that support networks can mitigate the impact of work-related stress on the mental health of professionals (27). These findings underline the key role of peer social support as a protective factor against work-related stress. Additionally, Zhou et al. (17) assessed work-related stressors, such as caregiving stress, workload, and peer stress. To support stress management, it is crucial to understand the interpersonal dynamics in the nursing work environment and how they affect the psychological well-being of professionals. A work environment that fosters open communication and mutual support can make a significant contribution to the emotional well-being of nursing professionals (17). Also, Kandal et al. (24) emphasize the need for a supportive working environment and collaborative strategies between education and the health sector, concluding that it is essential to address unmet needs to ensure safe and quality care for patients (24).

The findings by Zhou et al. (17) and Labrague and McEnroe-Petitte (4) on work stressors for nurses reflect the complexity of the work environment. Zhou et al. (17) identified caregiving stress, role and workload stress, and peer stress and professional skills as stressors. On the other hand, Labrague and McEnroe-Petitte (4) The study analyzed the impact that the unit to which newly graduated nurses were assigned had on their perceptions of workload and stress. The findings suggest that the work context can affect the experience of stress (28). This relates to Bakker and Demerouti’s Job Demands-Resources model (2007) (7), which states that a demanding and

under-resourced work environment can lead to burnout and dissatisfaction (7). For instance, Blomberg et al. (28) found high levels of stress in novice nurses, particularly in medical or surgical units, which was attributed to excessive workloads. Yeh and Yu (29) found lower levels of stress in nurses working in medical facilities, indicating that organizational interventions can reduce stress. Zhou et al. (17) also identified understaffing and multiple responsibilities as significant challenges, indicating the need to address workload at the institutional level to improve nurses' retention. These findings underscore the importance of interventions that tackle both individual and systemic challenges related to workload and job support to promote nurse retention.

Halpin et al. (2) identified workload as a common stressor, especially during the first 12 months of employment, suggesting that novice nurses are more prone to job stress, which may influence their intention to leave. This phenomenon is exacerbated by the aging workforce, as the decline in younger workers creates a generational imbalance that increases pressure on newly graduated nurses. Tett and Meyer's model on turnover intentions (1993) (30) reinforces this idea by pointing out that job dissatisfaction and stress contribute to the intention to leave. In addition, An et al. (21) examined the relationship between work-related stress, sleep disorders, and turnover intention among novice nurses, highlighting the importance of addressing these problems from the beginning of the career to avoid high staff turnover. This implies that stress and sleep management should be part of the initial training, as they can significantly influence the decision to change jobs (21). In this context, the study by Laschinger et al. (23) emphasizes that job dissatisfaction, influenced by unfavorable working conditions and lack of support, is one of the main causes of high turnover among novice nurses. This study also underlines that fostering positive work environments, with supportive and effective relationships, is key to improving satisfaction and reducing turnover (23).

The study by Chen et al. (6) highlights the competence of novice nurses in ethical and risk prevention areas, but points to deficiencies in team management. The positive correlation between educational level, competence in care, and intention to stay in the profession highlights the importance of continuing education for staff retention. Resilience emerges as a critical factor, particularly during the COVID-19 pandemic, where greater resilience was associated with greater intention to stay in the profession (6). A study in Jordan examined the impact of perceived stress in caring for patients with COVID-19 on nursing career decisions, finding that although many nurses chose this career voluntarily, they expressed dissatisfaction with working conditions and lack of adequate training. The pandemic has exacerbated staff shortages, generating high levels of stress and psychological trauma, particularly among inexperienced nurses. These findings indicate the need for interventions to improve nurses' well-being, given that perception of financial income has been identified as a significant predictor of the intention to remain in the profession (25). This is related to the resilience model by Windle et al. (31), which emphasizes how coping skills can protect against the negative effects of stress in health professionals (31). These findings highlight the importance of addressing training, stress management, and resilience building to enhance the retention and well-being of novice nurses (6).

Understanding the importance of interventions that reduce work-related stress and frustration, as well as the role of nurse managers in

providing support and enhancing professional competence, are key to promoting staff retention and improving quality of care (6).

The study by An et al. (21) focuses on the relationship between work-related stress, sleep disorders, and turnover intention, whereas Chen et al. (6) explore the relationship between competence, clinical stress, and intention to retain the job. Both studies highlight the need for early interventions and support to reduce turnover intention and improve retention of novice nurses. The lack of support and opportunities for skills development can demotivate novice nurses, affecting the stability of the healthcare team and leading to significant costs for healthcare organizations. Nurse leaders can promote the professional development, well-being, and engagement of novice nurses through early intervention and appropriate support, thereby contributing to the quality of care and stability of the nursing team (1).

In order to achieve well-being and satisfaction of newly graduated nurses, it is necessary to find congruence between the 'real self' and the 'ideal self', as stated in the study by Dames (22). This study highlights that discrepancies between expectations formed during university training and the reality of work may increase the risk of burnout, affecting retention in the profession. Integrating self-care and self-compassion practices into the nursing training curriculum can facilitate the adaptation of novice nurses and help them to manage work-related stress. Therefore, fostering an environment that promotes congruence and emotional management is essential for success and stability in the health care team (22).

Limitations

Although this research has contributed to current knowledge about the stress faced by novice nurses, some limitations have been identified. Firstly, when analyzing data from different countries, great diversity in nurses' responsibilities was found, which makes it difficult to establish an objective comparison of the results. This heterogeneity not only affects the interpretation of the data, but may also have implications for direct clinical practice, as stress management strategies may need to be adapted to specific country contexts.

Second, differences in work settings, health policies, and available resources may have the potential to introduce biases and limit the generalisability of results. It is therefore essential that future research focuses on more homogenous settings or incorporates comparative analyses.

Moreover, the inclusion of qualitative studies in the search is another limitation. This is because their exploratory nature may make it difficult to extrapolate the results.

Finally, determining when a nurse is considered a novice presented an additional challenge in assessing the included studies. This lack of clarity suggests that there is a need to standardize definitions and criteria in future research, which would not only facilitate comparison across studies, but also enrich knowledge in this field.

Conclusion

In conclusion, this study has highlighted the various challenges faced by novice nurses in new work environments, such as workload, adaptation to the environment, professional expectations, and

relationship dynamics in the team. By focusing on these aspects, a major need in the literature has been addressed, clarifying how these factors affect the intention of these professionals to remain in the profession, a topic that has been little addressed so far.

Therefore, proactive interventions, such as mentoring programs and structured training, that facilitate the adaptation of novice nurses and encourage improved teamwork are recommended. Future research would also benefit from evaluating the effectiveness of these initiatives, accounting for potential biases and the context of each setting, and from examining the role of leadership in stress reduction.

These actions seek to enhance the experience of novice nurses and also contribute to the stability of the profession, thereby ensuring quality patient care and promoting a healthier work environment. Recognizing and addressing these biases is essential to enrich understanding and strengthen the nursing practice.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

Author contributions

ÁN-G: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JG-I: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. DA-M: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. GF-V: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JG-S: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original

draft, Writing – review & editing. RA-C: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. JF-R: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. IM-T: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. CR-F: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1463751/full#supplementary-material>

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EDITED BY

Kim Walker,
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REVIEWED BY

Hamid Sharif-Nia,
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Indonesia
Kata Ivanišević,
University of Rijeka, Croatia

*CORRESPONDENCE

Shaherah Yousef Andargeery
✉ syandargeery@pnu.edu.sa

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Nurses' professional quality of life and job satisfaction in Jordan

Khaldoun M. Hamdan¹, Rabia S. Allari¹, Nadiyah A. Baghdadi²,
Shaherah Yousef Andargeery^{1,2*}, Abdullah M. Haymour³,
Evan Sabrah¹ and Abeer M. Shaheen⁴

¹Faculty of Nursing, Al-Ahliyya Amman University, Amman, Jordan, ²Department of Nursing Management and Education, College of Nursing, Princess Nourah Bint Abdulrahman University, Riyadh, Saudi Arabia, ³The Specialty Hospital, Amman, Jordan, ⁴Department of Community Health Nursing, School of Nursing, The University of Jordan, Amman, Jordan

Background: Professional quality of life has received widespread concern in nursing over the last few years. Nurses with a high professional quality of life enthusiastically approach their work and provide excellent patient care. On the other hand, poor professional quality of life may affect nurses' quality of care, resulting in job dissatisfaction and jeopardizing patient outcomes.

Aim: To examine the relationship between the professional quality of life and job satisfaction among registered nurses.

Method: A cross-sectional correlational design and convenience sampling were used. Data were collected using the Professional Quality of Life Scale-Health and the Job Satisfaction Survey.

Results: The mean total score for the nurses' job satisfaction survey was high 117.47 (SD = 27.26). The nature of work subscale had the highest mean, while the fringe benefits subscale had the lowest. The mean total score for the Professional Quality of Life Scale for Health Workers was moderate 98.41 (SD = 12.15). The Compassion Satisfaction subscale had the highest mean score, while the moral distress subscale had the lowest. There was a statistically significant positive relationship between nurses' job satisfaction and professional quality of life for health workers.

Conclusion: Nursing supervisors need to be more aware of the variables influencing nurses' professional quality of life and job to assess the degree of moral distress and satisfaction. Although nurses offer their patients physical, psychological, and spiritual care, their duties and interactions with patients can have a negative impact on them. As a result, nurses will be better equipped to care for patients if they have the assistance and support they need.

KEYWORDS

burnout, moral distress, professional quality of life, satisfaction, sustainability, nursing

Introduction

Among the 65.1 million healthcare workers globally, nurses comprise the largest workforce in the healthcare system, estimated at 27 million (World Health Organization (WHO), 2022). Involving nursing workforce is necessary to increase the quality of healthcare services. Globally, there is a shortage of nurses and midwives, representing more than 50% of the current shortage of health workers. By 2030, the globe will require nine million nurses and midwives for all countries to meet health and well-being (1).

the need to enhance nurses' quality of working life and satisfaction is growing (2). Besides this challenge, nurses frequently face patient-related complex issues, high and demanding workloads, an aging nursing workforce, ineffective policies supporting nurses in administrative systems, inadequate supervisor support, unfair compensation, unfavorable working conditions, a lack of tools and resources for efficient work, a lack of career and educational opportunities, and unstable work environments (3). These challenging conditions may affect nurses' quality of life and satisfaction with providing care daily (4).

Professional Quality of Life (PQL) has received widespread concern in nursing over the last few years, especially among nurses in the emergency department, intensive care units, and oncology wards. Helping and caring for patients is relevant to the nursing profession as the core value of nurses, and nurses are the frontline healthcare providers who deliver the most holistic and patient-centered care for patients. PQL refers to an individual's overall experience of well-being and satisfaction with their job (5). According to the professional quality of life model (5), it is a multidimensional concept encompassing two aspects: compassion satisfaction, which is considered the positive aspect, and compassion fatigue, the negative aspect of professional quality of life. Stamm (5) states that compassion satisfaction involves an individual's feeling of helping others. Compassion fatigue measures two parts: burnout and secondary traumatic stress. According to Kakemam et al. (6), secondary traumatic stress is less prevalent than burnout, yet it has an intense effect after the occurrence of adverse events on patients. Nurses are prone to burnout because of increased feelings of exhaustion and frustration from not effectively handling their work. On the other hand, nurses are prone to secondary traumatic stress from exposure to patients who suffer from traumatic conditions (5).

Nurses face complex challenges and stressors when they provide patient care, particularly for patients who are at high risk of life-threatening health problems and need cautious or intensive care. The continuous exposure to complex and demanding work environments increases the risk of developing compassion fatigue among nurses (7). These stressful events make nurses more prone to mistakes (8). Scott et al. (9) also mention that daily psychological and physical burdens nurses face can affect their performance and predispose them to error and unanticipated adverse events. In a recent study conducted by Yildirim and Ertem (10), it was found that the monthly number of shifts, manner of work, and average weekly working hours were the factors that affected nurses' quality of life. Another study conducted by (11) found that nurses' professional quality of life was affected by COVID-19. Sundgren et al. (12) found that reflective practice was more effective and positively impacted the professional quality of life scores, especially compassion burnout and satisfaction through the mediation of personal and job resources. Self-compassion has been linked with professional quality of life. In addition, it is vital to provide compassionate care to maintain balance (13) and develop resilience against stress and burnout among healthcare providers (14).

Understanding the employees' work and organizational environment and satisfaction with their presence and involvement in their workplace, resources, and activities influence their professional quality of life (15, 16). A reduction in professional quality of life can decrease the quality of care, patient outcomes, and employees' motivation while increasing absenteeism, psychological distress, and turnover (17–21). On the other hand, a higher professional quality of

life positively influences employees' performance, organizational identity, job satisfaction, and work commitment (15).

Attention to the factors influencing quality of life will help nurse administrators identify effective strategies to improve organizational efficacy, job satisfaction, and willingness to stay in their jobs. It is crucial to investigate nurses' perceptions of professional quality of life and its association with job satisfaction, to understand nurses' experience of compassion satisfaction and compassion fatigue at work. For health organizations to survive, it is essential to retain skilled nurses (22). Identifying professional life quality and associated aspects is one of the most promising approaches to encouraging nurse recruitment and retention, reducing shortage, burnout, and turnover (22). The relationships between areas of job satisfaction among nurses including pay, promotion, supervision, fringe benefits, contingent rewards, operating procedures, coworkers, nature of work, communication, and areas of professional quality of life including burnout, compassion fatigue, and compassion satisfaction have received little attention in prior global literature. Therefore, this research aims to bridge this empirical gap. Moreover, limited studies in Jordan investigated compassion satisfaction and compassion fatigue among nurses, and they were directed to particular groups like intensive care unit nurses or emergency department nurses (23, 24). Thus, this study aimed to examine the association between professional quality of life and job satisfaction among registered nurses working in different units in Jordanian hospitals.

Methods

Design

A descriptive correlational cross-sectional design was utilized in this study.

Sample

A convenient sample design was used to collect study data. An online self-administered questionnaire using Google Forms was utilized. The sample size was estimated using G*Power 3.1.10 (25) based on F statistics, medium effect size = 0.25, $\alpha < 0.05$, and power of 0.9; the minimum estimated sample size was 300 nurses. Inclusion criteria were: (1) Being a full-time registered nurse; (2) Having at least 1 year of experience.

Setting

Data were collected from nurses employed in Jordanian governmental, private, and university-affiliated hospitals in Amman, the capital of Jordan. The highest-bed capacity hospitals were selected.

Ethical considerations

Ethical approval was obtained from the Scientific and Research Committee at the Faculty of Nursing at Al Ahliyya Amman University (No. A2023/1520). Participation was voluntary, and nurses were

assured that their responses would be confidential. The anonymity of the participants was ensured throughout the study. The front page of the questionnaire contains the study objectives, confidentiality issues, and the anonymity and privacy of the respondents. Data was secured in a password-protected computer. The study instruments are permitted for public use by the tool developers.

Data collection

Data collection was begun after obtaining ethical approval. Data was collected using an electronic self-administered questionnaire using Google Forms and was distributed online via e-mails, and social media (WhatsApp, Facebook). The questionnaire contains a description that provides the participant with information about the study purpose, data collection procedure, and rights of the participants, followed by a consent statement that must be checked for acceptance if the participant accepts to participate in the study before answering the instrument questions.

Measurements

The *demographic information section* contained eight items to collect data on selected demographic variables: age, gender, marital status, work sector, job title, years of experience, department, and shift system.

The *Professional Quality of Life Scale (ProQOL)-Health* by Stamm (5) was used in this study. Professional Quality of Life (ProQOL) is intended for any helper, including health care professionals, social service workers, teachers, attorneys, emergency response, etc. Charles Figley created the measure in the late 1980s under the name Compassion Fatigue Self-Test; then, the ProQOL 5th version was created in 2009. This scale aims to understand the positive and negative aspects of helping those who experience trauma and suffering and can improve the ability to help them and keep their balance. ProQOL is the most used measure of the negative and positive effects of helping others who experience suffering and trauma. The ProQOL has sub-scales for compassion satisfaction (CS), burnout (BO), and compassion fatigue (CF). It consists of 30 items, a five-point Likert scale from 1 (never) to 5 (very often). The tool was found to be valid and reliable, with Cronbach's alpha values of 0.88 for CS, 0.75 for BO, and 0.81 for CF (5). There are three steps to scoring the ProQOL. The first step is to reverse some items. The second step is to sum the items by subscale and the third step is to convert the raw score to a t-score. Raw scores between 10 and 50 are presented for the three subscales (1) compassion satisfaction, (2) burnout, and (3) compassion fatigue. Each subscale score is also presented as two percentile ranks, comparing the respondent's scores to typical patterns of responding. And a percentile of 50 represents an average score (5).

The *Job Satisfaction Survey (JSS)* by Paul Spector (26) is a 36-item, nine-subscale to assess employee attitudes about the job. Each subscale is assessed with four items; a total score is computed from all items. A summated rating scale format is used, with a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). About half of the items require reverse scoring because they are worded in both ways. The nine subscales are pay, promotion, supervision, fringe benefits, contingent rewards (performance-based rewards), operating

procedures (required rules and procedures), coworkers, nature of work, and communication. The internal consistency reliability (coefficient alpha) score for JSS was documented by Spector (27) as 0.91. The instrument has been freely published online for the public to use since 1994.

Translation of instruments

The current study translated the ProQOL-Health and JSS into Arabic. Brislin's (54) translation model was applied. The instruments were translated into Arabic from the original language, English, using five steps. The first step involved forward translation involving two native Arabic speakers with Ph.D in nursing. One native Arabic speaker who was not involved in the forward translation reconciled the translations. Then, a native English speaker who was proficient in Arabic and was not engaged in the earlier stages translated the reconciled version back into English from Arabic. After that, the translated and original English versions were compared.

Validity and reliability

A pilot study was conducted with 15 participants to evaluate the translation instruments' reliability, the clarity of the language, and how long it took to complete the instruments. The coefficient alpha score for ProQOL was 0.74 and 0.91 for JSS.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences version 17 (55). Descriptive statistics were calculated to describe demographic information and the questionnaire items. *T*-test and ANOVA statistics were calculated to detect differences in nurses' responses concerning their demographics. Multiple logistic regressions were used to identify the predictors of nurses' professional quality of life.

Results

Sample characteristics

A total of 542 nurses participated in the study. The mean age was 32.77 (SD = 7.85), ranging from 22 to 63 years. Nurses' experience ranged from one to 38 years, with a mean of 9.95 (SD = 7.84). The sample included 74.4% females ($n = 403$), and 60% of the sample ($n = 325$) were married. Most nurses were from private hospitals, 57.4% ($n = 311$). Table 1 shows other characteristics of the sample.

Nurses' job satisfaction

The mean total score for nurses' job satisfaction survey was 117.47 (SD = 27.26). The scores ranged between 51 and 212. The Nature of Work subscale had the highest mean, 18.31 (SD = 4.37), while the Fringe Benefits subscale had the lowest mean, 10.28 (SD = 4.05), see Table 2.

TABLE 1 Sample characteristics (*n* = 542).

Characteristics	<i>N</i>	Percentage	Mean (SD)
Age			32.77 (7.85)
Years of experience			9.95 (7.84)
Gender			
Male	139	25.6	
Female	403	74.4	
Social status			
Married	325	60	
Single	191	35.2	
Divorced	19	3.5	
Widowed	7	1.3	
Hospital type			
Public	129	23.8	
Private	311	57.4	
Military	46	8.5	
University-affiliated	56	10.3	
Department			
Intensive and intermediate care units	75	13.8	
Specialized units (endoscopy, catheterization, dialysis, lithotripsy, etc.)	28	5.2	
Medical and Surgical departments	103	19	
Maternity and postpartum departments	65	12	
Emergency department	52	9.6	
Pediatric department	26	4.8	
Operation room	63	11.6	
Others	130	24	
Current position			
Head of department/ Nurse supervisor	4	0.7	
Registered nurse	300	55.4	
Continuous education department	12	2.2	
In charge nurse	57	10.5	
Associate nurse	93	17.2	
Administrative position	76	14	
The shifts you work most often			
Morning shift (A)	247	45.6	
Evening shift (B)	34	6.3	
Night shift (C)	21	3.9	
Rotating shift (A, B, and C)	240	44.3	

Professional quality of life for health workers

The mean total score for the ProQOL-Health was 98.41 (SD = 12.15). The scores ranged between 46 and 142. The compassion satisfaction subscale had the highest mean score of 23.52 (SD = 4.82), while the moral distress subscale had the lowest mean score of 16.44 (4.42), see [Table 3](#).

The relationships between nurses’ job satisfaction, professional quality of life for health workers and sociodemographic variables

There was a statistically significant positive relationship between nurses’ job satisfaction and professional quality of life for health workers ($r = 0.23, p < 0.001$). There was a significant difference in

TABLE 2 Nurses' job satisfaction (N = 542).

Scale	Mean (SD)	Range
Job satisfaction survey total score	117.47 (27.26)	51–212
Job satisfaction subscales		
Pay subscale	10.59 (4.72)	4–24
Promotion	11.57 (4.33)	4–24
Supervision	15.57 (4.78)	4–24
Fringe benefits	10.28 (4.05)	4–24
Contingent rewards	10.49 (4.69)	4–24
Operating procedures	11.35 (3.05)	4–24
Coworkers	14.56 (4.41)	4–24
Nature of work	18.31 (4.37)	4–24
Communication	14.70 (4.54)	4–24

nurses' job satisfaction in relation to hospital type ($F(3, 539) = 13.37, p < 0.001$). Nurses in private hospitals ($m = 122.79$) reported significantly higher job satisfaction than nurses in public hospitals ($m = 106.55$), $p < 0.001$, and nurses in university-affiliated hospitals ($m = 110.05$), $p = 0.005$. There was a significant difference in nurses' job satisfaction in relation to work shifts ($F(3, 539) = 3.57, p = 0.014$). Nurses working on the morning shift (A) ($m = 120.30$) reported significantly higher job satisfaction than nurses working on the night shift (C) ($m = 102.86$), $p = 0.024$. No significant differences were found between nurses' job satisfaction and other variables. No significant differences were found between professional quality of life for health workers and sociodemographic variables.

Discussion

The current study findings provide an essential understanding of exploring the relationship between professional quality of life and job satisfaction among registered nurses working in different units in Jordanian hospitals. The findings give stakeholders a thorough understanding of nurses' professional quality of life, enlightening appropriate management and motivation techniques to enhance their working conditions, which would thus help to improve their ProQOL, job satisfaction, quality of healthcare, and the efficiency of the healthcare system. The results of this study showed a high total mean score of job satisfaction among nurses, with a mean score of 98.41. This result is similar to other studies done by Kim et al. (28), Niu et al. (29), and Ndlovu et al. (30), and it is higher than was reported by other studies (7, 31, 32). In the present study, the results of ProQOL subdomains were similar to those of the Niu et al. (29) study. The results of compassion satisfaction, burnout, and secondary traumatic stress were better than other studies done in Saudi Arabia, Egypt, and China (32–34). This study's results may be explained by the improvement in the Jordanian healthcare system, especially after the COVID-19 pandemic when the nurses appeared as the first-line workforce who worked with patients. So, the Jordanian Ministry of Health paid attention to the status of nurses, including improving the quality of their work lives. Another reason for the previous results may be that most of the nurses who participated in this study were

TABLE 3 Professional quality of life for health workers (N = 542).

Scale	Mean (SD)	Range	N (%)
Professional quality of life scale for health workers	98.41 (12.15)	46–142	
Compassion satisfaction	23.52 (4.82)	6–30	
Low			18 (3.3)
Average			221 (40.8)
High			303 (55.9)
Perceived support	18.7 (4.57)	7–30	18.7 (4.57)
Low			44 (8.1)
Average			416 (76.8)
High			82 (15.1)
Burnout	20.69 (5.13)	6–30	
Low			34 (6.3)
Average			346 (63.8)
High			162 (29.9)
Secondary traumatic stress	19.05 (4.55)	7–30	
Low			38 (7)
Average			409 (75.5)
High			95 (17.5)
Moral distress	16.44 (4.42)	6–29	
Low			101 (18.6)
Average			411 (75.8)
High			30 (5.5)

from the private sector, where the environment is more comfortable and aided by high technology and resources that ease the work of the nurses (35). Perceived support and moral distress were the lowest-ranked items of ProQOL, possibly due to demanding daily schedules, heavy workloads, strained professional relationships, and emotional difficulties (36). At the same time, perceived support and moral distress were moderate in mean scores, which reflects the growing efforts of hospital administration to support the nurses and deal with organizational obstacles that may contribute to their feelings of moral distress. Counseling sessions that can control moral distress outcomes should be given to nurses. This should be done through a continuous screening process involving routine screening of nurses to detect moral distress (37). The hospital's administration and the Jordanian Ministry of Health should also put measures in place to address the causes of moral distress. To be relevant, they need to keep investigating the characteristics of moral pain among nurses, coming up with plans that enable nurses to proactively recognize the indicators of moral suffering before it develops into moral distress or burnout, and testing and funding efficient programs for helping those nurses who are going through it (38). In addition, hospitals' administration could support nurses in being more morally effective which seems to lead to more voice and less moral distress. Also increasing support for organizational ethics might be a crucial strategy (39).

The present study results regarding job satisfaction show a better mean score than many other Jordanian studies (23, 40, 41). This may indicate an improved work life and environment (42). The nature of

the work subscale had the highest mean score. However, the lowest mean score was for fringe benefits. This result is supported by studies by Ghazi and Dhafer (43), Loh et al. (56), and Saleh et al. (44). The results show that the healthcare organization's work environment and benefits should be revised to promote favorable outcomes and improve the overall satisfaction of nurses. This entails implementing a more effective system that uses operating procedures and supports higher satisfaction levels. Hospital managers are advised to implement new reimbursement policies acknowledging nurses' excellent performance and productivity.

A statistically significant positive correlation between nurses' job satisfaction and professional quality of life was detected in this study. This result is similar to many other studies (4, 23, 45). This is expected because high professional work-life quality is a good measure of workers' job satisfaction (46). This study showed a significant difference in nurses' job satisfaction with hospital type. Nurses in private hospitals reported significantly higher job satisfaction than in public hospitals and university-affiliated hospitals. Most likely, these results may be due to nurses at private hospitals solely carrying out the tasks outlined in their job descriptions. This result is also supported by Geta et al. (47), who explained that private hospitals have better work environments, infrastructure, and resources, which may influence the nature of the work among nurses and, accordingly, will raise job satisfaction.

The current study revealed that Jordanian nurses who participated in this study who are working on the fixed morning shift (A) reported significantly higher job satisfaction than nurses working on the night shift (B) and (C), or rotating shifts, which is similar to many other studies (48, 49). These results may be explained by many reasons, including hospital nurses who work in B, C, and rotating shifts may experience anxiety and stress (50), disruptions in their personal lives (51), disruptions in their regular eating routines, and lower job satisfaction (4, 23).

Measuring job satisfaction among nurses can be challenging because they take their responsibilities seriously and are quite effective at the biomedical parts of nursing care delivery. However, they may be hesitant or even afraid to interact with patients and other healthcare professionals. This group of nurses benefits from encouragement to strengthen their compassion and conviction that they give their patients high-quality care. Also, the moral aspect of their life should be assessed and evaluated occasionally by nurse administrators or specialized healthcare professionals to support them in solving their moral distress and provide them with specific techniques to ease their distress (39). Establishing an efficient management strategy is advised to decrease burnout in a way that decreases stress and raises compassionate satisfaction for nurses. Moreover, the statistically high turnover rate in the nursing profession can be explained by the tremendous strain of the occupation (52). The strain of daily obligations persists even after the COVID-19 pandemic. In this study results one of the lower satisfaction was related to pay scale compared to other factors. So, offering decent salaries is a great place to start (53). It is one of the main motivations for many people's first decision to become nurses and a motivator for improving satisfaction. For the most part, though, nursing is about more than money. Their concerns are career growth, general well-being, and professional work-life balance. Offering fringe benefits that are truly helpful to nurses is a great way to express the organization's gratitude and lighten their

overload. This study recommended that nursing supervisors be more aware of the variables influencing nurses' professional quality of life and job to assess the degree of moral distress and satisfaction.

Although nurses offer their patients physical, psychological, and spiritual care, their duties and interactions with patients can negatively affect them. As a result, nurses will be better equipped to care for patients if they have the assistance and support they need. Several limitations of this study need to be acknowledged. Job satisfaction was correlated with work-related stress, burnout, compassionate satisfaction, support, and nurses' moral distress; however, many other variables could interfere with the results, such as personal stressors like family issues, financial situations, and dysfunctional relationships. So, in future studies, it is recommended that many other variables be addressed using different tools. Another limitation is convenient sampling, so the random sampling strategy can be used in future studies to guarantee that everyone has an equal opportunity to be included in the research and that the recruited sample represents the population under investigation. These limitations call for more longitudinal studies to examine the mediation effects of job satisfaction and ProQOL among nurses.

This study has various merits, including that it is the first study done in Jordan that combines job satisfaction with the ProQOL. In addition, the findings better reflect the involvement of nurses from various units. More studies are advised to use this strategy in various clinical settings and conduct a long-term analysis of ProQOL over a long period.

Conclusion

This study shows a significantly positive correlation between job satisfaction and nurses' professional quality of life in Jordan. This study also showed that nurses who work in the private sector and in permanent A shift experience job satisfaction more than others. Promoting more stress-free, motivated, enough payment and incentives working conditions that lower health system costs and inefficiencies while raising patient outcomes, employee happiness, and quality of treatment is necessary to increase the nurses' professional quality of life and satisfaction.

Creating a morally stress-free and healthy work environment is something that legislators and nurse managers should prioritize to deliver higher-quality services. First and foremost, research into the variables influencing nursing professionals' professional quality of life and the healthcare services that have the most significant impact on or disrupt their well-being should be the focus of future studies. Therefore, employment and organizational measures have to be put into place appropriately. Targeted interventions should be developed depending on the situations that put nurses in moral distress. The goal of these interventions ought to be to foster adaptation and stress release. Counseling and supporting nursing staff are necessary programs that should be considered in Jordan hospitals.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by this research was reviewed by the Institutional Review Board at Al-Ahliyya Amman University. The Ethical Committees at the Faculty of Nursing have approved the protocol for the research project where the researcher works, and it conforms to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). Informed consent was obtained from nurses as well. The anonymity of the study participant was maintained throughout the research process. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. RA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. NB: Funding acquisition, Writing – original draft. SA: Methodology, Validation, Writing – original draft, Writing – review & editing. AH: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. ES: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration,

Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Massimo Tusconi,
University of Cagliari, Italy
Salvatore Zaffina,
Bambino Gesù Children's Hospital (IRCCS),
Italy

*CORRESPONDENCE

Haobo Ma
✉ hma@bidmc.harvard.edu
Min Yan
✉ zryanmin@zju.edu.cn

[†]These authors have contributed equally to
this work

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Enhancing the psychological well-being and sleep quality of healthcare providers with a multimodal psychological support program: a randomized controlled trial

Qi Gao^{1†}, Yuanyuan Yao^{1†}, Ruiyu Wang¹, Xinyue Zhang²,
Lisa M. Gudenkauf³, Guangxin Xu¹, Samantha Harrison⁴,
Leilei Zheng⁵, Jingping Wang⁶, Guanqing Chen⁴, Bin Zheng⁷,
Haobo Ma^{4*} and Min Yan^{1*}

¹Department of Anesthesiology, The Second Affiliated Hospital, Zhejiang University, Hangzhou, China,

²Medical Psychological Center, The Second Xiangya Hospital, Central South University, Changsha,

China, ³Department of Health Outcomes and Behavior, Moffitt Cancer Center, Tampa, FL,

United States, ⁴Department of Anesthesia, Critical Care and Pain Medicine, Beth Israel Deaconess

Medical Center, Harvard Medical School, Boston, MA, United States, ⁵Department of Psychiatry,

Second Affiliated Hospital, Zhejiang University School of Medicine and Liangzhu Laboratory, Zhejiang

University School of Medicine, Hangzhou, China, ⁶Department of Anesthesia, Critical Care and Pain

Management, Massachusetts General Hospital, Boston, MA, United States, ⁷Department of Surgery,

University of Alberta, Edmonton, AB, Canada

Background: The COVID-19 pandemic significantly challenged the global healthcare system, especially frontline healthcare professionals, such as those working in intensive care units (ICUs). In late 2022, a sudden increase in COVID-19 cases in China led to a large number of ICU admissions, requiring new ICU staff (non-ICU professionals to work in ICUs), exacerbating their stress. This study aimed to develop an effective stress management strategy for new ICU professionals, focusing on reducing the detrimental effects of stress on their psychological state. We hypothesized that the online multimodal psychological support (MPS) program might improve the psychological well-being and sleep quality of the participants.

Methods: This single-center, single-blind randomized controlled trial included new ICU staff during the COVID-19 pandemic. Participants were randomly assigned to either an intervention (online psychological support, MPS) or a control (routine wellness care, RWC) group for 28 days, and assessments were conducted before intervention (baseline), after intervention, and at the 1-month follow-up. The intervention included music therapy, sleep hygiene education, psychoeducation, and relaxation training, tailored to address common psychiatric issues experienced by healthcare professionals during the pandemic. The primary outcome was a DASS-21 score 28 days after the end of the intervention.

Results: One hundred and one professionals eventually participated in the study, 47 in the MPS group and 54 in the RWC group. No significant differences were observed in the overall psychological well-being immediately after the end of the intervention. However, the MPS group showed improved sleep and sustained lower stress levels, anxiety, and depression scores at the 1-month

follow-up, significantly improving the severity of insomnia (marginal mean difference -2.028 ; SE 1.00 ; $p = 0.044$).

Conclusion: The online multimodal psychological support program effectively enhanced the psychological well-being and sleep quality of new ICU staff demonstrating the potential of off line training in managing stress and improving health outcomes during crises. The findings of this study emphasize the importance of accessible, flexible psychological support, especially in high-stress environments such as ICUs during pandemics.

KEYWORDS

COVID-19, multimodal psychological support, healthcare providers, psychological health, public health

1 Introduction

Despite the adoption of stringent measures to contain the spread of COVID-19 in China (1), the healthcare system encountered a sudden increase in COVID-19 cases and ICU admissions following the relaxation of these restrictions in late 2022 (2–4). Owing to the shortage of ICU staff, physicians and nurses from other specialties underwent brief training and worked as part of the ICU care team (5). This experience, along with frequent work shifts and strict quarantine requirements, exacerbated stress in new ICU staff (6–9).

Several healthcare institutions are currently adopting support initiatives, advocating for self-care practices, and endorsing mental health resources to assist medical professionals in managing stress (10, 11). Many of these support resources facilitate open communication; provide access to counseling services; and foster a more supportive work environment inclusive of music, lectures, professional assistance, relaxation techniques, meditation, and other interventions targeting chronic stress (12). Although these in-person programs represent an important step toward improving the physical and mental well-being of healthcare professionals, they can be costly to organizations and healthcare professionals may experience difficulty in accessing the resources (13). Moreover, public health crises can increase the requirement while decreasing access to in-person psychological support resources, as evident by the social restrictions imposed during the COVID-19 pandemic (14).

To overcome the limitations of in-person interventions, we propose the use of online psychological support programs to reduce and manage stress among healthcare professionals as well as the general population (15, 16). Although internet-based psychosocial support programs have shown some benefits (17), the acceptability and effectiveness of programs that integrate diverse treatment modalities remain unclear (18). Moreover, these programs have not been systematically evaluated in the context of a global pandemic, wherein healthcare professionals are faced with sudden transitions in their work environment and responsibilities (19). We hypothesized that the online multimodal psychological support (MPS) program might improve the psychological well-being and sleep quality of participants immediately after the end of the intervention (which was 28 days after the participants were assigned to the ICU) at the 1-month follow-up (which was 28 days after the end of the intervention).

2 Methods

2.1 Participants

Healthcare professionals specializing in non-ICU fields such as anesthesiology, medicine, and surgery, including doctors and nurses, were recruited from the Second Affiliated Hospital of Zhejiang University School of Medicine, a quaternary-level hospital designated for the care of patients with COVID-19 in the Zhejiang province, from January to April 2023. These professionals had previously played an active role in caring for critically ill patients with COVID-19 during the beginning of the pandemic. Healthcare workers who were actively involved in the care of patients with COVID-19 and provided written informed consent were included. However, healthcare workers who declined participation or were unable to provide written informed consent were excluded. Moreover, healthcare workers who received prior relevant counseling or had severe mental illnesses were also excluded.

2.2 Procedure

This single-center, single-blind, randomized controlled trial was conducted at the Second Affiliated Hospital of Zhejiang University School of Medicine. This study was approved by the Institutional Review Board (Ethics Committee) of the Second Affiliated Hospital of Zhejiang University School of Medicine (20230401) and the National Institutes of Health Clinical Trials (approval number: NCT05713305, registration date: 01/18/2023). The included participants provided written informed consent and completed a pre-intervention (baseline, T0) psychological questionnaire within 2 weeks of their assignment to the ICU. Demographic information, including age, sex, marital status, family factors, occupation, job title, and personal or family history of psychiatric illness, was self-reported at baseline. Subsequently, the project coordinator randomly assigned participants to the MPS (online psychological support with multiple intervention modules) and RWC (routine health support) groups in a ratio of 1:1 using a computerized random number generator, with stratification by gender and occupation. The coordinator was not involved in intervention management or evaluation.

After 28 days of baseline assessment, the participants were asked to respond to a second questionnaire (T1) that was similar to the initial questionnaire. Approximately 2 months after baseline assessment, the participants were asked to respond to a third

questionnaire (T2), which was also similar to the initial questionnaire. The longitudinal design allowed for the assessment of changes over time within each individual, controlling for their baseline level of distress. The participants received \$50 as compensation for completing all assessments. Research assistants, blinded to the conditions of the participants, distributed the questionnaires either via E-mail or in person. The trial was concluded with the study end date and cessation of funding. Surveys are submitted anonymously online and participants are encouraged to complete the survey in a quiet environment.

2.3 Intervention (MPS group)

The MPS program was designed by a team of clinical psychologists and physicians based on in-depth interviews with 11 healthcare workers who sought psychological support during the COVID-19 pandemic ([Supplementary Table S1](#)). It was specifically designed to prevent and alleviate the most common psychiatric problems (depression, anxiety, stress, and insomnia) among healthcare workers dealing with the COVID-19 pandemic. WeChat was used to implement multimodal self-help intervention that included written and audiovisual content targeting four areas: music, sleep education, mental health education, and relaxation training. In addition, the intervention included daily reminders (notifications), which involved short questionnaires for providing feedback on the intervention ([Supplementary Figures S1–S3](#)), followed by the provision of information and resources tailored to the responses of individual participants. Examples include prolonging music sessions, increasing the content of relaxation sessions, and repeating sleep-assisting skills. Adjustments remain within the predefined framework. The intervention is described in detail below and in [Supplementary Table S2](#).

During the time of implementation of the intervention, participants were offered and reminded to study or practice at a regular time each day through their own choices. We also keep statistics on the frequency and duration of the participants' participation in training or learning, as well as their preference for self-selection. Psychological services were made accessible to both the MPS and RWC groups. All participants were encouraged to consult a psychologist if their symptoms deteriorated.

2.3.1 Music

A clinical psychologist in our research team oversaw implementation of music therapy. Music therapy encompassed activities such as listening to pre-recorded music ([20, 21](#)); participating in online instrumental performances; and integrating music with other therapeutic modalities such as movement, imagery, and art ([22](#)).

2.3.2 Sleep hygiene education

Participants were educated on health-related practices and environmental factors promoting sleep, such as light management, white noise utilization, temperature regulation, and the importance of including sleep-inducing music ([23, 24](#)).

2.3.3 Psychoeducation

The COVID-19 Universal Mental Health Handbook serves as the principal source of information for psychoeducation ([25, 26](#)). The

manual offers guidelines on the prevention and treatment of psychological disorders associated with COVID-19 and strategies for managing burnout, alleviating anxiety and depression, and fostering a healthy lifestyle ([27, 28](#)).

2.3.4 Relaxation training

Anxiety levels can be effectively decreased using relaxation imagery and muscle relaxation techniques ([29, 30](#)). In this study, relaxation training included muscle relaxation, breathing exercises, and meditation. The participants could conveniently attend the training sessions online, specifically within online chat communities.

2.4 Routine health support (control, RWC group)

Participants in the RWC group were provided access to the COVID-19 Universal Mental Health Handbook (similar to the MPS group) via the WeChat platform.

2.5 Outcome measures

The primary outcome was overall psychological well-being, which was measured using the 21-item Depression, Anxiety and Stress Scale (DASS-21). This instrument has been widely used to assess psychological well-being among healthcare professionals, has strong internal consistency, and has been empirically validated in different populations, including healthcare professionals from diverse ethnic backgrounds ([9](#)). Multiple studies from China have investigated the psychometric properties of the DASS-21 instrument, revealing commendable internal consistency indices for depression, anxiety, and stress (Cronbach's α values of 0.83, 0.80, and 0.82, respectively) ([31–33](#)).

Secondary outcomes included depression, anxiety, stress, and insomnia. Depression, anxiety, and stress were measured using DASS-21 subscale scores. Insomnia, both nighttime and daytime, was assessed using the Insomnia Severity Index (ISI), a seven-item Likert scale. The total score, ranging from 0 to 28, was calculated to assess the presence of insomnia within the study population ([34](#)).

2.6 Statistical analysis

To ensure a statistical power of 90% and a one-sided significance level of 5%, the sample size required to detect a minimum difference of 10 (± 15) points in DASS-21 between groups was estimated to be 110 participants (with 55 participants in each group, accounting for a 10% attrition rate) ([35, 36](#)). The main population for analysis was defined as the modified intention-to-treat cohort, which included all patients who underwent any form of psychological intervention and completed a follow-up assessment of their mental health scores. A linear mixed-effect model was used to analyze changes in primary and secondary outcome measures before ICU assignment and 4 weeks after the end of 1-month ICU assignment in the MPS and RWC groups. Post-hoc analysis was conducted to compare the estimated marginal means at different time points within each group and between the two groups.

Sensitivity analysis was performed using a mixed-effect model, which included the baseline variables as confounders (Supplementary Table S3). Post-hoc analysis (as mentioned above) was performed to compare the estimated marginal means in the adjusted model. The *p*-value was determined using the multivariate *t* method, and results were averaged over the levels of all confounders from the linear mixed-effect model. Statistical analysis was performed using the R (version 4.2.2) software. The lme4 R package was used to establish the linear mixed-effect model, whereas the emmeans R package was used to calculate the estimated marginal means.

3 Results

A total of 160 eligible participants were screened from January 2023 to April 2023. Based on the inclusion–exclusion criteria, 110 participants were selected, with 55 participants being assigned to the MPS and RWC groups each. Subsequently, 3 participants were excluded because they did not respond to the baseline questionnaire, resulting in 53 and 54 participants in the MPS and RWC groups, respectively. At the end of the intervention, 47 of the 53 participants in the MPS group had completed the intervention and assessment. Therefore, a total of 101 participants were eventually included in data analysis, with 47 and 54 participants in the MPS and RWC groups, respectively (Figure 1). Among the participants, 63.0% were women and 37.0% were men, with 60.3% being physicians and 39.6% being nurses. The median age of the participants was 30.0 years, with an interquartile range (IQR) of 28.3–32.0 years, and the mean DASS-21 score at baseline was 33. The baseline characteristics of the MPS and RWC groups were comparable. The median DASS-21 score at baseline was 34 (range: 26–46) in the MPS group and 26 (range: 18–42) in the RWC group. Regarding mental health, symptoms of depression, anxiety, stress, and insomnia were observed in 53.4, 65.3, 37.6, and 65.3% of participants, respectively (Table 1).

After 4 weeks, 47 of 53 (88.7%) participants in the MPS group were using the online support program. None of the participants developed an adverse event. Primary and secondary outcome data were available for 101 of 107 participants (94.4%). Without accounting for baseline covariates, the mixed-effect model provided estimates reflecting the average impact of the intervention on each mental health indicator. All estimates were negative, indicating that the intervention led to improvements in overall mental health. However, differences in total DASS-21 scores and individual depression, anxiety, and stress scores did not reach statistical significance (*p*-value > 0.05 for all). Notably, differences in ISI scores were significant, with an estimate of −2.028 and a standard error of 1.00, corresponding to a *p*-value of 0.0440 (Table 2).

Furthermore, changes in mental health were assessed based on total DASS-21 scores and individual depression, anxiety, and stress scores at T0, T1, and T2. No significant differences in mental health indicators were observed between the MPS (intervention) and RWC (control) groups at T0. At the end of the intervention, the scores were lower in the MPS group than in the RWC group. The RWC group showed a reduction in stress and depression scores at T1 but a slight increase in anxiety, stress, and depression scores at T2 (Figure 2). Regarding insomnia, both groups had similar ISI scores at T0. The scores were not significantly different at T1 but were significantly lower in the MPS group than in the RWC group at T2 (Figure 3).

We counted the frequency and duration of training or learning attended by participants in the MPS group (Supplementary Figures S1, S2), as well as self-selection preferences (Supplementary Figure S3). And no participant seeking additional mental health counseling, with no significant side effects.

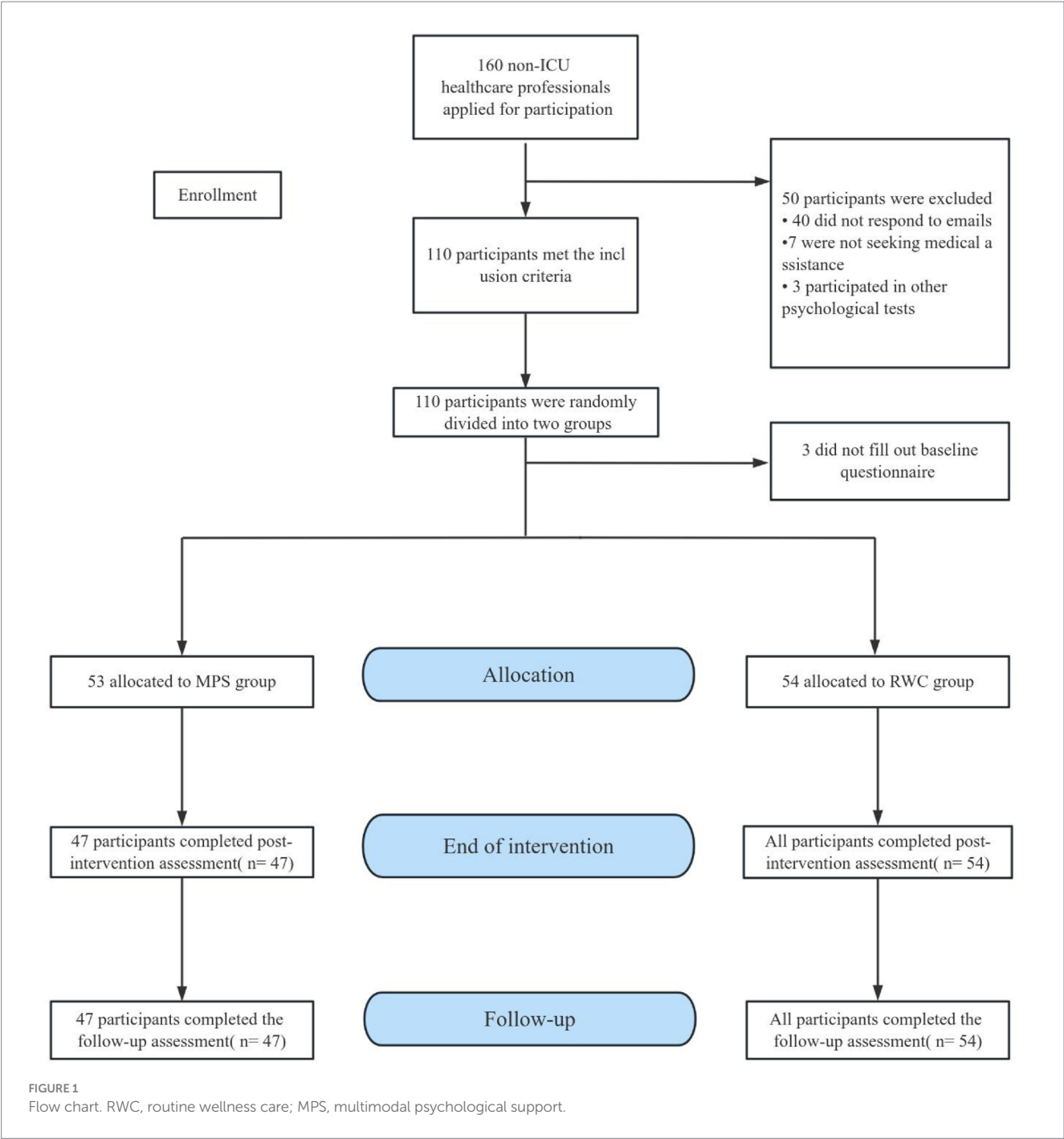
4 Discussion

This single-center randomized controlled trial demonstrated that Evidence-based online interventions have the potential to greatly benefit healthcare professionals working in ICUs. To our knowledge this is the first online intervention to include a real-time feedback adjustment system. In this study, we compared the effects of an online intervention program integrating music therapy, sleep hygiene education, psychoeducation, and relaxation techniques (MPS group) with those of standard health maintenance (RWC group) on healthcare professionals' psychological well-being. Symptoms of anxiety, stress, and depression were significantly alleviated from baseline to the 1-month follow-up in both MPS and RWC groups. In addition, the MPS group showed a significant decrease in the severity of insomnia. Altogether, the online multimodal intervention program was feasible, without side effects, and was received well by the participants.

This study focused on a group that has often been overlooked in previous studies: new ICU staff who worked in ICUs during the COVID-19 pandemic and were responsible for taking care of critically ill patients (37). These individuals experienced a transition in their job responsibilities and work environment; however, the effects of this transition on their psychological state have not been investigated to date. This study emphasizes that prompt attention should be paid to the psychological problems of healthcare professionals working under tremendous pressure during global health crises (38, 39). The baseline data, satisfaction scores, and in-depth interviews in this study validated the mental health problems of healthcare professionals and the high acceptability of the online multimodal intervention program (40). Therefore, this study not only fills a knowledge gap but also provides a promising strategy for improving the mental health of healthcare professionals. We will conduct further research to develop more effective support and intervention strategies for improving healthcare professionals' psychological well-being.

This study represents a novel addition to the existing literature, as it addresses the ongoing increase in the incidence of mental health disorders resulting from changes in the work environment and job responsibilities (41). During the COVID-19 pandemic, the healthcare system encountered considerable challenges owing to an increase in the number of critically ill patients. The online multimodal psychological support program used in this study was developed and executed by a multidisciplinary group of anesthesiologists, surgeons, and internists (42, 43). Designed to specifically address the challenges imposed by the COVID-19 pandemic, the MPS program incorporates evidence-based elements and can be tailored to meet individual requirements. Notably, the MPS program can be implemented via WeChat, a widely used communication platform in China, thereby offering flexibility and convenience under quarantined conditions during the pandemic (44).

This study is substantially different from previous studies. To date, most existing studies have used pre-determined content for



participants to choose from; however, the MPS program developed in this study integrates components that have been shown to be effective. Therefore, this study introduces a novel strategy for adapting support content based on user feedback and the effectiveness of internet-based cognitive behavioral therapy in alleviating mental health disorders (45, 46). Compared with traditional wellness care, the MPS program resulted in a more significant reduction in the severity of psychological disorders at the end of 1-month ICU assignment among new ICU staff, which is consistent with the findings of previous studies, systematic reviews, and meta-analyses (38, 47).

Unlike existing single-modality interventions, the innovative MPS program represents a diversified and personalized approach to

assessing the psychological well-being of healthcare professionals. Mental health interventions are crucial for alleviating emotional burnout and psychological burden among healthcare professionals (48). However, the effectiveness of single-modality interventions is often influenced by individual participant differences (49, 50). On the contrary, combining multiple interventions addresses a range of psychological issues and provides more comprehensive support (51, 52). This study showed similar findings, highlighting the importance of psychological interventions in the high-pressure ICU environment (53). The MPS program not only improved the sleep quality of the participants but also helped alleviate emotional stress, particularly leading to long-term improvements in the symptoms of anxiety and

TABLE 1 Baseline demographic characteristics of participants.

Characteristic	Intervention		<i>p</i> ^b
	RWC, <i>N</i> = 54 ^a	MPS, <i>N</i> = 47 ^a	
Age	30.0 (28.3, 32.0)	30.0 (28.0, 34.5)	0.682
Sex			0.928
Male	20 (37%)	17 (36%)	
Female	34 (63%)	30 (64%)	
Profession			0.802
Nurse	22 (41%)	18 (38%)	
Physician	32 (59%)	29 (62%)	
Seniority			0.342
Junior	39 (72%)	28 (60%)	
Intermediate	13 (24%)	18 (38%)	
Senior	2 (4%)	1 (2%)	
Marriage			0.243
Unmarried	36 (67%)	26 (55%)	
Married	18 (33%)	21 (45%)	
Children			0.078
Do not have child/children	42 (78%)	29 (62%)	
Has child/children	12 (22%)	18 (38%)	
COVID vaccination			>0.999
No	2 (4%)	2 (4%)	
Yes	52 (96%)	45 (96%)	
ICU course			0.553
Not received ICU Short Training	25 (46%)	19 (40%)	
Received ICU Short Training	29 (54%)	28 (60%)	
Antidepressant			0.702
Not taking antidepressant	51 (94%)	43 (91%)	
Taking antidepressant	3 (6%)	4 (9%)	
DASS-21 score	26 (18, 42)	34 (26, 46)	0.078
Depression score	9 (2, 14)	10 (5, 14)	0.266
Anxiety score	8 (4, 14)	12 (8, 15)	0.065
Stress score	12 (7, 16)	14 (10, 18)	0.171
Insomnia score	9.5 (5.0, 13.0)	10.0 (7.0, 14.0)	0.384

^a*n* (%).
^bWilcoxon rank-sum test; Pearson's chi-squared test; Fisher's exact test; RWC, routine wellness care; MPS, multimodal psychological support.

TABLE 2 Mixed-effect modeling for primary and secondary outcomes.

Follow-up (MPS and RWC groups)	Estimate	SE	<i>p</i>
DASS-21	−5.69	3.92	0.1472
Depression	−1.84	1.47	0.2123
Anxiety	−2.05	1.33	0.1239
Stress	−1.79	1.42	0.2075
ISI	−2.028	1.00	0.0440*

Mixed-effect model with no baseline covariates. RWC, routine wellness care; MPS, multimodal psychological support; ISI, insomnia severity index.
*The differences found were statistically significant.

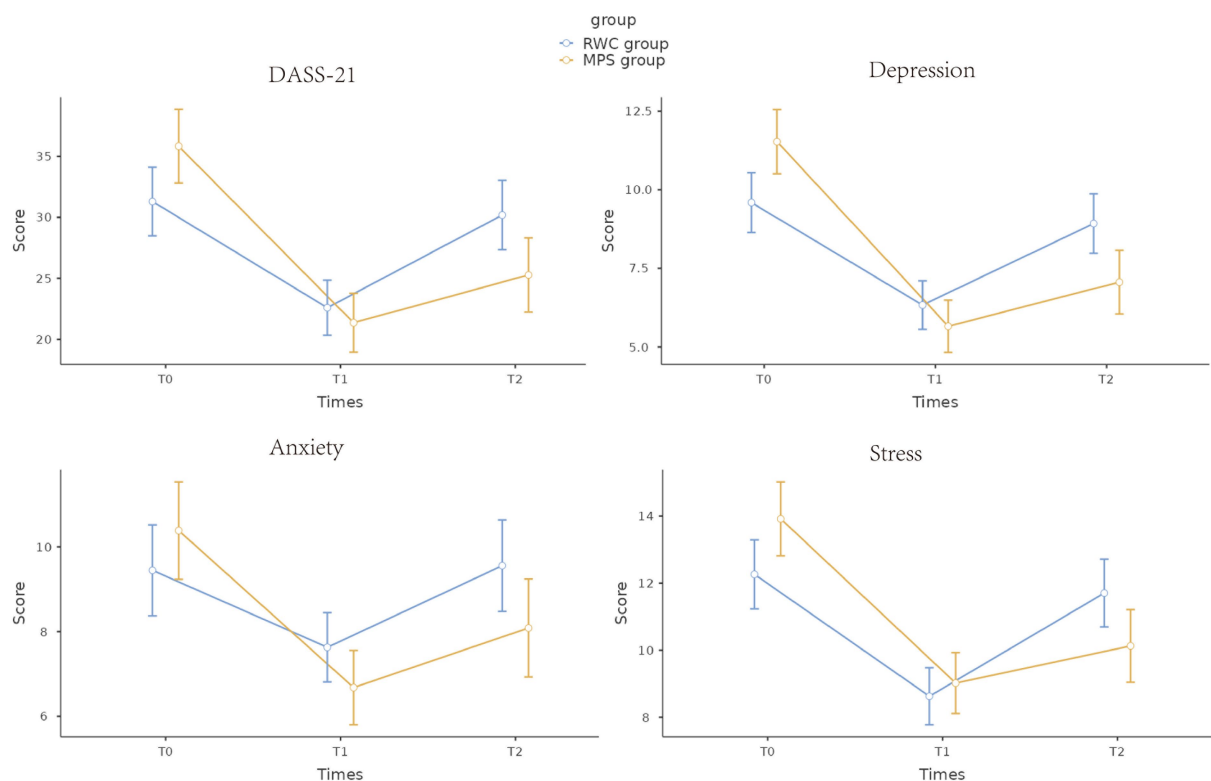


FIGURE 2

Changes in total DASS-21 scores and subscale scores during the intervention and follow-up periods. RWC, routine wellness care; MPS, multimodal psychological support; DASS-21, 21-item Depression, Anxiety and Stress Scale; T0, baseline; T1, immediately after the end of the intervention; T2, 4 weeks after the end of the intervention. DASS-21 and its subscale scores are expressed as the mean and standard error of the mean (SEM). The *p*-value represents statistically significant differences between the MPS and RWC groups at 4 weeks after the end of the intervention.

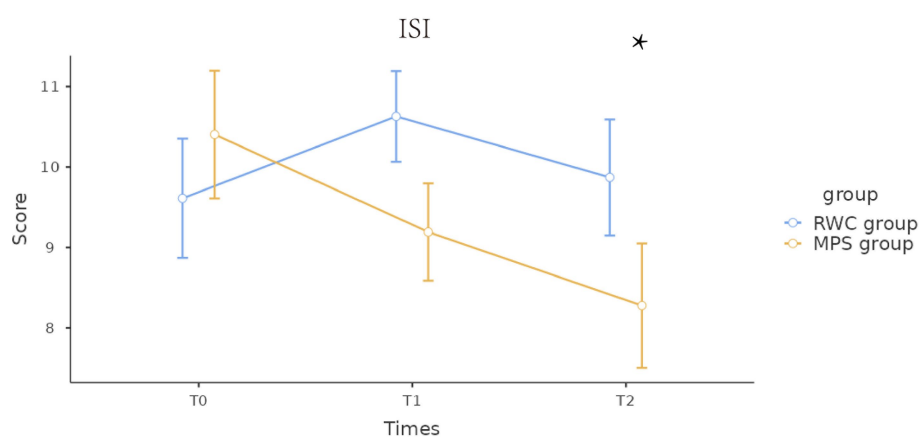


FIGURE 3

Changes in the Insomnia Severity Index scores during the intervention and follow-up periods. RWC, routine wellness care; MPS, multimodal psychological support; ISI, Insomnia Severity Index; T0, baseline; T1, immediately after the end of the intervention; T2, 4 weeks after the end of the intervention. Insomnia Severity Index scores are expressed as the mean and standard error of the mean (SEM). *p*-values represent statistically significant differences between the MPS and RWC groups at 4 weeks after the end of the intervention. * The differences found were statistically significant.

depression. Therefore, the online MPS program offers broad applicability and feasibility in emergency settings, providing a valuable basis for developing similar intervention strategies in the future.

The decrease in ISI scores in the MPS group provides a reference for investigating the effects of the MPS program on the sleep quality

of healthcare professionals working in high-stress environments such as the ICU (48). This improvement in insomnia severity is especially noteworthy given the demanding nature of ICU responsibilities and their known impact on sleep quality. The trend toward “no clinically significant insomnia” in the MPS group highlights the efficacy of MPS

in enhancing not only sleep quality but also overall well-being and job performance among healthcare professionals (49). On the contrary, the lack of changes in ISI scores in the RWC group emphasizes the requirement of targeted interventions, such as MPS, to address sleep disturbances among healthcare professionals working in high-stress environments.

We conducted an integrated analysis of participants' frequency of engagement, total time invested, and preferences for different interventions to better understand their impact on DASS-21 scores (see [Supplementary Figures S1–S3](#)). The results indicate variability in both frequency and duration of engagement among participants, with those who engaged more frequently typically reporting improved mental health outcomes (50). This variability suggests that the extent of engagement may directly influence the efficacy of the interventions. Furthermore, the preference data shown in [Supplementary Figure S3](#) demonstrates strong acceptance of relaxation techniques and music interventions, indicating that tailoring these interventions to individual preferences could significantly enhance their appeal and effectiveness (51).

4.1 Limitations

This study has certain limitations that should be acknowledged. This study was a single-center prospective randomized controlled trial that included new ICU staff working in ICUs during the COVID-19 pandemic. Therefore, the generalizability of the results may be limited. A double-blind approach was not practical in the context of the COVID-19 pandemic; therefore, demand characteristics and potential placebo effects cannot be completely ruled out when interpreting the results (52). However, the validity of the study is supported by the inclusion of exclusively new ICU staff from our center and the provision of a structured intervention through a pre-established online platform.

Future studies should test varying intervention dosage frequencies and durations and targeted content to determine their potential impact on depression, stress, and sleep (47, 53, 54). Additionally, given the overwhelming medical workload and the rapid spread of infection during the COVID-19 pandemic, weekly assessment of outcome measures over the intervention course was impractical in the present study. Future large-scale, multi-center randomized controlled trials should be conducted to assess the dose–response relationship with repeated longitudinal outcome measures and determine the feasibility, acceptability, and effectiveness of intervention strategies across medical contexts and healthcare professionals. No participants in this study used additional psychological counseling services, suggesting that future research should examine the protective effects of such counseling on outcomes.

4.2 Clinical implications

The novel, flexible online multimodal psychological support program developed in this study improved the overall psychological

well-being of new ICU staff working in ICUs during the COVID-19 pandemic and could be easily implemented. This program holds potential for widespread application in clinical settings. In addition, as evidenced by its effects on insomnia, the multimodal psychological support program may help address the critical issue of sleep disturbance among healthcare professionals, thus improving their overall well-being.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional Review Board (Ethics Committee) of the Second Affiliated Hospital of Zhejiang University School of Medicine (20230401). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

QG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft. YY: Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing. RW: Investigation, Methodology, Software, Visualization, Writing – original draft. XZ: Conceptualization, Writing – original draft. LG: Conceptualization, Methodology, Writing – original draft. GX: Investigation, Methodology, Writing – original draft. SH: Formal analysis, Methodology, Software, Validation, Visualization, Writing – original draft. LZ: Conceptualization, Methodology, Writing – original draft. JW: Conceptualization, Investigation, Methodology, Writing – original draft. GC: Data curation, Formal analysis, Methodology, Visualization, Writing – original draft. BZ: Conceptualization, Methodology, Writing – original draft. HM: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft. MY: Funding acquisition, Resources, Supervision, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1455174/full#supplementary-material>

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EDITED BY

Mansoor Malik,
The Johns Hopkins Hospital, Johns Hopkins
Medicine, United States

REVIEWED BY

Jasim Tariq,
IQRA University Islamabad, Pakistan
Massimo Tusconi,
University of Cagliari, Italy

*CORRESPONDENCE

Guochun Xiang
✉ melinda_lx@163.com

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Latent profile analysis of burnout, depression, and anxiety symptoms among Chinese medical staff with frontline anti-epidemic experience in the post-COVID-19 pandemic era

Huachun Xu¹, Lanjun Qiu¹, Yu Chen¹, Mengjun Zhang², Junyi Li¹
and Guochun Xiang^{2*}

¹College of Psychology, Sichuan Normal University, Chengdu, China, ²School of Public Health, Southern Medical University, Guangzhou, China

Background: Frontline medical staff's psychological symptoms deserve persistent attention after 3 years of high-pressure and high-intensity work during the pandemic. In addition, the meaning of burnout and its relationship with depression and anxiety have long been debated. This study aimed to identify profiles of these symptoms among Chinese medical staff with frontline anti-epidemic experience, along with their distinguishing characteristics.

Methods: Psychological symptoms of burnout (exhaustion, cynicism, and inefficacy), depression, and anxiety from 989 doctors and 1,105 nurses were explored with latent profile analysis. The R3step method was conducted to analyze the predictive factors of those medical staff's symptoms.

Results: Three symptom profiles were identified for medical staff, with high-level (62.1%), moderate-level (28.9%), and low-level symptoms (9.0%). In the low-level and moderate-level profiles, symptom variables considered had a consistent trend. However, within the high-level profile, the inefficacy of burnout remained at a lower level, and anxiety performed as the most prominent symptom. Variables of gender, age, salary satisfaction, work hours, and work intensity predicted medical staff profiles ($p < 0.05$).

Conclusion: In the post-COVID-19 era, former frontline Chinese medical staff's psychological symptoms were divided into three latent profiles. Symptoms of burnout, depression, and anxiety did not move in lock-step, indicating that they are different and robust constructs. Targeted intervention strategies should be developed for different subgroups.

KEYWORDS

latent profile analysis, burnout, depression, anxiety, medical staff

Introduction

During the COVID-19 pandemic, frontline medical staff was faced with an extremely uncertain work environment and high-intensity work pressure, which led to a high prevalence of psychological symptoms among them (1–3). Further, the experience of fighting the epidemic on the front line could have been traumatic, and the related psychological symptoms may persist for long periods. Previous evidence has shown that the experience of treating SARS patients

during the SARS outbreak brought long-term psychological and occupational impact, manifested as significantly higher levels of psychological symptoms (such as burnout, posttraumatic stress, depression, and anxiety) compared to those healthcare workers without the experience, even 1 or 2 years later (4, 5). Therefore, despite being in the post-pandemic era after January 8, 2023, when China entered the regular epidemic prevention and control stage, the long-term impact of the 3 years during the pandemic on the psychological symptoms of medical staff with frontline anti-epidemic experience deserves concern.

Numerous studies have suggested that burnout is a global phenomenon among medical staff. Burnout is conceptualized as a stress-related problem for individuals who work in interpersonally oriented occupations such as healthcare (6, 7), and consists of three interrelated components: exhaustion, cynicism, and inefficacy. Besides, depression and anxiety have always been challenging problems before and during the COVID-19 defense in China (8–11).

On the other hand, the meaning of burnout and its relationship with depression and anxiety have long been debated in academia (12). For example, previous literature reviews focusing on the distinction between burnout and depression have yielded mixed conclusions (13, 14). Especially, a growing body of research has supported that burnout and depression are overlapping constructs. Evidence suggests these concepts refer to syndromes with blurred boundaries, which often show a high degree of comorbidity and simultaneous onset (13). Burnout symptoms share a general dimension with depression (15), and they seem to represent the same continuum of distress (16). All of this evidence casts serious questions as to whether burnout is a standalone syndrome independent of depression. However, although burnout and depression appear to share some common features (e.g., loss of vitality), several researchers believe that burnout and depression are two separate constructs (17). At the same time, some researchers held that burnout can only be experienced in reaction to stressors experienced in the workplace, while depression is more pervasive and not specific to the work context (18, 19). Also, some researchers found that burnout could significantly predict depression (20, 21), and some other researchers believed that depression can increase the possibility of burnout (22). Whereas, other studies suggested a reciprocal relationship (17, 23). Similar controversies also exist regarding the relationship between burnout and anxiety (14, 24–26). Ding et al. (2014) found that exhaustion and cynicism were positively related to anxiety symptoms, whereas inefficacy was negatively related to anxiety symptoms (27). Turnipseed also found that there was a significant correlation between burnout and anxiety symptoms, with the connection between anxiety and exhaustion being the strongest (28). However, the exact relationship between burnout and anxiety is unclear. Specifically, are people with higher anxiety more prone to burnout, or does burnout exacerbate anxiety symptoms? Furthermore, is there an overlap between burnout and anxiety? Accordingly, more research is needed to understand how burnout relates to depression and anxiety symptoms among medical staff.

By now, most of the previous studies investigating burnout, depression, and anxiety symptoms together have adopted the “variable-centered” approach, assuming that all individuals from a sample are drawn from a single population for which a single set of “averaged” parameters can be estimated (29, 30). To the best of our knowledge, the person-centered approach has not been applied to study the relationship between the three components of burnout and symptoms of depression and anxiety. LPA is an emerging person-centered analytical technique that classifies individuals based on model-fitting estimation. Unlike traditional methods, LPA does not require strong

causal relationships between variables or large sample sizes collected from multiple time points. This statistical approach explains the relationships between observed continuous indicators through latent categorical variables. Objective statistical indices are employed to assess the accuracy and validity of the classification, thereby maximizing the identification of qualitative differences among individuals (31–33). The focus of this approach is on identifying latent sub-populations of individuals based on multiple observed characteristics (i.e., indicators). This provides a higher level of specificity compared to variable-centered approaches, offering a more intuitive and realistic description of the individuals and enhancing our understanding of the subjects (34).

With the construct of burnout, Leiter and Maslach have used latent profile analysis and identified multiple person-centered profiles across the burnout–engagement continuum with two large datasets, which demonstrated that dimensions of burnout did not rise and fall together all the time. Accordingly, we may reasonably assume that the relationship between burnout dimensions and symptoms of depression and anxiety do not always move in lock-step. LPA is just the method that can detect the presence of patterns of several variables within individuals that tend to recur between individuals, rather than the effects of specific variables on individuals (35–37), and therefore provides new ways to solve the problem of symptom classification.

Previous studies have shown that demographic variables and work-related variables have significant effects on medical staff’s psychological symptoms. For example, female medical staff tended to show more burnout and anxiety symptoms (38) and were more likely to suffer from depression than men (39); compared to married medical staff, unmarried nurses were more prone to burnout (40); workers in secondary hospitals were more likely to experience depression and anxiety than were those working in tertiary hospitals (41); medical staff with fewer work years and little practical experience were more likely to burnout (40); and medical staff who had low salary satisfaction and more job dissatisfaction had greater burnout (42). Accordingly, it is also meaningful to account for demographic and work-related factors when examining psychological symptoms via LPA. Especially, the results will help address the profile members with a high risk of psychological problems (43).

In summary, frontline medical staff may continuously experience burnout, depression, and anxiety after a sustained and high-intensity public health emergency (4, 5, 44). The present study extends previous research by assessing burnout, depression, and anxiety jointly with latent profile analysis. This analysis will help in accurately discerning the heterogeneity of these symptoms and understanding the relations between them in medical staff. Accordingly, this study aimed to investigate burnout (consists of exhaustion, cynicism, and inefficacy), depression, and anxiety symptoms of Chinese medical staff with frontline anti-epidemic experience through LPA. Also, we explored whether relevant factors (e.g., demographic variables and work-related variables) are significant influencing factors of distinct symptom profiles.

Methods

Participants and procedures

For this study, data were collected using an online survey platform, Wenjuanxing (Questionnaire Star), which is widely used for research purposes in China. The survey was completely anonymous and voluntary, ensuring that participants’ responses were

confidential and that no personal identifying information was collected. The data collection process followed the ethical guidelines set by our institutional review board, with informed consent obtained from all participants before participation.

The survey was distributed across four provinces of China (Guangdong, Guizhou, Chongqing, and Sichuan), following a stratified random sampling approach to ensure institutional diversity. The survey was open to healthcare professionals working in various departments between February and April 2023, with the following specific inclusion criteria: (1) being a doctor or a nurse; (2) being over 18 years of age; and (3) having participated in the anti-COVID-19 effort as frontline staff. We ensured that each participant could only submit one completed survey online to maintain data integrity.

Finally, a total of 2094 healthcare workers, consisting of 989 doctors and 1,105 nurses participated in the survey. As shown in Table 1, most of the participants were under 35 years of age ($n = 1,457$, 69.6%), worked in public tertiary hospitals ($n = 784$, 37.4%) and community healthcare centers ($n = 681$, 32.5%), were female ($n = 1,577$, 75.3%), were married ($n = 1,564$, 74.7%), had children ($n = 1,486$, 71.0%), had bianzhi ($n = 1,120$, 53.5%); Table 1 also shows the variables of education, job title, work years, income, salary satisfaction, work hours and work intensity.

Measures

Burnout

Burnout was assessed via the 22-item Chinese version of the Maslach Burnout Inventory-Human Service Survey (MBI-HSS) (45). The items consist of 3 dimensions: exhaustion (also described as wearing out, loss of energy, depletion, debilitation, and fatigue); cynicism (also described as depersonalization, negative or inappropriate attitudes, detached concern, irritability, loss of idealism, and withdrawal); and inefficacy (also described as reduced productivity or capability, low morale, low personal accomplishment and an inability to cope). A seven-point Likert scale ranging from “never” (1) to “every day” (7) was used to measure the frequency with which respondents experienced feelings related to each item. The Chinese version of MBI-HSS has also been shown to have excellent validity in a sample composed of participants from a range of occupations, including medical staff (46–48). In the present study, the exhaustion scale had an internal consistency (Cronbach's alpha) of 0.91, the cynicism scale of 0.88, and the inefficacy scale of 0.89.

Depression

The Center for Epidemiologic Studies Depression Scale (CES-D) (49) was used to assess depressive symptoms over the past week with 20 items. The responses to the items were given on a four-point Likert scale (never = 1, almost every day = 4). Higher scores on the CES-D indicate more depressive symptoms. Studies of CES-D in different populations, including medical staff, have further confirmed its high adaptability (50, 51). In this study, the Cronbach's alpha was 0.93.

Anxiety

The Generalized Anxiety Disorder Scale (GAD-7) (52) is a seven-item scale (GAD1 = Feeling nervous, anxious or on edge; GAD2 = Not

being able to stop or control worrying; GAD3 = Worrying too much about different things; GAD4 = Trouble relaxing; GAD5 = Being so restless that it is hard to sit still; GAD6 = Becoming easily annoyed or irritable; GAD7 = Feeling afraid as if something awful might happen), scored on a four-point Likert scale (never = 1, almost every day = 4). The GAD-7 has been shown to exhibit strong reliability and validity across diverse countries and populations (53, 54). In this study, the Cronbach's alpha was 0.96.

Demographic and work-related factors

Demographic and work-related variables can influence the psychological symptoms of medical staff. Therefore, we measured work unit (5-point scale; 1 = public tertiary, 5 = other hospitals), gender (1 = female, 2 = male), marital status (1 = single, 2 = married), parenting status (1 = without children, 2 = with children), bianzhi (which is also called the ‘iron rice bowl’ given by the state, meaning positions with lifetime job security; 1 = have bianzhi, 2 = no bianzhi), age (10-point scale; 1 = below 20; 10 = above 61), education (7-point scale; 1 = medical doctor, 7 = primary school or below), job title (5-point scale; 1 = advanced technical job title, 5 = no job title), work years (7-point scale; 1 = less than 1 year, 7 = more than 40), income (9-point scale; 1 = less than RMB 5,000, 9 = more than RMB 200,000), salary satisfaction (5-point scale; 1 = strongly dissatisfied, 5 = strongly satisfied), work hours (4-point scale; 1 = less than 8 h, 4 = more than 12 h), and work intensity (5-point scale; 1 = strongly relaxed, 5 = strongly intensive) using an open-ended response.

Data analysis

First, Pearson's r correlations for each administered measure among medical staff using SPSS 25.0, and the variables were positively correlated with each other. At the same time, to facilitate clear interpretation continuous scores from psychological symptoms screening tools were standardized by z -score.

Second, the LPA was conducted using Mplus8.3 with a three-step approach (55) to identify profiles of medical staff. In the first step of the LPA, three models were built and tested using the maximum likelihood with robust standard errors (MLR) estimator. In the second step, to identify the appropriate number of latent profiles, we used the Bayesian Information Criterion (BIC), the Akaike Information Criterion (AIC), and the sample-size adjusted BIC (aBIC) (56). Lower values of these indices suggest a better model fit. Additionally, the Lo–Mendell–Rubin adjusted LRT test (LMR-LRT), and bootstrap likelihood ratio test (BLRT) were used to determine the optimal number of profiles. A significant p -value for these tests suggested that a K-profile model fit the data better than a model with a (K-1)-profile (57). Meanwhile, when selecting the best model, entropy which checks whether the latent model can represent the different types, is also taken into account. Entropy calculations close to 1.0 indicate a better classification (58).

Finally, a univariate analysis (Chi-square analysis and ANOVA analyses) was conducted to explore the significant associations between sample characteristics (demographic and work-related factors) and psychological symptom profiles. The study then conducted a multinomial logistic regression, using the three-step

TABLE 1 Comparisons of medical staff's characteristics among profiles.

Characteristic	Categories	Total (<i>n</i> = 2094)	Profile 1	Profile 2	Profile 3	χ^2/F	<i>p</i>
			(<i>n</i> = 1,301)	(<i>n</i> = 605)	(<i>n</i> = 188)		
Position						4.122	0.127
	Doctor	989 (47.2%)	623 (47.9%)	268 (44.3%)	98 (52.1%)		
	Nurse	1,105 (52.8%)	678 (52.1%)	337 (55.7%)	90 (47.9%)		
Work unit						42.609	<0.001
	Public tertiary	784 (37.4%)	483 (37.1%)	226 (37.4%)	75(39.9%)		
	Public secondary	543 (26.0%)	389 (30.0%)	129 (21.3%)	25(13.3%)		
	Community healthcare center	681 (32.5%)	374 (28.7%)	226 (37.4%)	81(43.1%)		
	Private healthcare institution	29 (1.4%)	20 (1.5%)	6 (1%)	3(1.6%)		
	Other	57 (2.7%)	35 (2.7%)	18 (2.9%)	4(2.1%)		
Gender						15.347	<0.001
	Female	1,577 (75.3%)	971 (74.6%)	482 (79.7%)	124(66.0%)		
	Male	517 (24.7%)	330 (25.4%)	123 (20.3%)	68(34.0%)		
Marital status						12.816	0.002
	Single	530(25.3%)	295 (22.7%)	177 (29.3%)	58 (30.9%)		
	Married	1,564(74.7%)	1,006 (77.3%)	428 (70.7%)	130 (69.1%)		
Parenting status						18.816	0.004
	Without children	608(29.0%)	338(26.0%)	206(34.0%)	64(34.0%)		
	With children	1,486(71.0%)	963(74.0%)	399(66.0%)	124(66.0%)		
Bianzhi						3.248	0.517
	Have bianzhi	1,120(53.5%)	693(53.3%)	316(52.2%)	111(59.0%)		
	No bianzhi	974(46.5%)	608(46.7%)	289(47.8%)	77(41.0%)		

Variable	Mean (Standard deviation)				χ^2/F	<i>p</i>
Age	4.11 (1.608)	4.21 (1.650)	3.91 (1.509)	4.02 (1.567)	7.563	0.001
Education	3.25 (0.514)	3.25 (0.510)	3.25 (0.532)	3.29 (0.490)	0.61	0.544
Job title	3.64 (0.812)	3.60 (0.826)	3.70 (0.786)	3.70 (0.778)	3.634	0.027
Work years	3.27 (1.205)	3.32 (1.213)	3.18 (1.172)	3.27 (1.244)	2.783	0.062
Income	2.04 (1.134)	2.10 (1.153)	1.95 (1.107)	1.93 (1.065)	4.402	0.012
Salary satisfaction	3.35 (1.121)	3.62 (1.103)	2.91 (0.981)	2.90 (1.085)	112.656	<0.001
Work hours	2.23 (0.672)	2.16 (0.627)	2.28 (0.687)	2.53 (0.810)	22.999	<0.001
Work intensity	3.26 (1.015)	3.06 (1.005)	3.54 (0.897)	3.79 (1.048)	79.486	<0.001

method implemented by Mplus8.3 through the “Auxiliary” (R3STEP) command to determine the impact of demographic and work-related factors on profile membership. Consistent with previous work, significant factors from the univariate analysis are included in the multinomial logistic regression analysis.

Results

Latent profile analysis of medical staff

We assessed the fit of four models and the statistical fit indices are shown in Table 2. The AIC, BIC, and aBIC decreased with an increasing number of latent profiles; both the LMR and BLRT were also significantly less than 0.05. However, among the entropy values,

higher values being indicative of higher classification accuracy, the value of model 4 was smaller than that of model 3, which indicated that model 4 was no longer better than model 3. Considering all the above, we ultimately chose the three-profile solution as the best fit for medical staff.

The scores on each dimension of the medical staff psychological symptom for various profiles are shown in Figure 1 and Table 3. The first and largest number of medical staff was in “Low-level” (62.1%), with lower scores for all variables, indicating that medical staff in this profile had relatively good mental health, characterized by being able to effectively solve problems at work and having a better sense of competence and accomplishment in their work. In the second profile (28.9%), medical staff members scored significantly higher than those in the first profile and were characterized by frequent feelings of sadness and high levels of negative emotions. Therefore, this profile was labeled

as “Moderate-level.” The least numerous profile (9.0%) consisted of medical staff members who scored significantly much higher than the other two profiles on the dimensions of exhaustion, cynicism, depression, and anxiety. It was characterized by high levels of fatigue, difficulty at work, ease of annoyance, and irritation. Therefore, this profile was labeled as “High-level.” Notably, the dimension of the inefficacy of this profile was significantly lower than the second profile.

Univariate analysis

Table 1 also shows the relationships between sample characteristics variables and psychological symptom profiles. Work unit, gender, marital status, and parenting status were found to be significant among the three profiles; age, job title, income, salary satisfaction, work hours, and work intensity were also statistically significant with profile membership.

Multinomial logistic regression

The “Low-level” profile was the most prevalent group in the present study. Therefore, we used it as the reference class. At the same time, significant variables from the univariate analyses are included in the multinomial logistic regression analyses.

The results of the multinomial logistic regression analysis of variables associated with the psychological symptom profiles are listed in Table 4. There were significant differences among the latent profile members in terms of gender, age, salary satisfaction, work hours, and work intensity. Gender [OR = 1.641, 95% confidence interval, CI (0.220, 0.771)] was a predictor of “Moderate-level” profile membership. Males had a greater rate of belonging to “Moderate-level” profile members than females; age [OR = 0.881, CI (−0.224, −0.030)] also was a predictor of membership in the “Moderate-level” profile. Relatively young individuals were more likely to be members of the “Moderate-level” profiles. Work hours [OR = 1.511, CI (0.183, 0.643)] were a predictor of membership in the “High-level” profile. Low salary satisfaction [OR = 0.569, CI (−0.673, −0.456); OR = 0.644, CI (−0.616, −0.263)] and intensive work individuals [OR = 1.519, CI (0.299, 0.536); OR = 1.804, CI (0.377, 0.803)] were more likely to be members of the “Moderate-level” and “High-level” profiles.

Discussion

The present research identified the profiles and characteristics of the psychological symptoms of Chinese medical staff with frontline

anti-epidemic experience through LPA based on burnout (exhaustion, cynicism, and inefficacy), depression, and anxiety symptoms. Then, the demographic and work characteristics with different psychological symptom profiles were explored.

Three latent profiles were identified, which were “Low-level,” “Moderate-level” and “High-level.” More than half of medical staff (62.1%) fell within the “Low-level” profile, with the lowest scores on all symptoms and dimensions than other profiles. The percentage of members in the “Moderate-level” profile was 28.9% in our total sample, with each score of the symptoms and the dimensions significantly higher than those of the “Low-level” profile. The “High-level” profile accounted for the lowest proportion of medical staff (9.0%), with most of the scores of the symptoms and the dimensions significantly higher than those of the “Moderate-level” and “High-level” profiles. It seems that, after the pandemic, majority of frontline medical staff in China did not face a high risk of psychological problems. However, the cultural stigma surrounding mental health issues in China may significantly affect individuals’ willingness to disclose mental health problems. The traditional emphasis on family reputation, social harmony, and personal resilience often fosters reluctance to seek help or openly discuss mental health concerns (59).

Post-hoc comparisons revealed the significant differences observed between profiles. It supported the conclusion that inherent heterogeneity exists in the psychological symptoms of medical staff. However, compared to other symptoms, members in the “High-level” profile scored very low in the inefficacy dimension of burnout, which was even lower than those in the “Moderate-level” profile. Firstly, this result was consistent with some other LPA studies focused on burnout symptoms of healthcare staff before and during the pandemic (33, 60). These results may imply that, for the worst burnout members, inefficacy was always not the typical symptom, regardless of the stress situations. However, a meta-analysis based on studies of Chinese doctors’ burnout demonstrated that inefficacy (termed as reduced personal accomplishment) was the most prevalent symptom (66.53%) among Chinese doctors before and during the pandemic (46). Given a certain amount of intensity and duration of stress situations, one symptom may increase or transfer to other psychological symptoms, causing one to experience significant emotional distress and physical illness (33, 61). This may remind us not to underestimate the potential threat of inefficacy experience to medical staff’s psychological health even if it is only at a moderate level. On the other hand, anxiety was the most prominent symptom within the “High-level” profile. As previous evidence has already shown that anxiety was the most prevalent symptom among medical staff during the COVID-19 pandemic (62), we may conclude that anxiety was not only the most prominent but also the most persistent symptom for the vulnerable

TABLE 2 Fit indices for latent profile analysis of medical staff psychological symptoms.

Model	AIC	BIC	aBIC	Entropy	LMR (p)	BLRT (p)
1-Profile	29727.572	29784.040	29752.269			
2-Profile	25688.950	25779.299	25728.465	0.908	<0.001	<0.001
3-Profile	23922.123	24046.353	23976.457	0.952	<0.001	<0.001
4-Profile	23153.780	23311.891	23222.932	0.861	<0.001	<0.001

AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; aBIC, sample-size adjusted BIC; LMR-LRT, Lo–Mendell–Rubin adjusted LRT test; BLRT, bootstrap likelihood ratio test. Bold values indicate the AIC, BIC, and aBIC gradually decreased, indicating that the model’s fitting degree improved; the entropy calculations close to 1.0 indicate a better classification.

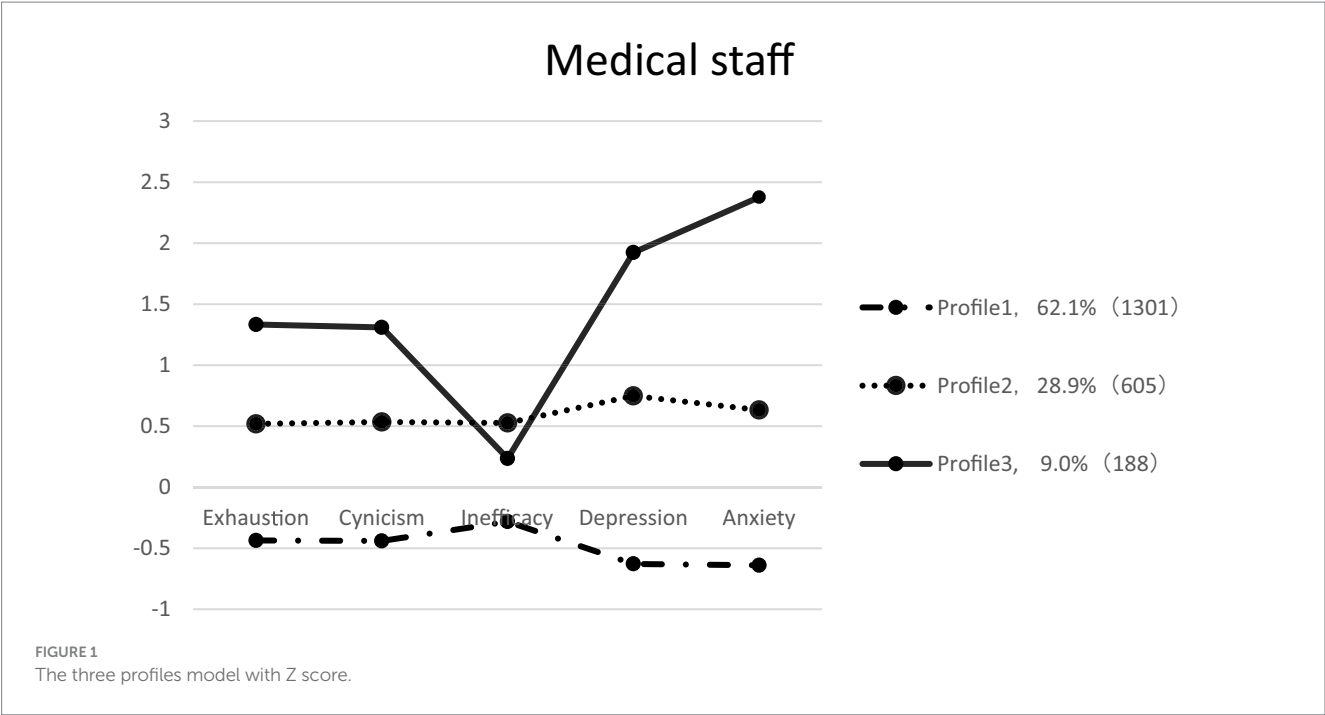


TABLE 3 Psychological symptoms of medical staff in different profiles.

	a. Profile 1	b. Profile 2	c. Profile 3	F
Medical staff				
Exhaustion	−0.434 (0.838) _b *** _c ***	0.524 (0.733) _a *** _c ***	1.319 (0.790) _a *** _b ***	585.217***
Cynicism	−0.437 (0.729) _b *** _c ***	0.533 (0.869) _a *** _c ***	1.307 (1.045) _a *** _b ***	468.420***
Inefficacy	−0.284 (1.010) _b *** _c ***	0.534 (0.726) _a *** _c ***	0.246 (0.927) _a *** _b ***	203.682***
Depression	−0.628 (0.477) _b *** _c ***	0.755 (0.502) _a *** _c ***	1.916 (0.721) _a *** _b ***	2404.675***
Anxiety	−0.640 (0.244) _b *** _c ***	0.637 (0.398) _a *** _c ***	2.376 (0.661) _a *** _b ***	4338.808***

Subscripts a–c indicate significant differences from other profiles. The psychological symptom scores with Z score. **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

medical staff, and therefore deserves the maximum concerns and interventions during and after a long-term high-pressure work.

Concerning the relationship between burnout, depression, and anxiety, our results suggest that burnout may share some common characteristics with depression and anxiety at low and moderate levels. In particular, the experiences of exhaustion and cynicism in burnout have consistently shown a similar developmental trajectory to depressive and anxiety symptoms. However, they do not develop in tandem when the symptoms worsen. This is especially true of the conclusion on the inefficacy dimension of burnout. Previous research addressing the burnout-depression or burnout-anxiety relationship, using a variable-centered approach, has already reached a consensus of a remarkable association between burnout and the other two symptoms but debating on the distinct construct of burnout (12, 14, 24). Adopted a person-centered approach, our findings expand knowledge on burnout and pervasive negative affectivity as underlying various symptom profiles. On one hand, our results suggest that burnout, anxiety, and depression are closely related; on the other, each has its unique characteristics. This provides a plausible explanation for why the debate as to whether or not burnout overlaps with depression or anxiety continues to this day (13, 14, 63, 64). In sum, frontline medical staff may experience various patterns of psychological

symptoms, with the relationship of the three burnout dimensions and its association with depression, and anxiety changing at different points in time. Therefore, our findings further confirm that burnout is a distinct construct. In particular, the relationship between exhaustion and cynicism in burnout and depression and anxiety remains stronger at all stages, whereas inefficacy in burnout does not continue to worsen with the escalation of other symptoms. On one hand, the dimensions of exhaustion and cynicism have been consistently shown in various studies to be more strongly related (33). Another possible explanation is that during and after the pandemic, frontline medical staff in China were praised and celebrated as models of collectivism and patriotism, which may have helped preserve their sense of efficacy. However, the emotional exhaustion resulting from excessive workload and emotional labor, along with alienation from their work environment and patients, was unlikely to be alleviated by such social recognition.

Also, our results indicate the impact of gender, age, salary satisfaction, work hours, and work intensity on the development of psychological symptoms. Specifically, “Moderate-level” profile members were more likely to be younger than “Low-level” profile members. This could be attributed to the workload and lack of working experience at the beginning of young medical staff careers (63, 65). On the other

TABLE 4 Coefficients from the multinomial logistic regression model.

Variable	Comparison of latent profiles							
	2 vs. 1				3 vs. 1			
	<i>B</i>	<i>SE</i>	<i>p</i>	OR	<i>B</i>	<i>SE</i>	<i>p</i>	OR
Work unit	0.018	0.060	0.764	1.018	0.009	0.097	0.928	1.009
Gender	0.495	0.141	<0.001	1.641	−0.149	0.192	0.437	0.861
Marital status	0.051	0.169	0.761	1.053	−0.129	0.264	0.625	0.879
Parenting status	−0.178	0.092	0.054	0.837	−0.142	0.145	0.326	0.867
Age	−0.127	0.050	0.010	0.881	−0.091	0.072	0.209	0.913
Job title	−0.003	0.095	0.973	0.997	−0.042	0.142	0.766	0.959
Income	0.023	0.057	0.685	1.023	−0.128	0.113	0.257	0.880
Salary satisfaction	−0.564	0.055	<0.001	0.569	−0.439	0.090	<0.001	0.644
Work hours	0.063	0.088	0.474	1.065	0.413	0.117	<0.001	1.511
Work intensity	0.418	0.060	<0.001	1.519	0.590	0.109	<0.001	1.804

The reference category for the dependent variables was the “Profile1, Low-level”; OR Odds ratio.

hand, more occupational experience of older medical staff may help in developing effective strategies to cope with diverse stressors and thus maintain their resilience (66). Next, it found that male medical staff members were more likely to be “Moderate-level” profile members than “Low-level” profile members, indicating that male medical staff members were more likely to experience severe psychological symptoms than females after the pandemic, which was inconsistent with both the results of previous person-centered approaches and variable-centered approaches (67–69). This may be related to gender differences in coping styles with negative emotions (70). At the same time, this discrepancy could be related to various assessment scales used, different samples selected, and different data analyses used in these studies. In addition, due to convenient sampling in this study, a relatively small sample size of male frontline medical staff might lead to cases of bias, so the conclusions need to be further validated.

In addition, frontline medical staff members who faced lower salary satisfaction, longer work hours, and greater work intensity were more likely to be “Moderate-level” or “High-level” profile members. These results were aligned with previous psychological health results based on the variable-centered approach, which showed a relationship between salary satisfaction, work hours, work intensity, and psychological health level (9, 71, 72). These findings suggest that hospital administrators can effectively identify medical staff with poor psychological health through demographic and work-related characteristics, and implement appropriate interventions to reduce their psychological symptoms.

Furthermore, this research has several strengths. Firstly, a large sample size was collected with a sufficient response, which provided adequate data support for the study. Secondly, the latent profile analysis method was used to investigate medical staff characteristics in the post-COVID-19 epidemic era, which effectively differentiated the heterogeneity of medical staff’s psychological symptoms, facilitating an understanding of the unique characteristics and latent differences of the different groups’ symptoms. Thirdly, burnout, depression, and anxiety symptoms were assessed jointly to explore their relationship with a person-centered approach.

The study adopted a person-centered method to explore the group heterogeneity of psychological symptoms among medical staff, but

several limitations of the current study should be noted. Firstly, this study was based on a cross-sectional design, which limits the ability to establish causal relationships. Longitudinal studies, incorporating a greater number of observational sites, are needed to examine the dynamic progression of psychological symptoms. Latent transition analysis could be employed to explore changes in latent profiles over time, while cross-lagged analysis may be used to investigate the interactions or reciprocal relationships between these symptoms. Secondly, this study was conducted solely in China, which may limit the generalizability of the findings to other cultural contexts. Thirdly, data were collected through self-report questionnaires, which are susceptible to social desirability bias and common method variance. To mitigate these limitations, future research should incorporate both objective and subjective indicators in measuring psychological symptoms. Additionally, inter-rater reliability statistics could be utilized to enhance the reliability of the data. Fourthly, the sampling in our study was voluntary and conducted through an online platform, which introduces the potential for selection bias. Finally, this study focused solely on the effects of demographic and work-related variables. Future studies should investigate potential moderators or protective factors (e.g., coping strategies, social support) to deepen the understanding of the relationship between work-related factors and mental health, thereby facilitating the design and implementation of future intervention programs.

Conclusion

In summary, our findings revealed that, in the post-COVID-19 pandemic era, burnout (exhaustion, cynicism, and inefficacy), depression, and anxiety symptoms of Chinese medical staff with frontline anti-epidemic experience could be categorized into three profiles, which were defined as “Low-level,” “Moderate-level,” and “High-level.” Symptoms of burnout, depression, and anxiety did not move in lock-step, which supports the proposition that burnout is a distinct construct. In the low-level and moderate-level profiles, all the symptoms and dimensions considered had a consistent trend. However, within the high-level profiles, the inefficacy dimension of

burnout remained at a lower level, and anxiety performed as the most prominent symptom. For medical staff, gender, age, salary satisfaction, work hours, and work intensity significantly influence the latent profiles of psychological symptoms among medical staff.

Therefore, the work-related pressures of frontline medical staff with anti-epidemic experience deserve more concern even in the post-COVID-19 pandemic era, for the prevention of not only burnout but also depression and anxiety. Meanwhile, more care and intervention measures should be targeted at men and young ones. For those medical staff with the worst mental health conditions, interventions should focus on symptoms of anxiety and depression directly. On the contrary, interventions targeting the inefficacy of burnout may not be effective. Future longitudinal and cross-cultural studies are needed to validate the findings of this research and provide insights for interventions.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of Sichuan Normal University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

HX: Conceptualization, Writing – original draft, Writing – review & editing. LQ: Formal analysis, Writing – original draft. YC: Formal

analysis, Writing – review & editing. MZ: Investigation, Writing – review & editing. JL: Investigation, Writing – review & editing. GX: Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Kim Walker,
University of Aberdeen, United Kingdom

REVIEWED BY

Massimo Tusconi,
University of Cagliari, Italy
Salvatore Zaffina,
Bambino Gesù Children's Hospital (IRCCS),
Italy
Carrie Amani Annabi,
Consultant, Budapest, Hungary

*CORRESPONDENCE

Huanzhong Liu
✉ huanzhongliu@ahmu.edu.cn
Feng Jiang
✉ fengjiang@sjtu.edu.cn

[†]These authors have contributed equally to this work

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Unraveling the interconnectedness between physician burnout and symptoms of depression, anxiety, and stress: a network analysis among Chinese psychiatrists

Song Wang^{1,2†}, Mengyue Gu^{1,2†}, Shujing Zhang³, Jingyang Gu^{1,2}, Yudong Shi^{1,2}, Yating Yang^{1,2}, Ling Zhang^{1,2}, Mengdie Li^{1,2}, Lei Xia^{1,2}, Feng Jiang^{4,5,6,7*}, Huanzhong Liu^{8,9,1*} and Yi-lang Tang^{3,10}

¹Department of Psychiatry, Chaohu Hospital of Anhui Medical University, Hefei, China, ²Anhui Psychiatric Center, Hefei, China, ³Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta, GA, United States, ⁴School of International and Public Affairs, Shanghai Jiao Tong University, Shanghai, China, ⁵Institute of Healthy Yangtze River Delta, Shanghai Jiao Tong University, Shanghai, China, ⁶Institute of Health Policy, Shanghai Jiao Tong University, Shanghai, China, ⁷Institute of Grand Health, Wenzhou Medical University, Wenzhou, China, ⁸Affiliated Psychological Hospital of Anhui Medical University, Hefei, China, ⁹Department of Psychiatry, School of Mental Health and Psychological Sciences, Anhui Medical University, Hefei, China, ¹⁰Atlanta VA Medical Center, Decatur, GA, United States

Background: The COVID-19 pandemic significantly increased the levels of burnout and symptoms of depression, anxiety, and stress among healthcare professionals. However, research on the interrelations between burnout and psychological symptoms is scarce, particularly among psychiatrists. This study addresses this gap in a national sample.

Method: Data was collected via an online survey conducted in Mainland China from January to March 2021 with a sample size of 3,783 participants. Psychological symptoms were assessed using the Depression, Anxiety, and Stress Scale-21 (DASS-21), and physician burnout was assessed using the Maslach Burnout Inventory-Human Service Survey (MBIHSS). Network analysis was used to examine the interconnection between physician burnout and psychological symptoms, with further analysis conducted on multiple levels, including individual symptoms in central positions or acting as bridges between clusters, and identifying core symptom combinations with significant correlations.

Results: Stress emerged as the highest Expected Influence (EI) index, with emotional exhaustion in the burnout cluster being the singular bridge symptom. Furthermore, depressive symptoms such as hopelessness and anhedonia showed a strong and the most straightforward association with emotional exhaustion, while stress-related overreaction was closely associated with depersonalization.

Conclusion: Network analysis between burnout and psychological symptoms identified critical symptoms like stress and emotional exhaustion in Chinese psychiatrists. Close monitoring of these symptoms may be crucial for mitigating the risk of common psychological disturbances and preventing their exacerbation in this population.

KEYWORDS

physician burnout, stress, depression, anxiety, psychiatrists, network analysis

1 Introduction

Physicians, including psychiatrists, are particularly vulnerable to a range of psychological symptoms such as depression, anxiety, stress, and insomnia (1–3). The COVID-19 pandemic has exacerbated these issues due to an increased workload and other stressors. Facing this global public health crisis, medical professionals must deal with immense work pressure, a higher risk of infection, and continuous emotional and psychological stress. A recent nationwide survey conducted by Yao et al. (4) revealed that Chinese psychiatrists experienced high levels of burnout during the pandemic, highlighting the significant impact of these pressures on their job satisfaction and overall mental health.

In addition to the heavy workload, medical professionals also face social stigma. Social stigma refers to the negative perceptions and discriminatory attitudes directed towards healthcare workers, stemming from their close associations with infectious diseases (5). This stigma can lead to social ostracization and emotional distress, further compounding the challenges these professionals face (6). According to Malik and Annabi (7), such psychological pressures, combined with professional burnout, can have a lasting effect on the mental well-being of healthcare workers, suggesting that intervention is critical. Summers et al. (8) further emphasized the global scope of this issue, noting that psychiatrists in North America also experienced elevated levels of depression, anxiety, and burnout during the pandemic. Kang et al. (9) noted that medical professionals who directly managed COVID-19 cases and were exposed to high-pressure environments were more susceptible to mental health issues such as depression, anxiety, and stress.

The COVID-19 pandemic has underscored the critical need for effective mental health interventions (10). During this period, psychiatrists have played an essential role in providing mental health support while facing unique challenges and pressures (11, 12). There has been an unprecedented surge in demand for psychiatrists that significantly increase their workload and stress levels since the COVID-19 pandemic (13). Especially in China, the mental health support system is facing a dual challenge of resource scarcity and uneven distribution, making it difficult to meet the public's growing demands for mental health services. According to government staffing guidelines, fewer than one-third of hospitals (31.7%) meet the minimum ratio of psychiatrists per bed, highlighting the insufficiency of resource allocation (14). They frequently manage complex cases involving severe psychological disorders and intense emotional fluctuations (15, 16), substantially increasing their work-related stress.

Moreover, widespread physician burnout, emotional exhaustion, and psychological distress underscore the challenges faced by medical professionals (17). Physician burnout is defined as a psychological syndrome stemming from enduring interpersonal stressors in medical practice (18). It is characterized by emotional exhaustion—described as a condition in which individuals feel emotionally overstretched and drained of emotional resources (19), depersonalization, and a diminished sense of personal achievement. Previous research

predominantly viewed burnout as just another manifestation of depressive symptoms (20, 21). However, this perspective was challenged by Maslach and Leiter (22) in their study, suggesting that the link between burnout and depression might not be straightforward. Despite this re-evaluation, physician burnout remains to be linked to a broad spectrum of psychiatric conditions and risky behaviors. For instance, West et al. (23) revealed that doctors experiencing physician burnout were at an increased risk of emotional disorders, substance and alcohol use disorder, and motor vehicle accidents, illustrating the complex implications of physician burnout beyond its connection with depression.

A recent study increasingly demonstrated the intricate connections between depression, and anxiety across the three dimensions of physician burnout: emotional exhaustion, depersonalization, and reduced personal accomplishment (24). While these investigations provided a broad overview of the associations among various symptoms, they did not delve into any specific links. Network analysis (NA) techniques offer a novel approach to moving beyond the traditional categorical definitions of mental disorders, focusing on the interplay among individual symptoms rather than broader syndromes, thereby uncovering the underlying associations within psychopathology (25, 26). NA enables the modeling of interactions between psychological structures at the symptom level. This method employs “nodes” to represent various psychological symptoms and “edges” to depict the connections between them. Previous research often concentrated on the structural relationships between depression and anxiety (27), potentially overlooking the unique links between the three dimensions of burnout and various mental health symptoms. By leveraging NA, especially through the use of partial correlations and regularization techniques, we can unveil the subtle connections among physician burnout, depression, anxiety, and stress. Moreover, by calculating the bridge expected influence (BEI) index, which sums the edges connecting a node to nodes in other clusters, we can better understand the protective role of various physician burnout dimensions on mental health, providing fresh insights for potential intervention strategies.

Through the utilization of NA, this study aims to achieve two objectives: (1) examine the associations between physician burnout symptoms (emotional exhaustion, depersonalization, and personal accomplishment), and the common psychological symptoms of depression, anxiety, and stress; (2) employ EI and BEI metrics to identify the most influential nodes within physician burnout and other psychological symptoms network. Given previous research suggesting emotional exhaustion has a stronger association with depression than it with anxiety (27), we hypothesize that emotional exhaustion in physician burnout will exhibit the strongest positive correlation with depressive symptoms. Additionally, earlier studies have indicated that alleviating burnout symptoms, especially emotional exhaustion, effectively improves depressive symptoms. As a result, we propose that interventions targeting emotional exhaustion in physician burnout may act as bridge nodes within the psychological symptom cluster, opening new avenues for enhancing overall psychological well-being.

2 Methods

2.1 Study design and participants

The current study data were obtained from a larger research project, the 2021 National Hospital Performance Evaluation Survey

Abbreviations: COVID-19, Coronavirus Disease 2019; DASS-21, Depression, Anxiety, and Stress Scale-21; MBIHSS, Maslach Burnout Inventory–Human Services Survey; NA, Network Analysis; EI, Expected Influence; BEI, Bridge Expected Influence; CS, Centrality Stability; R2, Predictability Index (related to variance explained); EBIC, Extended Bayesian Information Criterion; EBICglasso, A function used in network analysis for sparse Gaussian graphical modeling.

(NHPS) which was endorsed by the National Health Care Commission of China. Conducted between January and March 2021, the objectives of NHPS were to enhance mental health services, improve medical care quality, optimize healthcare professionals' working environment, and inform national medical policy and resource allocation. The survey recruited psychiatrists, nurses, psychologists, and pharmacists from tertiary care psychiatric hospitals nationwide in China. A total of 21,858 staff members completed the online questionnaire via the National Health Commission's "Health China" WeChat account, out of which 3,973 were identified as psychiatrists. After excluding 190 based on predefined criteria (detailed in [Supplementary materials](#)), data from 3,783 responses were analyzed, yielding a 95.2% response rate. There were no significant differences in demographic factors, including gender ($\chi^2 = 0.277$, $p = 0.599$), marital status ($\chi^2 = 4.041$, $p = 0.133$), and educational achievement ($\chi^2 = 2.04$, $p = 0.153$), between the effective and ineffective groups of participants. The study was approved by the ethics committee (approval number: 202002-KYXM-02), and informed consent was obtained from all participants.

2.2 Measurement

2.2.1 Demographic and work-related characteristics

Sociodemographic information of the participants were obtained via an author-designed questionnaire, including age, gender, marital status, and educational attainment. The questionnaire also assessed work-related factors associated with the COVID-19 pandemic by specifically inquiring about participants' direct experience in managing COVID-19 cases. Before conducting this nationwide survey, we conducted a pilot study with approximately 300 healthcare professionals who self-identified as doctors, nurses, psychologists, and pharmacists to enhance the quality of this questionnaire. This selection of demographic and work-related factors aligns with the established research methodologies.

2.2.2 Depression, anxiety, and stress scale-21

The Depression, Anxiety, and Stress Scale-21 (DASS-21), consisting of 21 items, is a widely utilized psychometric instrument for assessing symptoms of mental health conditions such as depression, anxiety, and stress (28). DASS-21 is extensively employed in diverse research investigations renowned for its simplicity and efficacy (29, 30). This scale contains three subscales to assess symptoms of: depression (items 3, 5, 10, 13, 16, 17, and 21); anxiety (items 2, 4, 7, 9, 15, 19, and 20); and stress (items 1, 6, 8, 11, 12, 14, and 18). Participants rate each item on a four-point Likert scale ranging from "not applicable" to "very applicable." The cut-off points for the three subscales are as follows: Depression subscale score not lower than 10, Anxiety subscale score not lower than 8, and Stress subscale score not lower than 8. The present study demonstrated a high level of internal consistency for the DASS-21 scale, as indicated by a Cronbach's alpha coefficient of 0.951, which exceeds the widely accepted threshold value (≥ 0.7) (31). Furthermore, individual assessments of the subscales revealed excellent reliability, with the Depression subscale exhibiting a Cronbach's alpha coefficient of 0.906 and the subscales of Anxiety and Stress showing coefficients of 0.854 and 0.888, respectively.

2.2.3 Maslach burnout inventory-human service survey

In our study, the Maslach Burnout Inventory-Human Services Survey (MBI-HSS) (18) was employed to evaluate levels of physician burnout. This scale comprises 22 items, rated on a 7-point Likert scale (0–6), and covers three dimensions: emotional exhaustion (items 1, 2, 3, 6, 8, 13, 14, 16, and 20), depersonalization (items 5, 10, 11, 15, and 22), and personal accomplishment (items 4, 7, 9, 12, 17, 18, 19, and 21, with reverse scoring). Individuals who achieve a score of 27 or higher in emotional exhaustion or 10 or above in depersonalization are classified as experiencing "burnout" (32, 33). The Mandarin version of MBI-HSS, which has been extensively utilized and validated in previous studies (34, 35), demonstrated a high level of reliability with a Cronbach's alpha coefficient of 0.833 for the current sample. Furthermore, the dimensions of emotional exhaustion, depersonalization, and personal accomplishment exhibited satisfactory internal consistency with Cronbach's alpha values of 0.912, 0.751, and 0.899, respectively.

2.3 Data analysis

The data analysis for this study was conducted using the R programming language in the RStudio environment (version 4.3.2) (36). The network reconstruction was achieved by employing the EBICglasso function in conjunction with the Spearman correlation. The EBICglasso method, which is a component of the lasso package, computes a sparse Gaussian graphical model using graphical lasso (37), with the tuning parameter determined by the Extended Bayesian Information Criterion (EBIC). The proposed approach effectively reduced the number of edges in the network, thereby facilitating a more lucid and interpretable representation (38). Our analysis focused primarily on the EI index, which was selected due to its suitability in networks with negative weights and its recognition as a relevant centrality measure (39). Additionally, the BEI index was calculated to identify bridge symptoms using the bridge function via the R package networktools (40). We opted against employing alternative centrality metrics, such as closeness and betweenness, due to their limited effectiveness in uncovering psychological variables (41).

The network's graphical representation was generated using the qgraph R software package (version 1.9.8) (38). In these visual models, nodes (circles) were interconnected by edges (lines), with the thickness of the edges representing the strength of interactions. Positive associations were depicted in dark green, while negative associations were shown in red. Nodes with strong associations were clustered together, and those with weaker associations were positioned on the periphery, utilizing the Fruchterman-Reingold force-directed algorithm (42). The R^2 predictability Index, calculated using the mgm R package (1.2–14) (43), quantified the variance explained by each node in connection with other nodes in the network. This index was visually depicted by the size of a semi-circular area surrounding each node on the graph.

The bootnet R package (version 1.5.6) was employed to evaluate the accuracy and stability of network edges, conducting 1,000 bootstrap iterations (44). Edge accuracy was assessed by examining the 95% confidence interval (CI) of bootstrap edge weights, with narrower intervals indicating higher precision. We further evaluated the robustness of centrality measures by comparing the association between

centrality indices obtained from the complete sample and those derived from a 70% reduced sample. The Centrality Stability coefficient (CS coefficient) was also computed to assess network robustness. A value of ≥ 0.5 indicates high reliability, 0.25 to 0.5 signifies moderate reliability, and < 0.25 reflects a less robust network (45).

3 Results

3.1 Demographic characteristics, burnout, and psychological symptoms

Table 1 presents the demographic data of the sample. Among the participating psychiatrists, 1,521 (40.2%) were male, and 2,262 (59.8%) were female. The median age was 38.0 years, with an interquartile range (IQR) of 12.0 years. Notably, approximately one quarter (25.1%) of the participants reported experiencing burnout symptoms (95% CI: 23.7–26.4%). Regarding psychological symptoms, 1,011 participants (26.7%) endorsed depressive symptoms (95% CI: 25.3–28.1%), 913 individuals (24.1%) reported anxiety symptoms (95% CI: 22.8–25.5%), and 416 people (11%) reported stress symptoms (95% CI: 10.0–12.0%).

TABLE 1 Demographic characteristics of 3,783 Chinese psychiatrists.

Variables	Median (IQR) or N (%)
Age (years)	38.0 (12.0)
Marital status	
Single	631 (16.7)
Married	3008 (79.5)
Divorced or widowed	144 (3.8)
Education level	
College/medical degree	2438 (64.4)
Master's degree	1115 (29.5)
Doctoral degree	230 (6.1)
Frontline experience with COVID-19 patients	1019 (26.9)
Outcome measures	
Emotional exhaustion ^a	11.0 (15.0)
Depersonalization ^a	5.0 (7.0)
Personal accomplishment ^a	34.0 (17.0)
Depression ^b	4.0 (10.0)
Anxiety ^b	2.0 (6.0)
Stress ^b	6.0 (12.0)
Physician burnout ^c	948 (25.1)
Clinically relevant symptoms of depression ^d	1011 (26.7)
Clinically relevant symptoms of anxiety ^e	913 (24.1)
Clinically relevant symptoms of stress ^f	416 (11.0)

^aMBI-HSS.

^bDASS-21.

^cEmotional exhaustion (≥ 27) or depersonalization (≥ 10) scores.

^dDepression overall-score ≥ 10 .

^eAnxiety overall-score ≥ 8 .

^fStress overall-score ≥ 8 .

3.2 Estimation of the network and centrality between burnout and psychological symptoms

The left side of Figure 1 illustrates the network structure encompassing physician burnout, depression, anxiety, and stress. Within this comprehensive network, 11 of the potential 15 connections (73.3%) exhibited nonzero values, highlighting significant interconnectivity among the symptoms. The average edge weight stood at 0.187, reflecting the overall robustness of the connections within the network. Predictability for individual nodes ranged from 8.7 to 73.5%, with an average of 58.3%. Among the symptoms, stress and depression had the highest predictability, while personal accomplishment had comparatively lower predictability in the burnout categories.

The strongest connection was observed between emotional exhaustion and depersonalization ($r = 0.568$). Weaker associations were found between anxiety and stress ($r = 0.468$), depression and stress ($r = 0.437$), depression and emotional exhaustion ($r = 0.259$), and depression and anxiety ($r = 0.227$).

3.3 Centrality and bridge symptom analysis

The left side of Figure 1 shows the EI and BEI within the network structure. Stress had the highest EI, indicating its dominant role in explaining the network model, followed by emotional exhaustion, depression, anxiety, and depersonalization. Personal accomplishment exerted minimal influence on the network's structure.

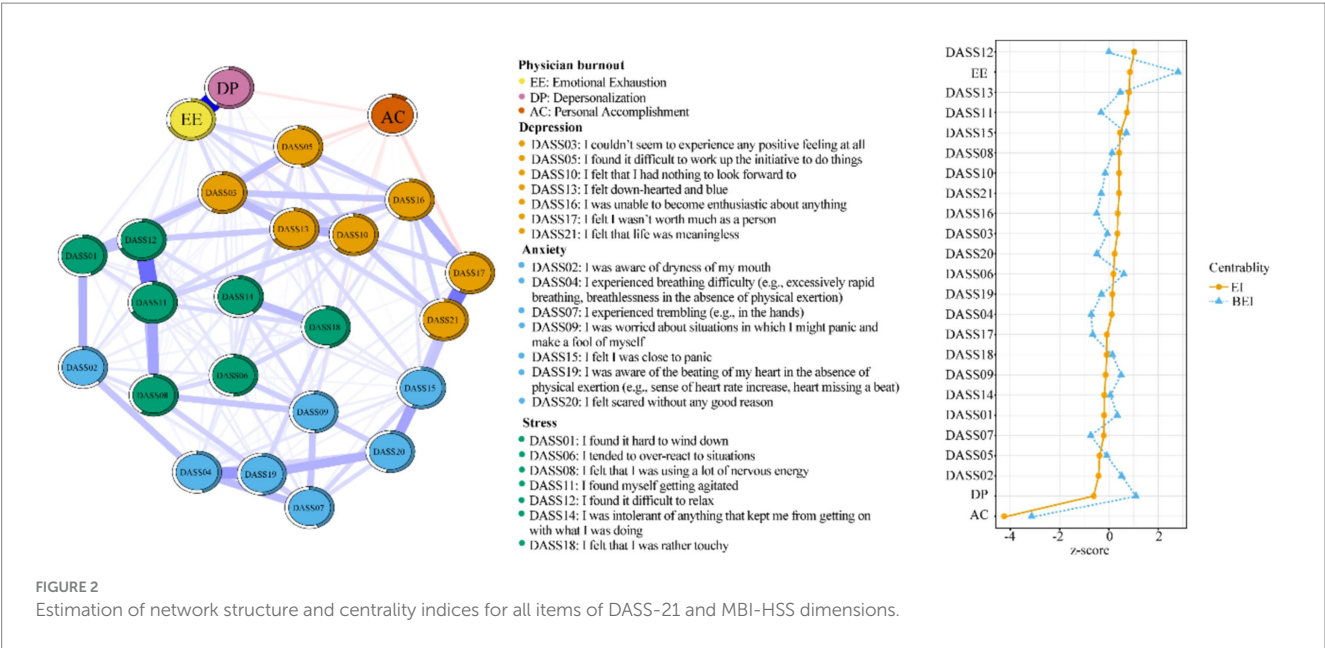
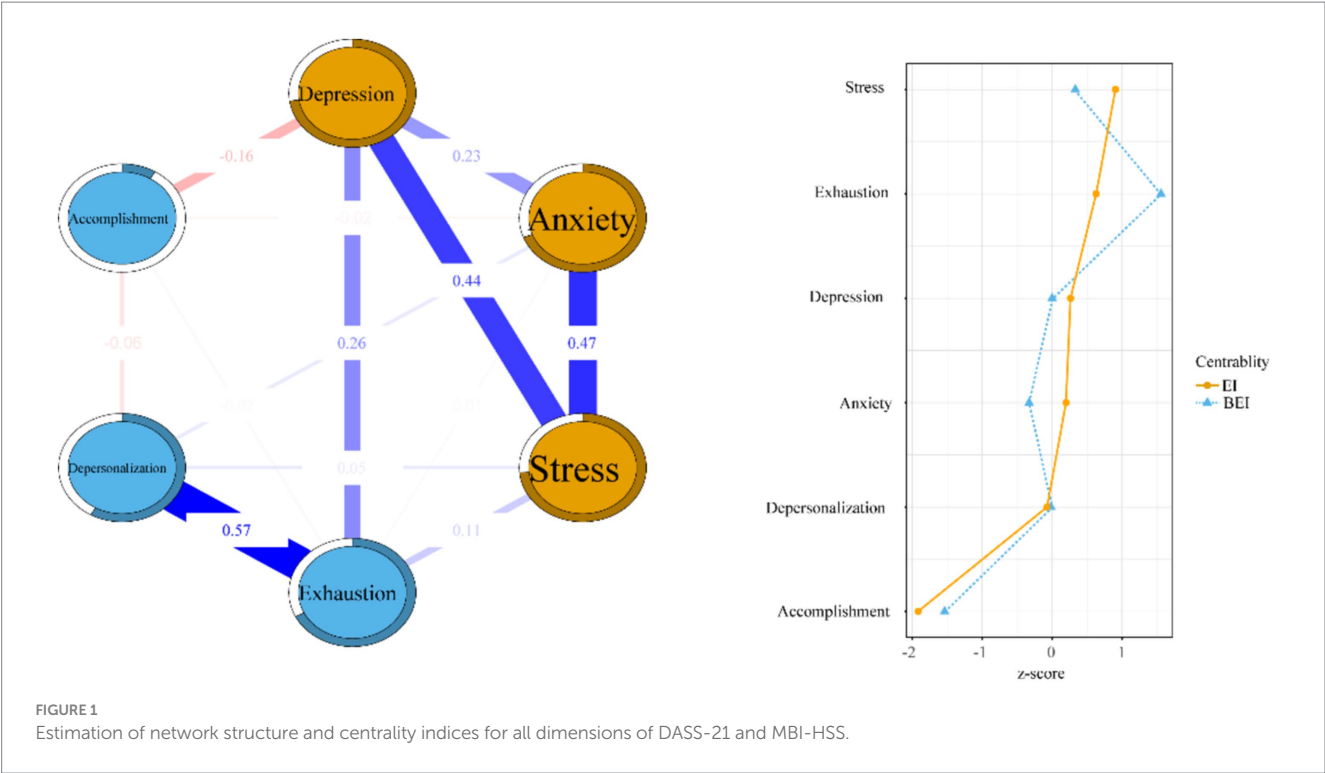
Emotional exhaustion had the highest BEI, suggesting its critical role in connecting different symptom clusters. Among the inter-group connections, emotional exhaustion and depression had the strongest association, indicating a key link within the network.

3.4 Specific associations between burnout and psychological symptoms

Figure 2 depicts the associations between the three dimensions of physician burnout and psychological symptoms. Emotional exhaustion was strongly correlated with DASS-21_10 ("I felt that I had nothing to look forward to"), DASS-21_05 ("I found it difficult to work up the initiative to do things"), and DASS-21_03 ("I could not seem to experience any positive feeling at all"). Depersonalization was linked to DASS-21_18 ("I felt that I was rather touchy") and DASS-21_06 ("I tended to over-react to situations"). A reduced sense of personal accomplishment was associated with DASS-21_17 ("I felt I wasn't worth much as a person") and DASS-21_05 ("I found it difficult to work up the initiative to do things").

3.5 Stability and precision of the network

To ensure the accuracy of edge measurements, the current study compared the average associations from resampling (bootstrap averages) with those obtained from the original sample. The left side of Figure 3 illustrates satisfactory accuracy, as evidenced by the convergence of the black and red lines.

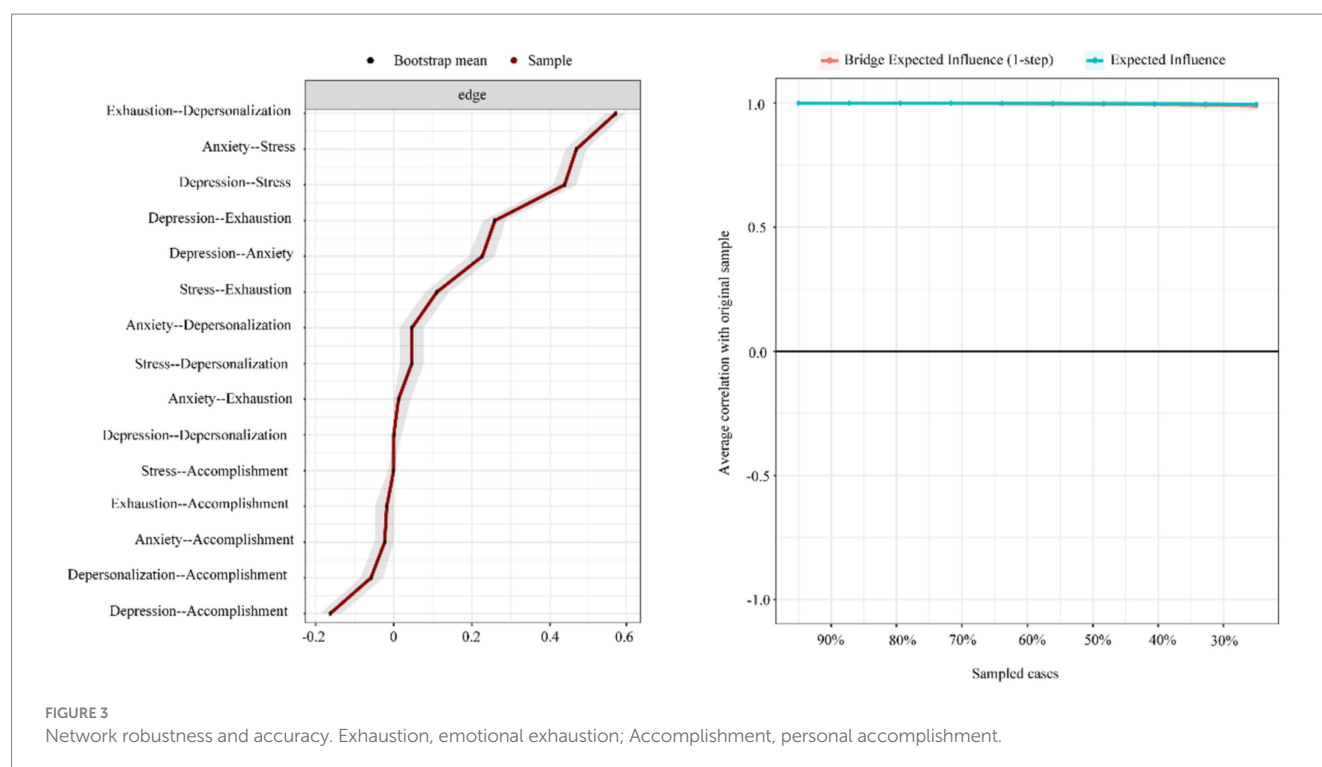


Additionally, the narrow gray band indicates minimal variability during resampling.

The stability analysis in the left side of Figure 3 robustly confirms the network model's reliability, focusing particularly on the stability of edge weights. This demonstrates a dependable estimation of connection strength. Remarkably, even when excluding cases, there is a consistent observation of an average correlation between original and resampled data that significantly surpasses the 0.75 threshold, maintaining this high level. Both measures of EI and BEI affirmed our analysis's reliability with stability coefficients (CS) of approximately 0.75.

4 Discussion

This study highlights the significant mental health challenges faced by Chinese psychiatrists, revealing that approximately 25.1% experienced symptoms of burnout. This finding is consistent with a meta-analysis by



Bykov et al. (46), which reported an overall prevalence of physician burnout at 25.9% across 36 studies. Such alignment emphasizes that physician burnout is a widespread issue in healthcare systems across different cultures and institutions. However, unlike previous studies that mainly focus on prevalence rates, our study provides deeper insights by utilizing network analysis to explore the intricate relationships between different dimensions of burnout (emotional exhaustion, depersonalization, and personal accomplishment) and psychological symptoms such as depression, anxiety, and stress.

Around one in four Chinese psychiatrists also reported symptoms of depression and anxiety, a finding consistent with Sahebi et al. (47), who observed similar rates among internists. Although Yao et al. (5) reported similar prevalence figures, our network analysis revealed stronger associations between depression and emotional exhaustion, highlighting the critical importance of addressing emotional well-being in high-pressure environments, particularly during crises like the COVID-19 pandemic.

This study also revealed that approximately one in four Chinese psychiatrists reported symptoms of depression and anxiety, aligning with findings from a meta-analysis among internists, which showed prevalence rates of depression and anxiety at 24.83 and 24.94%, respectively (47). The 11% prevalence rate of stress symptoms among Chinese psychiatrists also mirrors findings among psychiatric residents in Bangladesh (48). It is important to note that different assessment tools can yield varying results, as demonstrated by a study that used a single-item measure for stress symptoms and reported a significantly higher prevalence rate of 35.3% (49).

These findings are consistent with prior literature emphasizing the prevalence of burnout and psychological symptoms among healthcare workers globally, especially during crises like the COVID-19 pandemic (50, 51). For example, Dalmasso et al. (52) evaluated the impact of individualized psychological support in the Bambino Gesù

Paediatric Hospital in Rome and found that such interventions significantly improved healthcare workers' mental health by reducing anxiety and stress levels. This suggests that similar psychological support interventions could be highly beneficial for Chinese psychiatrists, particularly in addressing the psychological distress highlighted in our study.

The dense regularized network offers a deep dive into the complex associations between the three dimensions of physician burnout—emotional exhaustion, depersonalization, and personal accomplishment—and the other mental health variables in this study—depression, anxiety, and stress, unveiling notable differences among them. Emotional exhaustion was strongly linked to multiple mental health symptoms within the DASS (Depression, Anxiety, and Stress Scales) community, particularly within the depression spectrum. This is evident in three key indicators: DASS-21_10 (“I felt that I had nothing to look forward to”), DASS-21_05 (“I found it difficult to work up the initiative to do things”), and DASS-21_03 (“I could not seem to experience any positive feeling at all”). These connections highlight how closely emotional exhaustion is related to an individual's motivation and the ability to experience joy and positivity. Previous research has indicated that feelings of despair and an absence of pleasure contribute to the exacerbation of emotional exhaustion (53, 54).

In previous network analyses, emotional exhaustion has also been identified as a key component of burnout, often serving as a central link between burnout and other psychological symptoms, such as depression and anxiety (22, 55). Our findings expand on this by identifying emotional exhaustion as a critical bridge symptom in the burnout network, suggesting that interventions targeting emotional exhaustion could help prevent the progression of burnout into more severe mental health issues. This is in line with research by Maslach and Leiter (22), who emphasized emotional exhaustion as one of the first indicators of burnout. Therefore, targeted interventions focusing

on reducing emotional exhaustion could have far-reaching effects on preventing other mental health complications (56).

Depersonalization, characterized by an indifferent attitude towards work and feeling like an outside observer of oneself, was found to be correlated with DASS-21_18 (“I felt that I was rather touchy”) and DASS-21_06 (“I tended to over-react to situations”) within the stress community. These associations suggest that depersonalization may lead to an increased sensitivity and overreaction to everyday situations (57), where enhanced reactivity could heighten tensions in interpersonal relationships and exacerbate the symptoms of depersonalization.

The central role of stress in our network model aligns with previous findings, where stress was found to play a pivotal role in mental health deterioration, particularly under high-pressure conditions (58–60). Our findings further support the assertion that stress can serve as a precursor to psychological disorders, including depression, anxiety, and burnout. Previous studies have also shown that stress can predict depression over time (59). Given the high stress levels reported during the COVID-19 pandemic, these findings underscore the importance of early interventions to manage stress in healthcare professionals.

Additionally, stress was shown to have the highest EI (Expected Influence) index in our network, reflecting its centrality in the burnout-depression-anxiety-stress network. This finding is supported by the work of Mihić et al. (61), who found that stress played a core role in the depression-anxiety-stress network in healthcare workers. Similarly, previous research has found that relaxation techniques such as mindfulness and yoga can be effective in reducing stress and its associated symptoms (62, 63). Therefore, implementing effective intervention strategies such as these becomes crucial when stress symptoms appear.

This study also unveils the pivotal role of emotional exhaustion as a bridge symptom in the nexus of physician burnout and other mental health symptoms, including stress, depression, and anxiety. Bridge symptoms are vitally important in network analyses, as they act as essential conduits for the interaction of different mental health issues, potentially leading to comorbidity or exacerbation of existing conditions (55). Emotional exhaustion has been recognized as a core symptom of physician burnout in numerous studies (22). It often signals the commencement of physician burnout. By targeting bridge symptoms, clinicians can more effectively treat or prevent complications (56). This indicates that interventions designed to alleviate emotional exhaustion could have wider implications for promoting psychological well-being. Organization-based interventions, mindfulness-based stress reduction, and cognitive-behavioral therapy suggested by previous studies should be widely used in healthcare settings to mitigate emotional exhaustion (51, 64).

Our findings also highlighted emotional exhaustion and depersonalization had the strongest link. This further confirms that physician burnout is not merely a manifestation of depression (22). However, empirical findings showed that emotional exhaustion and depression had a stronger association when compared to the link between depersonalization and personal accomplishment (21). When facing this controversial debate, it seems more appropriate to consider the two core symptoms of physician burnout, emotional exhaustion and depersonalization, are separate from symptoms of depression. Physician burnout, stemming directly from prolonged work-related stress, affects not just an individual’s mental well-being but can also result in a detached approach to the workplace and responsibilities, or

in other words, depersonalization. Additionally, while physician burnout and depression exhibit overlapping characteristics, physician burnout is intricately linked to the work environment, contrasting with depression, whose symptoms persist regardless of changes in the work setting (65).

Consistent with empirical findings, our research also confirmed that personal accomplishment had a minimal impact across the entire network, suggesting a limited association with the physician burnout-depression network dynamics. Emotional exhaustion (22) and depersonalization (66, 67) have been empirically considered as the primary domains of physician burnout measured by Maslach Burnout Inventory-Human Services (MBIHSS), which is also the statistical tool applied in this study to assess physician burnout (23). Additionally, a previous study indicated that more than half of the individuals in the high burnout group experienced at least a moderate level of personal accomplishment (20).

While the current study highlighted important findings, it is crucial to acknowledge its limitations. First, as a cross-sectional study, it does not capture the dynamic changes in burnout and psychological symptoms over time. This design limits our understanding of the long-term psychological impact. Future research should consider employing a longitudinal design to track changes in mental health and burnout over time, offering a more comprehensive understanding of the pandemic’s lasting effects on psychiatrists.

Second, this study did not include a control group of non-psychiatric healthcare professionals, making it difficult to differentiate the specific factors contributing to burnout among psychiatrists compared to other healthcare workers. Including a control group in future research would help to better identify the unique stressors faced by psychiatrists and provide more targeted intervention strategies.

Third, the study did not assess the use of psychotherapy or counseling interventions, which may serve as protective factors in alleviating burnout and associated symptoms. The absence of data on these interventions is a limitation, and future research should evaluate their potential role in preventing and mitigating mental health issues among psychiatrists.

Lastly, while this study underscores the need for psychological support, it did not assess the effectiveness of specific interventions. Future studies could focus on evaluating the impact of psychological support programs on reducing burnout and improving mental health outcomes for psychiatrists, especially in the context of the post-pandemic recovery.

To our knowledge, this is the first study to investigate the network of physician burnout and symptoms of depression, anxiety, and stress among Chinese psychiatrists during the COVID-19 pandemic. By employing innovative methodologies to quantify the strength and centrality of connections among various symptoms, this research offers a more holistic approach to comprehending mental health disorders and identifies highly centralized symptoms in networks, such as stress, which may shed light on targeted therapeutic interventions.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by the Ethics Committee of Chaohu Hospital of Anhui Medical University, the approval number was 202002-kyxm-02. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SW: Data curation, Methodology, Software, Visualization, Writing – original draft. MG: Investigation, Software, Supervision, Validation, Visualization, Writing – review & editing. SZ: Writing – review & editing. JG: Investigation, Supervision, Validation, Writing – review & editing. YS: Data curation, Investigation, Writing – review & editing. YY: Conceptualization, Data curation, Formal analysis, Writing – review & editing. LZ: Data curation, Formal analysis, Writing – review & editing. ML: Data curation, Formal analysis, Writing – review & editing. LX: Conceptualization, Data curation, Formal analysis, Writing – review & editing. FJ: Conceptualization, Data curation, Formal analysis, Project administration, Supervision, Validation, Writing – review & editing. HL: Conceptualization, Data curation, Funding acquisition, Resources, Writing – review & editing. Y-IT: Conceptualization, Data curation, Formal analysis, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1493424/full#supplementary-material>

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EDITED BY

Mansoor Malik,
Johns Hopkins Hospital, United States

REVIEWED BY

Zhongming Chen,
Weifang Medical University, China
Lim Sheue Hui,
ViTrox College, Malaysia

*CORRESPONDENCE

Huaping Huang
✉ jrzhou26@aliyun.com
Guirong Li
✉ 384895848@qq.com

[†]These authors have contributed equally to this work and share first authorship

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The mediating effect of clinical belongingness on the relationship between anxiety and professional identity in nursing interns: a cross-sectional study

Junhao Zhang^{1†}, Lijia Wang^{1†}, Xue Yang¹, Yuwei Yang², Xuehua Wu³, Huaping Huang^{4*} and Guirong Li^{4*}

¹School of Nursing, Chengdu Medical College, Chengdu, Sichuan, China, ²Department of Clinical Laboratory, Mianyang Central Hospital, School of Medicine, University of Electronic Science and Technology of China, Mianyang, Sichuan, China, ³School of Nursing, Sichuan College of Traditional Chinese Medicine, Mianyang, Sichuan, China, ⁴Nursing Department of Mianyang Central Hospital, School of Medicine, University of Electronic Science and Technology of China, Mianyang, Sichuan, China

Background: Previous studies have reported that anxiety negatively affects professional identity (PI), and clinical belongingness is positively correlated with PI among nursing interns. However, little is known about the relationship between anxiety, PI, and clinical belongingness among nursing interns.

Objective: To explore the relationship between PI, clinical belongingness, and anxiety among nursing interns, and to demonstrate the mediating role of clinical belongingness in this relationship.

Methods: A cross-sectional study using an online questionnaire was conducted between November 2023 and January 2024 among 1,050 nursing interns from 26 teaching hospitals in Sichuan Province, China. A general information questionnaire, the Belongingness Scale–Clinical Placement Experience (BES-CPE), the Self-Rated Anxiety Scale (SAS), and the Professional Identity Questionnaire for Nursing Students (PIQNS) were used to collect data. SPSS (version 25.0) and AMOS (version 28.0) were used to analyze the data.

Results: Nursing interns had moderate mean scores for all variables; PI (60.77 ± 12.18), clinical belongingness (115.99 ± 17.02), and anxiety (47.44 ± 8.75). Correlation analyses revealed that both PI ($r = -0.129$, $p < 0.01$) and clinical belongingness ($r = -0.087$, $p < 0.01$) were negatively correlated with anxiety and clinical belongingness was positively correlated with PI ($r = 0.601$, $p < 0.01$). The clinical belongingness of nursing interns had a mediating effect on the relationship between anxiety and PI ($\beta = -0.072$, 95% confidence interval = -0.133 to -0.013 , $p < 0.001$), accounting for 40% of the total effect.

Conclusion: The anxiety level of nursing interns can have a direct impact on the prediction of PI and an indirect influence on PI mediated by clinical belongingness. Accordingly, nursing educators and managers should screen and channel the mental health problems of nursing interns in a timely manner, improving their clinical belonging, which will help improve PI and ultimately improve the stability of the nursing workforce.

KEYWORDS

anxiety, clinical belongingness, professional identity, mediating effect, nursing interns

1 Introduction

The shortage of nurses has become an important issue in global health systems (1). In particular, aging populations, international conflicts, the climate crisis, and financial instability have exacerbated the imbalance in medical and health resources (2, 3). According to the World Health Organization estimate, if no interventions are implemented, there will be a global nursing shortage of 5.7 million by 2030 (4). The considerable shortage of nursing staff restricts the growth of the nursing workforce and affects the quality of nursing care (5). Nursing interns are a new force in the future development of nursing careers, and professional identity (PI) plays an important role in the quality training of modern nursing talent (6, 7).

PI is a positive assessment of the cognitive and emotional perceptions of nursing interns with respect to clinical nursing work and the nursing profession, which directly affects their willingness to participate in nursing work in the future and the stability of nursing teams (8). Furthermore, Li et al. found that a strong PI not only improves the professional confidence of nursing interns and clinical belongingness but also minimizes the accumulation of negative emotions, such as anxiety, depression, and burnout (9). However, influenced by traditional culture, social environment, and working environment, nursing interns tend to have a lower sense of PI (10). A systematic review found that low PI awareness was the leading cause of burnout and turnover among nursing interns (11). It should be noted that anxiety is common in nursing interns. Before entering a hospital, nursing interns typically have a romantic perception of the nursing profession, as nursing involves caring for and treating patients. However, in reality, high standards requirements, heavy workloads, low salary, and poor working conditions can cause various psychological problems for nursing interns, particularly anxiety (12). Studies have shown that anxiety in nursing interns has a negative effect on their PI (13). High levels of anxiety not only affect the PI of nursing interns, but also have long-term negative consequences on their willingness to become nurses, affecting career planning, and causing serious mental health problems (14). Furthermore, nursing interns experience more severe anxiety than students in other medical disciplines, which can persist throughout their clinical practice (15). Therefore, more emphasis must be placed on the relationship between anxiety and PI among nursing interns to strengthen their intention to remain in the nursing field.

The concept of clinical belongingness refers to nursing interns in clinical practice who feel accepted, recognized, respected, and appreciated (16). According to the Maslow hierarchy of needs, belongingness and love are fundamental human needs (17). Therefore, some relevant studies have been conducted on the relationship between clinical belongingness and PI among nursing interns and it was found that clinical belongingness was positively correlated with PI (18). Clinical belongingness is essential for nursing interns to feel motivated to learn, to actively participate in clinical practice, to increase professional confidence, and develop PI (19). In addition, studies have suggested that nursing interns with a high level of clinical belongingness are more likely to have better interpersonal relationships, a better sense of adaptive skills to overcome complex clinical problems, and be more capable of coping with nervousness and anxiety (20, 21). Consequently, it is hypothesized that clinical belongingness plays a positive moderating role in the relationship between anxiety and PI.

Previous studies have found that clinical belongingness among nursing interns is positively correlated with PI and that anxiety has a

negative effect on PI (13, 18). However, most previous research has focused on the impact of professional identity on nursing interns, few studies have reported the relationship between PI, clinical belongingness, and anxiety among nursing interns; and there are fewer researches on the specific mechanism of the action between these three variables and the construction of a model using them. Therefore, this study focuses on a group of nursing interns as research objects to explore the intrinsic mechanisms and mediating effects of clinical belongingness, PI, and anxiety among them. Based on the above findings, it is further hypothesized that clinical belongingness plays a positive moderating role in the relationship between anxiety and PI (Figure 1), the following hypotheses about the nursing interns are formulated:

H1: PI is positively correlated with clinical belongingness.

H2: Clinical belongingness is negatively correlated with anxiety.

H3: PI is negatively correlated with anxiety.

H4: Clinical belongingness plays a mediating role between PI and anxiety.

2 Methods

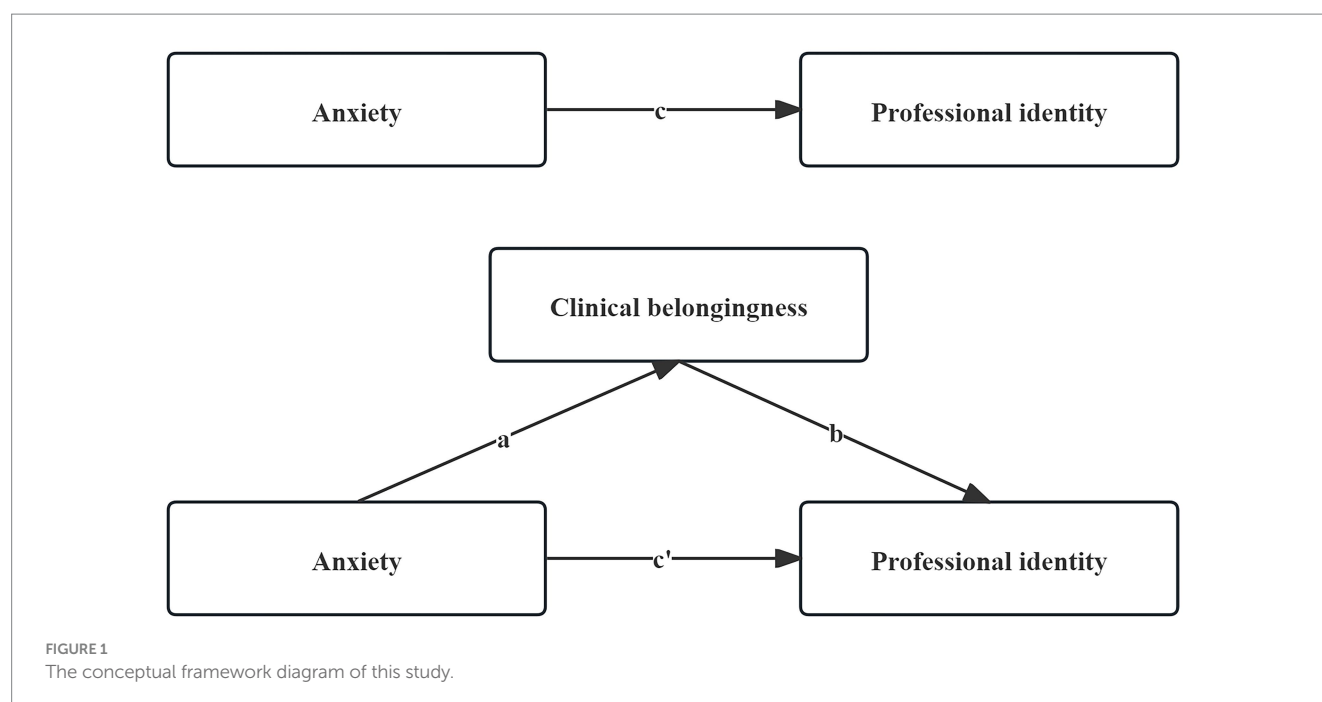
2.1 Study participants

A cross-sectional study was conducted between November 2023 and January 2024 using an anonymous self-administered online questionnaire in 26 teaching hospitals from the members of the Nursing Professional Committee of Sichuan Province, including 18 tertiary hospitals and 8 secondary hospitals. The convenience sampling was chosen due to its practicality and feasibility. Inclusion criteria were: (1) nursing interns, including secondary education, college, undergraduate, or postgraduate; (2) clinical practice for more than three months; and (3) signed informed consent and voluntary participation. The exclusion criterion was absence during the internship period of more than one month. Based on the Kendall (22) sample size estimation method, the recommended sample size for descriptive research should be 10 to 20 times the number of variables. In this study, there were 10 variables from the sociodemographic characteristics questionnaire and 12 variables from 3 scales, totaling 22 items. Considering that 20% of the questionnaires were invalid, the sample size was estimated to be 264 to 528. However, to achieve more accurate and stable results, a larger sample sizes was recruited. Ultimately, this process yielded a final sample of 1,050 valid responses from a total of 1,271 nursing interns. Of these, 221 questionnaires were excluded: 59 due to high response homogeneity across all items, 30 due to logical inconsistencies across the items, and 132 for having completion times of <3 minutes, with a valid recovery rate of 82.6%.

2.2 Measurement

2.2.1 General information questionnaire

A self-designed general information questionnaire was used to investigate gender, age, duration of the completed internship, educational level, place of origin, grades of the internship hospital,



whether it was an only child, whether they chose the nursing profession voluntarily, student leadership experience and having anyone in the medical profession in the family.

2.2.2 Belongingness scale-clinical placement experience (BES-CPE)

BES-CPE was developed by Levett-Jones et al. (23) and adapted by Tian et al. (24) for Chinese culture to assess the level of clinical belongingness among medical professionals. The scale consists of 31 items, of which items 9, 12, and 23 were reverse-scored. Dimensions 1–3 represent self-esteem, communication, and efficacy, respectively. A five-point Likert scale was used (1, never true; 2, rarely true; 3, occasionally true; 4, frequently true; and 5, always true). Higher scores indicate higher levels of clinical belongingness. The Cronbach's α coefficient of reliability of the scale was 0.96.

2.2.3 Professional identity questionnaire for nurse students (PIQNS)

The PIQNS is widely used to measure the PI of nursing students in China (25). The 17-item scale is categorized into five dimensions: professional self-image, retention benefits and exit risks, social comparison, self-reflection, independence of career choice, and social modeling. Each item was rated on a five-point Likert scale, ranging from 5, strongly agree; to 1, never agree; of which item 12 was reverse-scored. The higher the score, the more positive the PI. The scale had good reliability and validity, with a Cronbach's α coefficient of 0.95.

2.2.4 Self-rating anxiety scale (SAS)

The SAS was developed by Zung (26), with four dimensions and 20 items, of which, questions 5,9,13,17, and 19 were reverse scored. A four-point scale ranging from 1, never to 4, always was used. The SAS standard score was calculated by summing all items, multiplying by 1.25, and rounding to an integer. The thresholds for identifying anxiety symptoms were defined as a standard score of <50 (no

symptoms), 50–59 (mild anxiety), 60–69 (moderate anxiety) or 70 (severe anxiety). The Cronbach's α coefficient was 0.81.

2.3 Quality control

All questionnaires were imported into the online platform, WENJUANXING.¹ To ensure data quality, we conducted pilot tests before hand to estimate the completion time and make the necessary adjustments. The system limited each account or IP address to only one submission, and if the data were incomplete or missing, participants were unable to submit their questionnaires through the survey platform. Based on the agreement of the nursing education team leaders of 26 teaching hospitals, questionnaires were distributed to nursing interns who met the inclusion and exclusion criteria. The purpose and content of this study were explained, and informed consent was obtained before the questionnaire was distributed. In addition, the nursing interns who participated in this study did not receive any reward after completing the questionnaire. Questionnaires completed in less than 3 minutes or showing patterns of regularity, consistency (80% of the answers were the same option), or logical inconsistencies were excluded.

2.4 Data analyses

All data were analyzed using SPSS 25.0. Categorical variables were described by numbers with percentages, and inter-group comparison was carried out by the chi-square test. Continuous variables that conform to a normal distribution were expressed as means with standard

¹ www.wjx.cn

deviation (SD), and inter-group comparison was performed by using independent t-test and the ANOVA test. Pearson's correlation analysis was used to explore the correlations between PI, clinical belongingness, and anxiety. AMOS 28.0 was used for structural equation modeling (SEM). An adequate model is considered acceptable if the threshold values are as follows: $\chi^2/df \leq 5.00$, RMSEA < 0.08 , and CFI/GFI/NFI/IFI/AGFI > 0.90 (27, 28). Subsequently, a stepwise regression analysis investigated associations between anxiety and PI, and the potential mediating role of clinical belongingness in these associations was explored. Additionally, the mediation test was performed using the SPSS PROCESS macro to validate the data and calculate the 95% confidence intervals (CIs). $p < 0.05$ was considered statistically significant.

3 Results

3.1 Sociodemographic characteristics of nursing interns

Table 1 shows the baseline characteristics of the nursing interns. A total of 1,050 questionnaires were collected with an effective recovery rate of 94.94%. Of these, 82.5% were female, 28.9% were the one-child family, 74.5% were from rural areas, 59.6% had experience as a student leader, 25.2% voluntarily chose the nursing profession, and 25.6% of family members or relatives were medical workers.

3.2 The mean scores for clinical belongingness, PI, and anxiety of nursing interns

The mean scores for clinical belongingness, PI and anxiety were 115.99 ± 17.02 , 60.77 ± 12.18 , and 47.44 ± 8.75 , respectively (Table 2). The detection rate of anxiety was 35.52% (677/1050). Of those, 26.86% (282/1050), 6.10% (64/1050), and 2.57% (27/1010) of the nursing interns had mild, moderate, or severe anxiety, respectively.

3.3 Correlation analyses

Table 3 presents a detailed overview of the relationships between the variables. The clinical belongingness of the nursing interns was negatively correlated with anxiety ($r = -0.087$, $p < 0.01$), positively correlated with PI ($r = 0.601$, $p < 0.01$), therefore, H1 and H2 were supported. Meanwhile, and there was a negative correlation between anxiety and PI ($r = -0.129$, $p < 0.01$). The result indicated support for H3.

3.4 Analysis of mediating effects

A stepwise regression analysis investigated the association between anxiety and PI, and the potential mediating role of clinical belongingness in these associations was explored. PI as a dependent variable (y), anxiety as an independent variable (x), and clinical belongingness as a mediating variable (m). In step 1, PI and anxiety were included into the regression equation, and it showed that anxiety had a negative predictive effect on PI ($\beta = -0.129$, $p < 0.001$). In step 2, clinical belongingness and anxiety were included into the regression

equation, and the result showed that anxiety also had a negative predictive effect on clinical belongingness ($\beta = -0.087$, $p < 0.01$). In step 3, clinical belongingness, PI, and anxiety were included into the regression equation, and the result was that anxiety had a negative predictive effect on PI ($\beta = -0.078$, $p < 0.01$). However, clinical belongingness had a positive predictive effect on professional identity ($\beta = 0.594$, $p < 0.001$) (Table 4).

3.5 Verifying the hypothesized model

Under the condition of controlling gender, age, education level, duration of internship, place of origin, grades of internship hospital, whether the only child, whether chose nursing profession voluntarily, student leadership experience, anyone in the medical profession in the family. The mediating effect of clinical belongingness on anxiety and PI in nursing interns was analyzed. This study showed that the indirect effect was statistically significant and represented 40% of the total effect, with a value of -0.072 (95%CI: $[-0.133, -0.013]$, $p < 0.05$); the direct effect was statistically significant and represented 60% of the total effect, with a value of -0.108 (95%CI: $[-0.192, -0.030]$, $p < 0.05$), respectively (Table 5).

Given that the χ^2/df ratio is significantly influenced by sample size and the sample size in this study was 1,050, this metric should not be used to reject the model (29). The large sample size in this study contributed to the general robustness of the findings. The successfully fitted model is illustrated in Figure 2. According to Harman's single-factor test, there were nine factors with an eigenvalue > 1 , and the first factor explained 33.51% of the variation, which is lower than the critical value of 40.0%. Thus, the data did not have serious common method bias. The model fitting index of the model is acceptable ($\chi^2/df = 6.765$, RMSEA = 0.072, CFI = 0.938, GFI = 0.959, NFI = 0.969) (Table 6). This finding indicates that clinical belongingness significantly mediates the relationship between anxiety and PI among nursing interns. Therefore, H4 was supported. The effects of the interactions between the variables in the model are visually represented in Figure 1 and Table 5.

4 Discussion

This study explored the relationships between PI, clinical belongingness, and anxiety among nursing interns. These results are consistent with the proposed conceptual research model. First, the results showed that the anxiety of nursing interns was negatively correlated with clinical belongingness and PI, while clinical belongingness was positively correlated with PI. Second, the mediating effect showed that clinical belongingness had a partial mediating effect between anxiety and PI of nursing interns.

4.1 Analysis of the current status of PI in nursing interns

In this study, the mean PI score was 60.77 ± 12.18 , which was at the medium level and consistent with the findings of other

TABLE 1 Sociodemographic characteristics of nursing interns (N = 1,050).

Demographics		N (%)	PI (M ± SD)	CB (M ± SD)	Anxiety (M ± SD)
Gender	Female	866 (82.5%)	60.23 ± 11.99	115.44 ± 16.89	44.34 ± 7.54
	Male	184 (17.5%)	63.27 ± 12.79	118.56 ± 17.43	48.10 ± 8.85
	<i>t</i>		3.09	2.26	−5.36
	<i>P</i>		<0.01	0.02	<0.01
Age (years)	<18	160 (15.2%)	64.49 ± 11.08	116.38 ± 17.76	46.83 ± 9.17
	18–20	420 (40.0%)	61.72 ± 11.95	115.94 ± 17.53	47.57 ± 9.14
	21–23	396 (37.7%)	58.94 ± 12.49	115.91 ± 16.42	47.41 ± 8.14
	>23	74 (7.0%)	57.05 ± 11.62	115.84 ± 15.84	48.21 ± 8.84
	<i>F</i>		11.42	0.03	0.48
	<i>P</i>		<0.01	0.99	0.70
Duration of internship (months)	3	15 (1.4%)	57.60 ± 9.99	110.53 ± 13.11	49.08 ± 8.92
	4–9	937 (89.2%)	60.89 ± 12.06	115.97 ± 17.00	47.39 ± 8.54
	>10	98 (9.3%)	60.05 ± 13.58	116.94 ± 17.64	47.65 ± 10.61
	<i>F</i>		0.72	0.92	0.31
	<i>P</i>		0.49	0.40	0.74
Education level	Technical secondary school	235 (22.4%)	64.08 ± 11.75	116.46 ± 17.97	46.52 ± 8.94
	Junior college	522 (49.7%)	62.06 ± 12.04	116.50 ± 17.12	47.47 ± 8.85
	Bachelor	219 (20.9%)	55.96 ± 11.37	114.76 ± 16.35	48.29 ± 8.26
	Master	74 (7.0%)	55.31 ± 11.12	114.50 ± 15.05	47.60 ± 8.81
	<i>F</i>		25.75	0.79	1.57
	<i>P</i>		<0.01	0.50	0.20
Place of origin	Urban	268 (25.5%)	59.69 ± 12.60	116.25 ± 16.97	47.63 ± 8.81
	Rural	782 (74.5%)	61.14 ± 12.02	115.90 ± 17.04	46.88 ± 8.58
	<i>t</i>		1.68	−0.29	1.22
	<i>P</i>		0.09	0.77	0.22
Grades of Internship hospital	Level II	107 (10.2%)	61.36 ± 12.99	113.15 ± 16.76	45.77 ± 7.67
	Level III	943 (89.8%)	60.70 ± 12.09	116.31 ± 17.03	47.63 ± 8.85
	<i>t</i>		0.54	−1.82	−2.08
	<i>P</i>		0.59	0.07	0.04
Whether the only child	Yes	303 (28.9%)	61.88 ± 13.15	117.55 ± 17.68	47.39 ± 8.70
	No	747 (71.1%)	60.31 ± 11.75	115.35 ± 16.71	47.56 ± 8.89
	<i>t</i>		−1.80	−1.90	−0.28
	<i>P</i>		0.07	0.06	0.78
Whether chose nursing profession voluntarily	Yes	787 (75.0%)	63.69 ± 11.58	118.33 ± 17.04	48.75 ± 8.69
	No	263 (25.0%)	52.02 ± 9.47	108.96 ± 14.91	47.00 ± 8.73
	<i>t</i>		−16.32	−7.96	2.80
	<i>P</i>		<0.01	<0.01	0.01
Student leadership experience	Yes	626 (59.6%)	61.51 ± 12.06	117.23 ± 16.81	47.49 ± 8.77
	No	424 (40.4%)	59.67 ± 12.30	114.15 ± 17.18	47.41 ± 8.75
	<i>t</i>		−2.41	−2.89	0.15
	<i>P</i>		0.02	<0.01	0.88
Anyone in the medical profession in the family	Yes	269 (25.6%)	62.55 ± 12.22	118.31 ± 17.94	47.38 ± 8.62
	No	781 (74.4%)	60.15 ± 12.12	115.19 ± 16.62	47.61 ± 9.14
	<i>t</i>		−2.80	−2.60	−0.36
	<i>P</i>		0.01	0.01	0.72

CB, clinical belongingness; PI, professional identity. The bold values are intended to highlight general data with $P < 0.05$ and can be represented routinely.

TABLE 2 The overall scores of the CB, PI and anxiety scale of nursing interns (*N* = 1,050).

Variables	Items	Total score (<i>M</i> ± <i>SD</i>)	Item score (<i>M</i> ± <i>SD</i>)
CB	31	115.99 ± 17.02	3.74 ± 0.55
Self-esteem	13	47.31 ± 6.78	3.64 ± 0.52
Communication	10	36.88 ± 6.26	3.69 ± 0.63
Efficacy	8	31.80 ± 4.80	3.97 ± 0.60
PI	17	60.77 ± 12.18	3.57 ± 0.72
Social modeling	2	7.59 ± 1.78	3.79 ± 0.89
Independence of career choice	2	6.64 ± 1.47	3.32 ± 0.73
Social comparison and self-reflection	3	11.43 ± 2.05	3.81 ± 0.68
Retention benefits and exit risks	4	13.65 ± 3.42	3.41 ± 0.85
Professional self-image	6	21.45 ± 5.14	3.58 ± 0.86
Anxiety	20	47.44 ± 8.75	1.90 ± 0.35
Anxious mood	4	6.86 ± 2.60	1.72 ± 0.65
Motor nervous	6	12.52 ± 2.32	2.09 ± 0.39
Autonomic system disturbance	8	14.57 ± 3.31	1.82 ± 0.41
Mixed factor	2	4.00 ± 1.31	2.00 ± 0.66

CB, clinical belongingness; PI, professional identity.

TABLE 3 Pearson’s correlation analysis of CB, PI, and anxiety.

Variables	CB	Anxiety	PI
CB	1		
Anxiety	−0.087**	1	
PI	0.601**	−0.129**	1

***p* < 0.01. CB, clinical belongingness; PI, professional identity.

TABLE 4 The regression results of the effects of PI and anxiety on CB.

Step	Outcome variable	Predictor	<i>β</i>	<i>t</i>	<i>R</i>	<i>R</i> ²	<i>F</i>
1	PI	Anxiety	−0.129	−4.219***	0.129	0.017	17.802
2	CB	Anxiety	−0.087	−2.829**	0.087	0.008	8.002
3	PI	Anxiety	−0.078	−3.141**	0.606	0.367	303.839
		CB	0.594	24.084***			

p* < 0.01, *p* < 0.001. CB, clinical belongingness; PI, professional identity.

TABLE 5 Direct and indirect effects of clinical belongingness.

	Effect	SE	95%CI		%
			LLCL	ULCL	
Indirect effect	−0.072	0.031	−0.133	−0.013	40%
Direct effect	−0.108	0.042	−0.192	−0.030	60%
Total effect	−0.180	0.045	−0.199	−0.022	-

SE, Standard Error; CI, Confidence Interval; LLCL, Lower Limit Confidence Interval; ULCL, Upper Limit Confidence Interval.

studies (30, 31). Nursing interns with various characteristics showed obvious differences in their PI scores (32). Nursing interns with a college degree or lower had a higher PI than those with a bachelor’s degree or higher. This could be attributed to the increased educational output of nursing interns as well as their higher expectations of professional treatment and standing. However, the current nursing employment environment was not positively correlated with degree level (33). With the expansion of

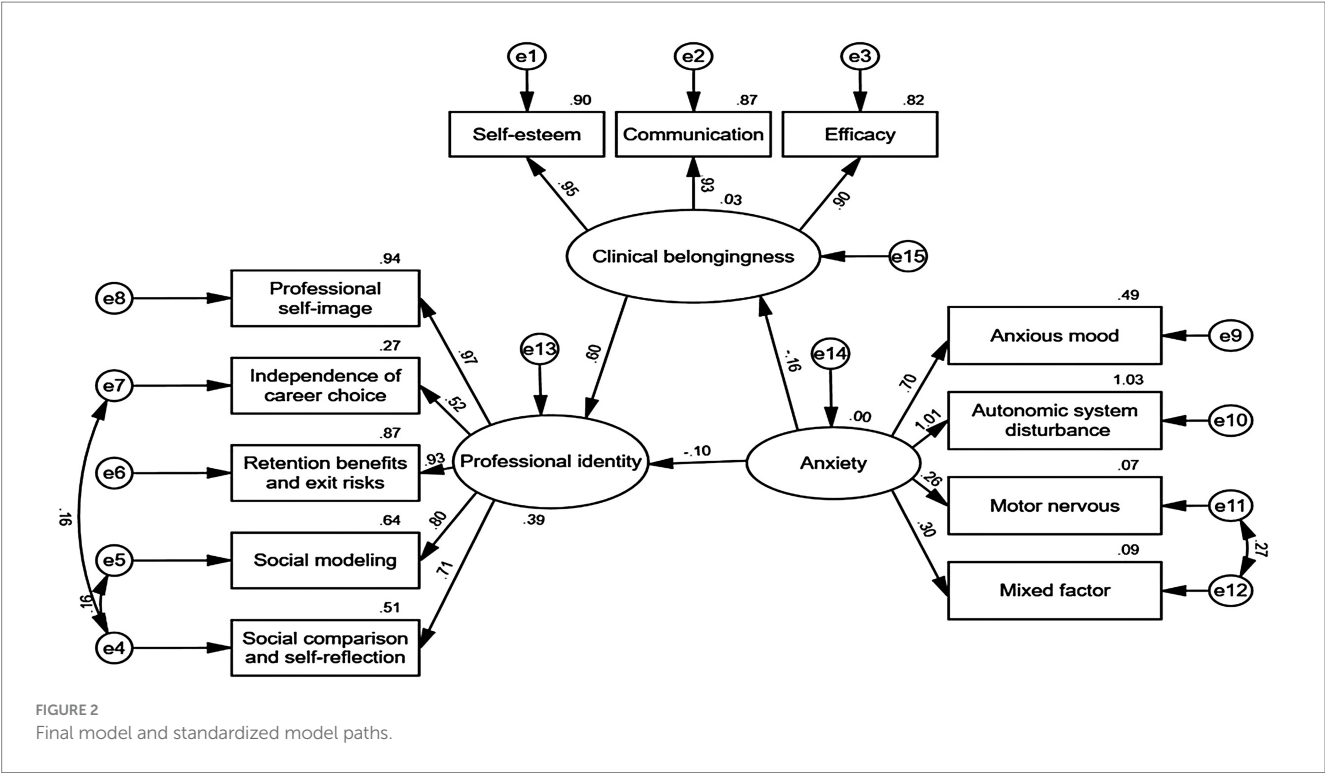


TABLE 6 Summary of model fit indices.

Model	χ^2/df	RMSEA	GFI	AGFI	NFI	IFI	CFI
Recommended value	≤ 5	≤ 0.08	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90
Actual value	6.765	0.072	0.959	0.930	0.969	0.974	0.974

RMSEA, root mean square error of approximation; GFI, goodness-of-fit index; NFI, normed fit index; IFI, incremental fit index; CFI, comparative fit index.

the graduate nursing program, competition among graduates is increasing, leading to employment and career pressure increased significantly (34). Additionally, in a busy clinical work environment, with a low salary and influenced by the traditional Chinese impression, the public image of nurses is viewed as performing simple and repetitive tasks and having to follow the orders of doctors, which leads to nurses often being overlooked by people and low PI (35). As a result of the combination of these factors, some nursing interns have to reconsider their future career paths.

The results of this study showed that the majority of nursing interns chose nursing majors voluntarily, and compared to involuntary nursing interns, they had higher PI and clinical belongingness, and a lower rate of anxiety. This is because the nursing interns who voluntarily enrolled in a nursing major were already familiar with, and understood, the nursing major before choosing it. Consequently, they were able to more effectively formulate their career plans and respond positively to academic challenges (36). Furthermore, the PI of male nursing interns was higher than that of female nursing interns, contrary to the results of previous studies (37), which may be related to the increasing social demand for male nurses and the stereotype of nursing as being a profession only for females, which is gradually

disappearing (38). However, there were fewer male nursing interns in this survey; therefore, the results may have been biased.

Furthermore, PI is a dynamic developmental process, which means that the PI of nursing interns can be reconstructed or strengthened (39). Therefore, to improve the PI of nursing interns, nurse educators and clinical practice managers should pay attention to the PI of nursing interns with different characteristics, strengthen the construction of a professional culture, assist nursing interns to better integrate into the group, formulate a personalized internship plan, and provide a clear career plan.

4.2 Correlation analysis of PI, clinical belongingness, and anxiety in nursing interns

The results of this study showed that anxiety was negatively correlated with PI ($p < 0.01$), consistent with the findings of Wu et al. (40). The higher the anxiety level of the nursing interns, the lower the PI. This is because the psychological development of nursing interns is still immature; facing a complex clinical setting, their experience and ability to solve problems is limited, and they are prone to negative emotions (41). Furthermore, nurses with negative psychology are

more likely to accept negative information and magnify the shortcomings of the nursing profession, resulting in impaired professional values, lower PI, and burnout, which in turn leads nursing interns to leave the nursing profession, increasing the shortage of nurses (42, 43).

The results of this study showed that clinical belongingness was positively correlated with PI ($p < 0.01$), consistent with the results of Mirhosseini et al. (44). Social psychology posits that satisfying the need to belong has a positive effect on emotional patterns and behavioral responses (34). A supportive clinical environment is beneficial for increasing the sense of collective integration and emotional needs of nursing interns, which in turn encourages them to adopt a positive approach to complex clinical problems during their internships, resulting in better professional performance and professional identity. By contrast, those who lack a sense of belonging are more likely to experience anxiety and burnout (45).

4.3 Analysis of the mediating effect of clinical belongingness between anxiety and PI in nursing interns

Finally, by including clinical belongingness in the regression equation, we analyzed and verified the hypothesis. Clinical belongingness mediated the relationship between anxiety and PI, with a mediation effect of 40%. This result is in agreement with those of previous studies in which clinical belongingness was a protective factor for reducing anxiety and improving PI among nursing interns (46). From the perspective of positive psychology, if nursing interns feel the benefits and positive emotional experiences provided by nursing work, it can encourage them to be more active in clinical practice and have a positive mindset to deal with negative emotions, such as pressure and anxiety (47). Conversely, clinical belongingness can assist nursing interns to become more recognized for nursing work and accelerate the transformation of nursing interns into qualified medical personnel (48). Therefore, it is recommended that nursing managers and educators pay greater attention to the clinical belongingness of nursing interns from a positive psychology perspective and utilize management and teaching methods that are appropriate to the characteristics of the current nursing intern cohort to improve their sense of PI.

4.4 Implication for theoretical and practice

This study offers valuable theoretical foundation for nurse managers and educators in developing strategies to enhance nursing interns' PI. On the one hand, these results theoretically testify that clinical belongingness plays a positive moderating role in the relationship between anxiety and PI. On the other hand, the results of this study are instructive for improving and enhancing the PI of nursing interns. Therefore, nurse managers and educators should pay attention to nursing interns with high levels of anxiety, low PI, and low clinical belongingness. In addition, we suggest that nursing managers and educators

demonstrate caring behaviors toward patients and colleagues, setting an example for team. Regular heart-to-heart talks with nursing interns are conducted to identify and assist in solving their clinical practice difficulties, and to help them establish a correct outlook and cognition of nursing the profession, which has far-reaching implications for the overall career development of nursing interns and the quality of nursing care.

4.5 Limitations of this study

Several limitations need to be acknowledged. Due to time and manpower constraints, this cross-sectional survey was only conducted in Sichuan Province, China, which may limit the extension of these results to other regions. Therefore, more large-scale and multi-center studies are required to improve the generalization of these findings in various geographies. Second, this study used a cross-sectional survey, and it is impossible to identify the order of clinical belongingness, PI, and anxiety. Therefore, variables may have a reverse causal relationship, longitudinal studies will be needed in the future to explore the true causal relationship. Third, the influence path of anxiety on professional identity is multifaceted, clinical belongingness provides only a component of the mediating effect, consequently, there may be additional potential mediating effects that have not yet been identified. Therefore, qualitative interviews should be considered to collect more data to investigate potential mediating factors. Four, data were collected through online self-reporting (e.g., BES-CPE, PIQNS, SAS) may recall and response bias, potentially affecting data accuracy. Future research could incorporate face-to-face qualitative interview data or utilize objective measurement instruments to enhance data accuracy and reliability.

5 Conclusion

This study bridges the gap in the literature on the relationship between clinical belongingness, PI, and anxiety, and provides a new theoretical perspective for future nursing education and practice. In the context of global healthcare resource constraints, nursing educators and clinical practice managers must change traditional management and teaching concepts, offer appropriate tolerance and praise to nursing interns, reduce criticism and blame, further meet their needs for love and belonging, assist in better integration into the collective, reduce the impact of the clinical environment and professional bias, and stimulate learning motivation and work enthusiasm, thus improving PI and promoting the stability and development of nursing careers.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of Mianyang Central Hospital. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

JZ: Writing – original draft, Writing – review & editing. LW: Validation, Writing – original draft. XY: Writing – original draft. YY: Formal analysis, Writing – review & editing. XW: Data curation, Resources, Writing – review & editing. HH: Supervision, Writing – review & editing. GL: Conceptualization, Funding acquisition, Resources, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Kim Walker,
University of Aberdeen, United Kingdom

REVIEWED BY

Shah Imran Ahmed,
Shah Abdul Latif University, Pakistan
Magnus Svartengren,
Uppsala University, Sweden
Yupin Aungsuroch,
Chulalongkorn University, Thailand

*CORRESPONDENCE

Magnus Akerstrom
✉ magnus.akerstrom@vgregion.se

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Organisational-level risk and health-promoting factors within the healthcare sector—a systematic search and review

Magnus Akerstrom^{1,2*}, Jens Wahlström³, Agneta Lindegård^{1,2},
Inger Arvidsson⁴ and Anna-Carin Fagerlind Ståhl¹

¹Region Västra Götaland, Institute of Stress Medicine, Gothenburg, Sweden, ²School of Public Health and Community Medicine, Institute of Medicine, The Sahlgrenska Academy at University of Gothenburg, Gothenburg, Sweden, ³Department of Public Health and Clinical Medicine, Sustainable Health, Umeå University, Umeå, Sweden, ⁴Division of Occupational and Environmental Medicine, Lund University, Lund, Sweden

Introduction: The healthcare sector is globally experiencing increasing demands and workplace interventions on an organisational level is sought to create healthy workplaces. The aim of this study was to provide an overview of Nordic research on the work environment and health of healthcare professionals, with a focus on identifying organisational-level risk and health-promoting factors.

Methods: This systematic search and review was based on an analysis of studies published in peer-reviewed journals between 1 January 2016 and 3 January 2023. The selected studies investigate the relationships between organisational-level risk and health-promoting factors and measures of health and well-being among healthcare professionals during ordinary operations. To increase applicability, this systematic search and review was limited to the Nordic countries as they share the same context with a publicly-funded widely accessible healthcare system. A total of 2,677 articles were initially identified, with 95 original studies meeting the criteria for relevance and quality.

Results: Identified organisational risk and health-promoting factors were categorised into five categories: work schedule distribution, operations design and work methods, ergonomic conditions, working conditions and personnel policies, and the organisation's ethical environment. In addition, two themes across the categories emerged, providing further insight into the implications for practice. The first theme emphasises risk and health-promoting factors in the actions that employers take to fulfil the organisation's goals. The second theme emphasises risk and health-promoting factors in connection with the ability of employees to do their jobs at a level of quality they deem acceptable.

Conclusion: Several organisational-level risk and health-promoting factors were identified, and the results indicate that the actions that employers take to fulfil the health-care organisation's goals and promote the ability of employees to provide high-quality care are important for the health and wellbeing of healthcare employees.

KEYWORDS

risk factors, health-promoting factors, healthcare, organisational-level, occupational health and safety management, prevention

1 Introduction

High-quality healthcare is essential for social welfare, and attention to the health and wellbeing of healthcare workers is a crucial aspect of this effort. Reduced health in healthcare workers can have adverse effects on the individual healthcare workers. In addition, it may also lead to reduced quality in patient care, the risk of accidents, and challenges attracting and retaining a skilled workforce. Maintaining healthcare workers' health is especially important since the competition for healthcare professionals is increasing due to an aging population in many societies (1–6). Despite this, healthcare in Europe is recognised as a high-risk sector from an employee wellbeing perspective (7), and healthcare workers report the highest levels of work-related stress compared to other professionals (8). They also experience poor wellbeing (9, 10) and physical symptoms (11).

Challenges within the healthcare sector arise from demands connected to healthcare work, which include contact with distressed and ill patients, work overload, up-to-date learning, and high-quality standards of performance (8). In addition, ongoing medical developments have resulted in growing demands for speed, complexity, and responsibility; an increased administrative burden, and reduced autonomy among healthcare workers (12, 13). In order to maintain healthy workplaces, job demands need to be manageable, and workers need to have access to sufficient resources to balance these demands (14). This challenging situation is not unique to Europe, and the World Health Organization (WHO) estimates that within the healthcare sector alone, there will be a shortfall of 10 million employees globally by 2030 (15).

Creating healthy workplaces requires organisational approaches that aim to improve working conditions and the organisation of work, rather than individual approaches that aim to improve workers' competencies, knowledge, and coping capacity (16–18). In addition, instead of simply preventing harm, an approach that focuses on promoting employee wellbeing has been recommended as a way to improve working conditions within the healthcare sector (19). Such organisational-level interventions require not just in-depth knowledge of the healthcare sector (i.e., challenges, structure, and processes imbedded in that system and culture) but also knowledge on risk and health-promoting factors (i.e., working conditions that increase the likelihood of illness among employees or reduce the likelihood of health, and increase the likelihood of health among employees or reduce the risk of illness, respectively) that may be targeted (20, 21).

At present, the knowledge of the impact of risk and health-promoting factors on the workplace level within the healthcare sector is extensive, as a wide range of systematic reviews have been performed. These systematic reviews have provided evidence of the associations between burnout and a high workload, time constraints, value incongruence, low level of control, insufficient support from colleagues and managers, lack of collaboration, inadequate rewards, insufficient staffing, shifts exceeding 12 h, limited scheduling flexibility and uncertain employment conditions (22–25); musculoskeletal disorders and pain due to awkward working postures, a large number of patients, administrative work, vibration, and repetitive work (26, 27); and job satisfaction with workload and income, responsibility, recognition, autonomy and collaboration (28, 29).

However, there is still limited knowledge of the underlying causes of the presence or absence of these risk and health-promoting factors (i.e., risk and health-promoting factors on a higher organisational level). Following the principles of the hierarchy of controls for occupational safety and health (30, 31), risks to health and wellbeing should be reduced or eliminated by targeting the organisational level rather than the workplace or individual level. Thus, there is an urgent need to increase knowledge on organisational-level risk and health-promoting factors that may be used to improve the health of employees within the healthcare sector. To increase applicability to practice, this systematic review was limited to the Nordic context (Denmark, Finland, Iceland, Norway and Sweden), where all countries have a publicly-funded, widely accessible healthcare system (32).

The aim of this study was to provide an overview of Nordic research on the work environment and health of healthcare professionals, with a focus on identifying organisational-level risk and health-promoting factors.

2 Methods

2.1 Study design

Due to the multifaceted nature of organisational-level risk and health-promotive factors, in combination with the absence of earlier systematic reviews that could be used to guide the search, a broad scope that incorporates multiple study types rather than focusing on a single preferred study design had to be used. Thus, this study was carried out as a systematic search and review with a narrative summary (33) and reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) 2020 statement (34); see supporting information on-line [Supplementary material](#) (Prisma 2020 checklist). This study has not been reviewed by the Swedish Ethical Review Authority. This is not required for this type of study according to the Swedish Ethical Review Act. Informed consent to participate was not applicable in this study. No protocol exists for this review, since it was first commissioned as a part of a government assignment to the Swedish Agency for Work Environment Expertise and the absence of ethical review requirements.

2.2 Inclusion and exclusion criteria

Studies investigating health-related risk and health-promoting factors for healthcare professionals in the Nordic countries that were published in peer-reviewed journals between 1 January 2016 and 3 January 2023 were included. The start date of the searches was a pragmatic choice used to increase the relevance of the included studies by reflecting the current context and normal operations. The search strategy was structured according to SPIDER (sample, phenomenon of interest, design, evaluation, and type of research) as we expected a wide range of study designs, including quantitative, qualitative, and mixed method designs (35). Studies were included if they examined the relationship between health and illness in relation to risk and health-promoting factors at the organisational level, or employees' experiences of these factors. Descriptive studies that described relationships without examine the relationship between health and

illness in relation to risk and health-promoting factors at the organisational level were excluded. Outcomes that cannot be directly seen as an aspect of health or illness have also been excluded, although they may be an outcome of a risk or health-promoting factor and related to health or illness. For example, various performance-related outcomes, such as patient satisfaction, quality of care, or incidents, have been excluded since such outcomes do not directly reflect worker health. Outcomes related to employee turnover, such as the desire to leave or remain in the workplace or organisation, have also been excluded. Finally, studies conducted under non-ordinary or non-generalisable conditions, such as pandemics or crises, have been excluded. Complete inclusion and exclusion criteria can be found in [Table 1](#).

2.3 Information sources and search strategy

Literature searches were developed and conducted by librarians/information specialists to reflect the concept outlined by the project team. A set of key articles were identified before the search process,

TABLE 1 Inclusion and exclusion criteria structured according to SPIDER (sample, phenomenon of interest, design, evaluation, and type of research).

SPIDER	Inclusion criteria	Exclusion criteria
Sample	Healthcare professionals in the Nordic countries	Healthcare professionals outside the Nordic countries
Phenomenon of interest	Organisational and health-related risk and health-promoting factors that can affect employees' health and wellbeing, either directly or by affecting job demands and resources at the workplace level	Risk and health-promoting factors at the workplace level. Organisational risk and health-promoting factors that affect staff turnover, as well as willingness to remain at the workplace, or performance-related outcomes, such as patient satisfaction, quality of care, or patient-related incidents
Design	Observational studies under ordinary conditions	Studies under non-generalisable or extraordinary conditions, for example, purely experimental studies, intervention studies, and studies conducted during pandemics and crises
Evaluation	Studies that examined the relationship between health and illness in relation to risk and health-promoting factors at the organisational level	Studies that did not examine the relationship between health and illness in relation to risk and health-promoting factors at the organisational level
Research type	Quantitative, qualitative, and mixed methods studies	Systematic reviews, intervention studies, experimental studies, and grey literature

which were used to generate search terms (MeSH and free-text terms) and test the effectiveness of the strategies in each database. A combination of three different thematic search terms (blocks) were used: (1) population (e.g., "healthcare worker*," "healthcare personnel*," "health professional*," etc.), (2) the phenomenon of interest (e.g., "occupational health*," "workplace health*," "employee health*," etc.), and (3) the context (e.g., "Sweden," "Norway," "Denmark," "Finland," "Iceland,"). The complete list of search terms is presented in the on-line [Supplementary material](#) (Search terms). To cover a wide range of disciplines such as healthcare, psychology, and occupational health research, the search was performed using four different databases (Pubmed, Scopus, Cindahl, and PsycINFO) 3 January 2023.

2.4 Selection process

Records found during the search phase were exported to a reference management software (EndNote) to identify and remove duplicates. To ensure adequate understanding and consistency in the application of inclusion and exclusion criteria, a calibration exercise was carried out within the project team prior to the formal screening. In this calibration exercise, the project team met to discuss inclusion and exclusion decisions on randomly selected records until adequate consensus and consistency was assessed to be reached within the group. The records were then screened based on the inclusion and exclusion criteria using Covidence, a web-based application for systematic reviews. The initial screening on the title/abstract level and the full-text assessments of each record were done independently by two of the authors (MA, JW, ALA, and/or ACFS). Cohen's Kappa showed an agreement between 0.33 and 0.60 between the different evaluators. To increase the agreement between evaluators, the project team met up to discuss inclusion and exclusion decisions until adequate consensus and consistency was assessed to be reached. Disagreements were resolved by discussion until consensus was reached.

2.5 Quality assessment

The methodological quality of each included study was assessed by two of the authors (MA and JW). To provide a nuanced view of study quality across multiple research designs, in line with the methodology of this systematic search and review, the 2018 Mixed Methods Appraisal Tool (MMAT) was used. MMAT is designed to review the quality of studies with different designs and varying methods (36). When using the MMAT, no scores or overall assessments, such as low/medium/high quality, are calculated; rather, the MMAT provides an in-depth picture of the quality of the studies. The quality review was conducted in two stages. In the first stage, each study was evaluated based on two screening questions (whether there were clear research questions and whether these questions could be investigated using the available data in the study). The assessment of these questions (yes, no, or cannot tell) determined whether the study should be included or excluded due to a lack of methodological quality. In the second stage, the included studies were evaluated using five additional and specific study design questions (with response alternatives: yes, no, or cannot tell), to provide an in-depth picture of the quality of the study. In this stage, the templates

for qualitative studies, randomised controlled trials, non-randomised trials, and mixed methods studies were used. Any disagreement during the quality appraisal were resolved by discussion until consensus was reached.

2.6 Data extraction

Data extraction was performed by the authors (MA, JW, ALA, and ACFS) and cross-checked to ensure accuracy and consistency in the extracted data by another author (MA or ACFS). To include both information on the identified organisational-level risk or health-promoting factors and contextual and methodological information that may be used to support the analysis, a matrix, including: (A) country representing the context of the study, (B) study aim, (C) study design, (D) study period, (E) study population, (F) Size of the study population (G) outcomes, and (H) identified organisational-level risk or health-promoting factors was used and is provided in the on-line [Supplementary material](#) (Data extraction matrix). Any disagreements during data extraction were resolved by discussion until consensus was reached.

2.7 Data synthesis

Since a large heterogeneity was expected in the included studies, the data synthesis was conducted with a narrative summary based on which aspects of the organisation of health care had been examined. This categorisation was done jointly by the authors (MA, JW, ALA, IA, ACFS) and was reported together with the more descriptive compilation of the included studies. Finally, overarching themes were also identified across these categories (i.e., meaningful patterns that contribute to a better understanding) (37). An example of the qualitative data synthesis process, including the identification of the categorisation and identification of overarching themes can be seen in [Table 2](#).

3 Results

3.1 Study selection

The database searches identified 4,461 records, and 2,677 record were screened on the title/abstract level after removal of duplicates. Of these, 375 full-text articles were reviewed, and 95 were included for analysis ([Supplementary Table S1](#)). A flow diagram of the review process is shown in [Figure 1](#). A list of excluded full-text articles are provided in the on-line [Supplementary material](#) (Excluded full-text articles).

3.2 Characteristics of the included studies

Most of the included studies had a cross-sectional design ($n = 34$, 36%) or a longitudinal cohort design ($n = 34$, 36%). A total of 20 studies (21%) were qualitative, and two studies (2%) used a mixed methods design. The remaining five studies (5%) used a case-control design or examined the importance of organisational risk and health-promoting factors in connection with natural experiments under normal operations (quasi-experimental intervention or randomised field experiments) ([Supplementary Table S1](#)).

Two out of five studies ($n = 38$, 40%) included healthcare professionals from different professional groups, without examining the groups separately or specifying the groups in greater detail. The other studies ($n = 57$, 60%) focused on specific professional groups, including registered nurses ($n = 37$, 39%), physicians ($n = 9$, 9%), healthcare managers ($n = 5$, 5%), midwives ($n = 4$, 4%), dental hygienists and other dental professionals ($n = 2$, 2%), and psychotherapists ($n = 1$, 1%) ([Supplementary Table S1](#)).

There was an even distribution of studies from the Nordic countries, with 27 studies (28%) from Finland, 25 (26%) from Sweden, 22 (23%) from Norway and 22 (23%) from Denmark. Iceland was the exception with only one study (1%) ([Supplementary Table S1](#)). No overall differences in the identified factors could be seen between the Nordic countries.

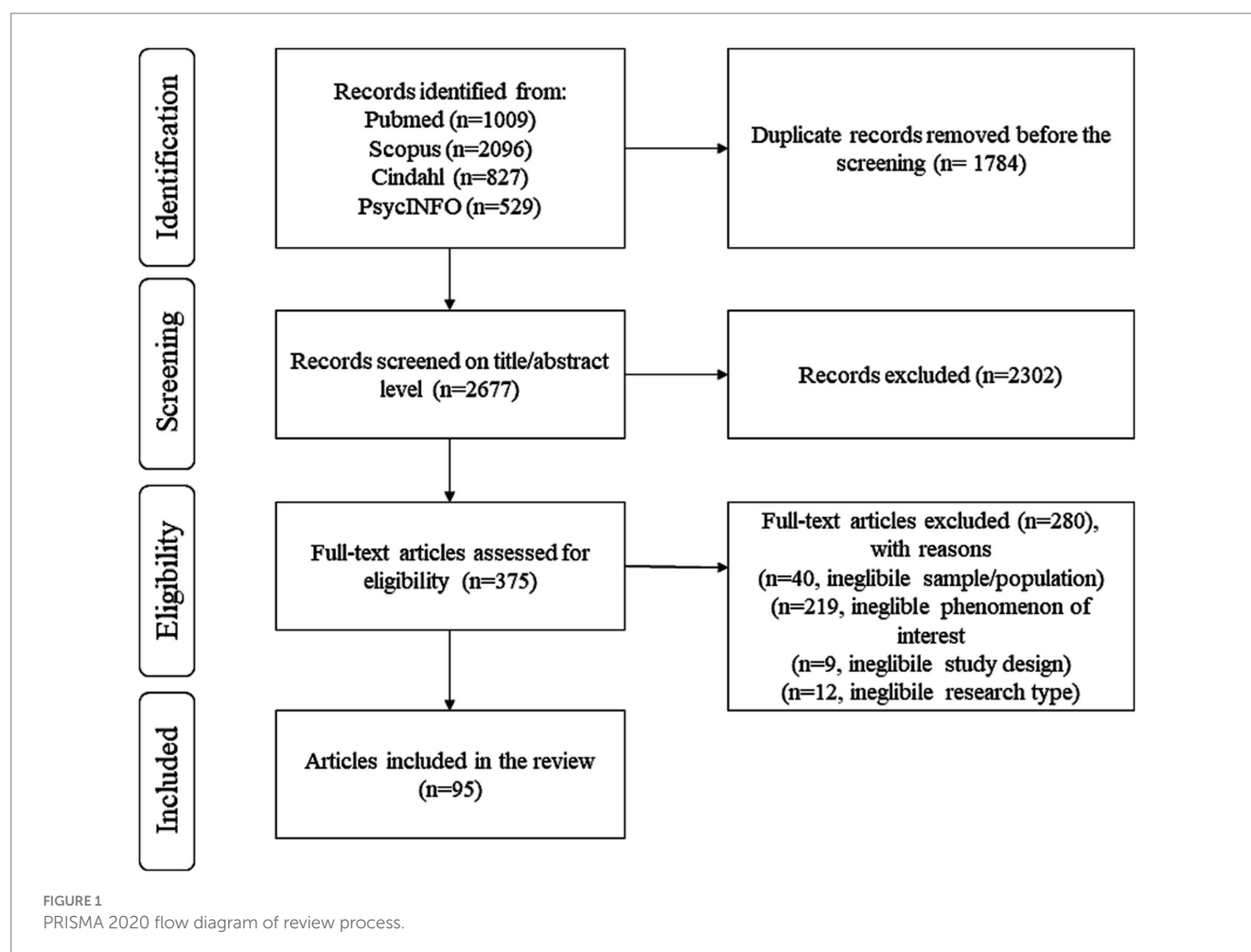
A majority of the included studies studied organisational risk factors ($n = 67$, 71%) connected to a wide range of outcomes with a focus on both mental and physical illness and disease ([Supplementary Table S1](#)). The remaining studies ($n = 28$, 29%) focused on health-promoting factors connected to outcomes such as job satisfaction, motivation, engagement, etc. ([Supplementary Table S1](#)).

3.3 Quality assessment results

All reviewed studies were assessed to be of sufficient methodological quality and were included in the systematic review. In the in-depth assessments of the methodological quality of the included studies, most of the qualitative and mixed method studies were found to lack information on whether the authors had quality assured the article using a checklist for reporting the study (such as the “Consolidated criteria for reporting qualitative research” [COREQ] or similar resource). For the quantitative studies (17 out of 75 studies), questions were raised regarding whether the participants were representative of the intended study population due to low response rates and/or a non-random sample of the study population. The checklist for the evaluation of methodological quality is provided in the on-line [Supplementary material](#) (Quality assessment).

TABLE 2 Example of the qualitative data synthesis process.

Theme	Sub-theme	Category	Sub-category	Organisational factor	Quote
Organisational-level risk and health-promoting factors within healthcare	Importance of the organisation's culture and values and what it communicates to its employees	Operations design and work methods	Risk factor	Operations design; working alone	“There was a significant association between working alone and psychological distress, both in univariate and multivariate models corrected for age and gender”



3.4 Organisational-level risk and health-promoting factors

To obtain an overview of the results, all studies were categorised based on which aspects of the organisation of health care had been examined (Supplementary Table S1). Results identified risk and health-promoting factors in the organisation of health care in terms of the distribution of working time schedules ($n = 39$, 36%), design of operations and working methods ($n = 28$, 26%), ergonomic conditions ($n = 18$, 17%), terms of employment and personnel policy ($n = 13$, 12%), and the organisation's ethical environment ($n = 10$, 9%), Table 3. These categories are described in detail below. In some cases, a single study contained risk and health-promoting factors associated with more than one of these categories, bringing the total number of studies in the above summary to more than 95.

3.4.1 Work schedule distribution

A relatively large group of studies ($n = 39$) investigated employees health related to the distribution of working time schedules, that is, how shifts and working hours were distributed among existing staff. Shift work can refer to both fixed night shifts and rotating shifts. Shifts can rotate regularly or irregularly, and their duration may vary. For many healthcare organisations that must be staffed around the clock, the need for evening and night work is unavoidable. Still, the

distribution of these shifts and working hours among available staff is a changeable factor at an organisational level.

Schedules that largely included night shifts and shift work, especially over several years, were found to be an organisational-level risk factor. An association was found between night work and cerebrovascular disease and stroke (38), sleep disturbances and severe fatigue (39), exhaustion (40), heart disease (41), diabetes (42), sick leave (43) and work-related accidents (44). Working several night shifts in a row increased the risk of exhaustion (45), sick leave (46, 47), and premature birth (48). Working night shifts for more than six years increased the risk of dementia (49, 50), and multiple night shifts over more than five years increased the risk of telomere shortening, which, in turn, increases the risk of breast cancer (51). However, the findings were not completely unanimous, and some studies found no association between night work and health (52, 53) or sick leave (44), or only for specific subgroups (54–56). Evening shifts were also found to be a risk factor and were associated with diabetes (42), long-term sick leave (46), and the incidence of accidents during these shifts (57, 58). Some studies found that both evening and night shifts increase the risk of both mental illness (50, 59) and mortality (60), while other studies conclude that the increased risk of mental illness was greater for people who work night shifts than evening shifts (61, 62). Shift and night work was also associated with sleep problems and insufficient recovery (63).

TABLE 3 Summary of the five identified categories of organisational-level risk-and health-promoting factors, and the types of factors associated with each of these categories.

Identified categories	Work schedule distribution	Operations design and work methods	Ergonomic conditions	Terms of employment and personnel policies	The organisation's ethical environment
Included studies (n) ^a	39	28	18	13	10
Types of organisational-level risk-or health-promoting factors	Shift type and distribution of shifts in the short term and over time Number of working hours per shift and week Distribution of shifts and time off/rest	Organisation of the work, alone and with others Objectives and quality management Models/ principles guiding the work	Assistive devices and work tools (physical and cognitive) Physical work environment	Permanent/ temporary employment Salary and other rewards Opportunities to adapt the work Tutorials, courses, training	Communicated policies and guidelines Support for employees in ethical issues Opportunities to perform work in line with ethical values

^aOne study can contribute to more than one category bringing the total number of studies to more than 95.

The distribution of working time schedules over the day and week was also found to be a risk factor. Long shifts of more than eight hours and long weeks of more than 40 h increased the risk of sick leave (46, 47, 64), work-related accidents (65), and work-related injuries (66). A schedule with fewer but longer shifts on weekends (12-h shifts instead of 8-h shifts) did not affect job satisfaction among registered nurses, but the effect of this schedule on health depended on the nurses' general health and family situation (67). The number of 24-h on-call shifts was positively associated with burnout among surgeons (68).

Another identified risk factor was quick returns (i.e., a short duration between shifts), which was associated with perceived stress (69, 70), sleep disturbances and severe fatigue (39, 139), exhaustion (45), heart disease (41), cerebrovascular disease and stroke (38), sick leave (46, 64, 70), premature birth (48), and work-related accidents (43, 44, 58, 65).

The importance of these risk factors was also seen in studies that examined the impact of reducing shift work, quick returns, and working hours. Night workers' symptoms of mental illness improved when they stopped working night shifts (71), and their sleep disturbances and severe fatigue decreased when they reduced the number of quick returns, discontinued night work, or reduced the number of night shifts (39). A reduction in the number of quick returns also reduced the risk of work-related injuries among registered nurses (72). When working hours were reduced from eight to six hours (with the same salary), assistant nurses and registered nurses felt that they had more energy, both on the job and outside of work (72, 137).

A health-promoting factor was identified in the ability to influence the schedules, working hours, and holidays, which was perceived as a reward (73) and increased job satisfaction (74) among registered nurses. Another study found that participation in the planning of working hours resulted in increased control, but not increased well-being, compared to traditional planning among healthcare workers (138).

3.4.2 Operations design and work methods

The second largest category ($n = 28$) comprises studies focusing on how the organisation and its work are designed and what working methods prevail and are rewarded within the organisation. This includes different ways in which tasks and responsibilities have been distributed and how the organisation has chosen to structure the work, measure quality, provide feedback, offer rewards, and manage goals. Although all studies in this category address the design of operations and working methods, this is a broad field, and the

identified articles mostly examine different aspects, in different contexts, for different groups, making it difficult to draw overall conclusions.

Some studies identified risk and health-promoting factors in the social aspect of how work was designed in terms of collaborations and hierarchies. Associations were identified between working alone and increased perceived anxiety (75) and musculoskeletal disorders and pain (76), but also with increased job satisfaction (77). Non-hierarchical collaboration was associated with motivation among primary care staff (78), and collaboration within the organisation and with policymakers and support (administratively and organisationally) increased well-being among healthcare managers (79). Working in self-organising teams (80) and having the ability to self-manage (81) were positively associated with job satisfaction.

Other studies identified both risk and health-promoting factors in how the tasks were designed and distributed. Physicians who were required to perform illegitimate tasks had increased presenteeism (82). The risk of exhaustion increased for physicians within primary care when they were forced to take over tasks from specialist care providers and when documentation and administration increased and became more complex (83). For general practitioners in Norway, the number of consultations per day had no association with stress, but the number of consultations containing elements of conflict did (84). Among registered nurses, the manner in which responsibility for patients was distributed was both positively and negatively associated with various aspects of stress (85). Among healthcare workers in Denmark, job satisfaction increased when clinical tasks were delegated from the physician to other health professions (86). The dissatisfaction of general practitioners with their work situation decreased when the time per patient consultation increased from less than 10 min to more than 20 min (77). When the work of midwives was organised to ensure that patients could have one midwife throughout their pregnancy, this resulted in lower rates of burnout (87) and increased job satisfaction, as the midwives felt important and appreciated (88). The more primary care units relied on a lean-based working method, the lower the levels of fatigue among staff, who also reported a greater sense of well-being (89). Operational designs that resulted in short-term planning and uncertainty about the future and finances were a risk factor for poor health among healthcare managers (79). Work that involves standing still was not associated with pain among healthcare workers (90).

Risk and health-promoting factors were also identified in the way organisations set up and managed their goals and how they chose to

measure quality and performance. Clear goals and systematic quality work were associated with increased motivation among primary care staff (78), while the use of inadequate quality measures was associated with reduced job satisfaction among registered nurses (91). A focus on cost-effectiveness within an organisation sparks frustration among home care staff, who feel that they are not able to work as effectively as they would like (92). Accreditation of the enterprise was negatively associated with physicians' job satisfaction if it was perceived as a means of control, but increased job satisfaction if it was considered to improve quality (93). Healthcare workers who were exposed to demands connected to financial constraints, administration, and productivity by their senior management had increased sickness absence compared to other healthcare workers (94). When registered nurses were rewarded based on performance goals, it sometimes resulted in increased stress (73). Registered nurses reported feeling more motivated and that collaboration improved when tasks were visually presented and could be discussed and ticked off after completion by using activity boards (95).

Finally, this category also included studies of risk and health-promoting factors linked to whether senior management had the necessary conditions to acknowledge and understand the needs of their employees. The perception that the management of a healthcare organisation focuses and acts based on the needs and desires of employees is positively linked to job satisfaction and engagement among registered nurses (96). Registered nurses reported that being seen and receiving recognition and feedback from senior management increased motivation (73, 74). A senior management team that supported patient safety and inter-unit teamwork was associated with lower levels of burnout among registered nurses (97). Registered nurses and midwives perceived that managers promoted health when they had the opportunity to take a hands-on approach, whereas a lack of instructions and procedures was perceived as a risk factor (98). Registered nurses experienced greater job satisfaction when their line manager had a moderate number of employees, thus enabling them to take on a more active leadership role (99). In another study, the number of subordinate registered nurses had no correlation with the neck and back pain of unit managers (100).

3.4.3 Ergonomic conditions

In this category, 18 studies had investigated the results of actions at the organisational level to eliminate ergonomic risk factors and optimise ergonomic conditions, including electronic information and communication systems (e.g., electronic medical record systems or registers), with the purpose of simplify or facilitating work.

Risk and health-promoting factors were seen in measures that reduced strain in individual work tasks at the organisational level and measures that provided and enabled the use of various aids to reduce the workload and the risk of injury. When working in clients' private homes, difficulty in using adequate aids or equipment poses a risk of injury (63). The inability to use assistive devices when moving patients from one place to another was associated with ill-health among healthcare workers (63, 101, 102). Access to adapted assistive devices in the form of prism glasses reduced the risk of neck pain and injury among dental professionals by limiting neck strain (103). The design of medical equipment did not affect pain among dialysis registered nurses (104), but a closer analysis identified risks associated with repetitive tasks and the design of the workplace and various tools (76).

Other risk and health-promoting factors were found in the physical work environment. A work environment that was perceived as pleasant and allowed for social interaction increased job satisfaction among healthcare workers in long-term dementia care homes (105). Access to daylight was perceived to be important for well-being and working ability (106). The inability to see the outside world (e.g., through a window) over the course of an entire shift, as well as the long-term use of surgical equipment that requires darkness, contributed to stress and exhaustion (106). Acceptable indoor air quality was identified as an important factor for decreasing hoarseness among healthcare workers (107, 108). However, the use of blue lights in healthcare facilities had no effect on either the mood or stress levels of healthcare workers compared to normal lighting (109).

Lastly, IT systems were perceived as a health-promoting factor, if they reduced documentation requirements, improved access to information, and gave staff a sense of security (110, 111). However, they were identified as a risk factor if their use was found to be an obstacle to the ability of staff to do their work or were fraught with technical problems (112–114). The perceived stress caused by electronic tools was reduced for registered nurses if they were perceived to be user-friendly (115). This was also the case for healthcare managers, if they had access to sufficient IT support (111). Daily use of multiple IT systems was associated with a higher level of stress compared to using only one system (115, 116). Physicians who already experienced time constraints reported more IT-related stress, and physicians in primary care experienced more stress related to IT than physicians in hospitals (113).

3.4.4 Terms of employment and personnel policies

This category includes 13 somewhat diverse studies, which in various ways examined the conditions under which their organisation employs staff and how they take care of and support these staff.

Risk and health-promoting factors were identified in job security (73, 92), salary, and other monetary rewards (73, 79, 117), which were associated with higher levels of engagement and job satisfaction. Short-term work contracts, combined with shift work with variable shift lengths, irregular rest periods, and weekend shifts, increase the risk of sick leave (118). At the same time, a study found that temporarily employed registered nurses rated their health as better than permanent registered nurses (119). In the period preceding downsizing, staff absenteeism due to illness decreased, mainly among employees with temporary contracts (120). Requirements for employees to switch units against their will negatively affected job satisfaction (74).

Risk and health-promoting factors were also identified in the organisation's systematic work to create conditions to increase the individual's capacity to manage their own work and development. Two studies examine access to supervision among psychotherapists with different results: group clinical supervision was associated with lower stress (121), but no association could be confirmed between participation in clinical supervision and burnout (122). Another study investigated whether the opportunity to attend courses during working hours can be a health-promoting factor but found no correlation with job satisfaction (123). Physical exercise at work reduced pain and pain sensitivity more than exercise at home (124). Registered nurses reported that inadequate adaptation of work for pregnant workers and those with health problems was a reason for sickness absence (125).

3.4.5 The organisation's ethical environment

The category of studies that addressed the ethical environment of organisations includes relatively few studies ($n = 10$). However, they are generally homogeneous and examine the ability of employees to perform their work in accordance with their own fundamental values of what constitutes good care, as well as the values of their profession. The ethical environment also encompasses the extent to which the organisation encourages ethical discussions in the workplace and ensures that employees are supported in ethical issues and dilemmas.

Risk and health-promoting factors were identified in the ability of employees to act in accordance with their values and receive support in dealing with ethical issues, as this was seen as important for job satisfaction and engagement. When an organisation shares the values of its staff and ensures that there are resources and conditions for employees to be able to deal with ethical issues and act in accordance with their values, it is a health-promoting factor (126). Motivation and engagement increase when employees feel that they have adequate time (95) and sufficient staff (92, 98). Furthermore, when the number of employees in a unit increases or functions are outsourced, the risk of long-term sick leave decreases (127). Conversely, healthcare workers in home care services who are forced to “count the minutes” feel frustrated and unable to work as effectively (92), and inadequate staffing poses a health risk that entails extra stress, pressure, and responsibility (63).

For managers, the inability to implement decisions that were made higher up in the organisation or the obligation to implement decisions with which they personally disagree constitute a risk factor for future illness (128). Another risk factor for reduced job satisfaction arises when an individual's values conflict with the values of the organisation. This demonstrates the importance of management understanding the ethical challenges related to the profession (91). Conversely, a health-promoting factor for job satisfaction was identified in the organisation's encouragement of ethical discussions and support in grappling with ethical issues (129).

3.5 Overall themes in the categories

Although there was a wide variety within and between the categories in terms of the risk and health-promoting factors on which the studies focused, there were also similarities. Within each category, the studies demonstrated that what the organisation does to control and manage the work to meet its goals has an impact on employee health. This applies, for example, to how the organisation allocates working hours and staffs its operations, manages its objectives, and provides aids and support. In addition, there were studies in all categories that pointed to the importance of the organisation's culture and values and what it communicates to its employees, including through priorities that affect both the work environment and the opportunities for employees to work effectively.

4 Discussion

This review presents knowledge from recent Nordic research on organisational risk and health-promoting factors in the healthcare sector. It takes a relatively new approach to risk and health-promoting factors, insofar as it focuses on the organisational level, that is, the

structure, choice of principles, and values of the organisations. When work-related illness and well-being are discussed, workplace and individual factors are usually the dominant theme (18, 130, 131).

4.1 Organisational-level risk and health-promoting factors within healthcare

Our findings indicate that organisational-level risk and health-promoting factors can be divided into five categories: distribution of working time schedules; design of operations and working methods; ergonomic conditions; terms of employment and personnel policy; and the organisation's ethical environment. In terms of their effect on the health of healthcare workers, these categories are well known. It is common knowledge that the scheduling of shifts (duration, number, and frequency, as well as time for recovery between shifts) can be both a risk factor for physical and mental illness, for example, exhaustion and cancer (22, 23, 132–134), and a health-promoting factor that increases job satisfaction (133). Furthermore, Aust et al. (16) recently showed the importance of job and task modification, flexible work and scheduling, and changes in the physical work environment in improving healthcare workers mental health and wellbeing. The HR practices of organisations have been associated with nurse absenteeism (135), and ethical value conflicts in healthcare have been associated with the health of nurses (2, 136). However, what this systematic review adds is a deeper understanding of how these risk and health-promoting factors can be created at the organisational level – and hence a better understanding of how to address risks at their roots and create a hotbed for a healthy and attractive work environment through the active engagement of the top management. It also identifies similarities between categories, highlighting the importance of including multiple perspectives within the employer's occupational safety and health management, since both the actions that employers take to fulfil the healthcare organisation's goals and the ability of employees to provide good quality care were found to be important for the health and wellbeing of healthcare employees. Consequently, employee health and wellbeing can and should be managed at the organisational level, not only at the workplace or individual level by first-line managers, according to the principles of the hierarchy of controls for occupational safety and health (30, 31) and recommendations from peers (16, 18).

This review also shows that there is a lack of knowledge on measures to promote well-being and health compared to knowledge of measures to counteract illness and disease. This is highlighted by the fact that most of the studies investigated risk factors rather than health-promoting factors. The definition of health-promoting factors differed substantially between the included studies, and in some studies, measures that sought to address risk factors rather than add something positive were also defined as health-promoting factors (e.g., reducing quick returns or alleviating strain/workload through well-adapted aids). Such factors may reduce the risk of illness but likely do not promote health or well-being, since they simply mean that a risk factor has been addressed. The utilisation of health-promoting factors within the occupational health and safety management of organisations may be particularly important if the healthcare sector (19) is to remain attractive to professions that are both demanding for the individual and essential for a well-functioning society.

4.2 Strengths and limitations

Some limitations need to be considered when interpreting the results of this review. The current study is limited to healthcare professions in the Nordic countries and the findings cannot automatically be generalised to other professions or countries. Given the complex characteristics of healthcare organisations (20), future research would benefit from performing similar reviews for other contexts, rather than broadening the search criteria to include other professions and countries. Future research could also build on these findings to enable systematic reviews that include meta-analyses for individual categories of organisational-level risk and health-promoting factors. The present review only considered studies published on or before 3 January 2023. We did not update the search further because we did not want to include studies that reflected the extraordinary circumstances following the COVID-19 pandemic, which currently influences research in this area. As a result, many studies published from 2021 onwards were excluded during the study selection of this review.

A very broad approach was used to provide an overview of Nordic research on the work environment and health of healthcare professionals, with a focus on identifying organisational-level risk and health-promoting factors. This resulted in a wide range of study types across different healthcare professionals and settings, targeting a variety of outcomes. Although this heterogeneity did not allow for firm conclusions, it showed the large variety of studies within the area. Dividing these studies in five categories of organisational-level risk and health-promoting factors provided a better understanding of areas of interest when investigating potential risk factors within an organisation. However, due to this heterogeneity, it was not possible to perform a meta-analysis of the findings within each category.

It should also be pointed out that a large proportion of the included studies used a longitudinal cohort design. This means that they followed participants over time and investigated how factors related to health, illness, and the organisation of work changed in relation to each other. This is useful when pinpointing the risk and health-promoting factors in the work environment. A relatively large number of qualitative studies were identified. This helps to provide a deeper understanding of employees' perceptions of risk and health-promoting factors. Two out of five studies included more than one occupational profession. This increases the generalisability of the results but at the expense of being able to comment on individual occupational groups. Many of the studies that reported results for individual occupational groups focused on registered nurses.

4.3 Implications for practice

This review offers valuable information on how leaders within healthcare organisations can promote employee wellbeing through strategies that target the way work is organised, designed, and managed. Our results call for action on the strategic level within the occupational health and safety management in healthcare organisations, since it is at the organisational level that opportunities arise to not only manage but eliminate risks in the work environment, and it is also here that there is an opportunity to promote health in the workplace (16, 18).

In addition, our analysis of overall themes can also give an indication of which perspectives on the organisation of work in health care are important for both employer and employees, regardless of which specific areas are considered. To ensure a sustainable, safe, and healthy working life, the effect of actions that employers take to meet the health care organisation's goals and provide employees with the ability to provide high-quality care must be given equal priority. Management must ensure that its staffing, distribution of working time schedules, and choice of working methods are adequate to meet society's needs for healthcare and that their operations are designed in a way that ensures the organisation can fulfil its mission. Yet it is equally important that management prevents employees from being exposed to the risk of illness and provides them with the opportunity to conduct their work in accordance with their fundamental values regarding what constitutes good care. The organisation must ensure that working methods, aids, and the physical work environment enable employees to perform their work in a manner that is satisfactory to both patients and employees. The terms of employment and work must be adapted to the organisation's need for flexibility and simultaneously provide sufficient security to meet the employees' needs for security and rewards. The organisation's ethical environment must consider not only care priorities, but also how these affect employees.

5 Conclusion

Overall, the main contribution of this review is threefold. Firstly, our results indicate that organisational-level risk and health-promoting factors can be found within an organisation's work schedule distribution, operations design and work methods, ergonomic conditions, terms of employment and personnel policies, and within the organisation's ethical environment. Secondly, by addressing organisational-level factors within healthcare organisations, risks in the work environment may be eliminated rather than simply managed at the workplace level. Thus, our findings emphasise that the underlying causes of adverse working conditions within the healthcare sector must be identified and managed at the organisational and structural level. Lastly, two themes emerged across the categories, providing further insight into implications for practice. The first theme concerns how risk and health-promoting factors are present in the actions that are taken to fulfil the organisation's goals, and the second theme concerns how these factors affect the ability of employees to perform their jobs at a level of quality that they consider reasonable. Thus, a successful approach to occupational health and safety management needs to consider both aspects when taking measures to improve working conditions, as well as the organisation of work within the healthcare sector. Integrating organisational-level factors in the occupational health and safety management could potentially result in a retention of skilled professionals within healthcare organisations both in the Nordic countries and globally.

Author contributions

MA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft,

Writing – review & editing. JW: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. AL: Conceptualization, Formal analysis, Investigation, Validation, Writing – original draft, Writing – review & editing. IA: Conceptualization, Software, Validation, Writing – original draft, Writing – review & editing. A-CF: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2024.1509023/full#supplementary-material>

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Honorio Silva,
IFAPP Academy, Inc., United States
Nanqu Huang,
Third Affiliated Hospital of Zunyi Medical
University (The First People's Hospital of
Zunyi), China

*CORRESPONDENCE

Jia Li
✉ lijia816@163.com

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Investigation on the occupational situation of clinical research associates in China

Can Du, Qi Han, Ziqian Lu and Jia Li*

National Clinical Research Center for Oral Diseases, Clinical Research Department, West China Hospital of Stomatology, Sichuan University, Chengdu, Sichuan, China

Clinical research associates (CRAs) are the sponsor's representatives, monitor the process and quality of clinical trials, their professional quality can affect the quality of clinical trials. But there is a conflict between the large number of CRAs personnel and unsatisfactory quality of clinical trial monitoring, and the reason is unknown. Therefore, our study investigated the occupational status of CRAs through a questionnaire survey. A total of 401 eligible questionnaires were included in the final analysis. Of whom, 71.32% were females, the average age is 27.86 years (range: 22–46 years), 95.01% had a bachelor's degree or above, and 60% had a pharmaceutical major. 76.31% had month income of <20,000 Yuan RMB, and dissatisfied with their current salary level. Over 80% weekly working time more than 40 h. 79.3% CRAs traveling for less than 7 days per month under the impact of the COVID-19 epidemic. 80% of them are satisfied with promotion channels and company training. Furthermore, Through the analysis of satisfaction differences, we found that CRAs with different educational backgrounds have significant differences in career satisfaction. It was suggested by more than 80% CRAs that the application materials for clinical trials should be unified nationwide and an ethical mutual recognition system. In conclusion, our study is the first large-scale survey of CRAs in China, the current professional situation of CRAs is considerable, but overall it still needs further improvement and enhancement, the monitoring difficulties faced by CRAs mainly come from hospitals, companies, and themselves. With the robust growth of clinical trials in China, hospitals and companies need to improve the professional quality and status of CRAs through a series of measures, further driving the improvement of clinical trial quality.

KEYWORDS

clinical research associate, clinical trial, occupational situation, monitoring, institution, research site

1 Introduction

In recent years, an increasing number of people embark on their careers related to clinical trials as various clinical trials are launched in China. Clinical research associates (CRAs), are the practitioners who go to institutions as the representatives of the sponsor to monitor the process and quality of clinical trials (1), guarantee the rights and interests of subjects and verify the accuracy of trial data in order to ensure that clinical trials follow the established protocol and meet the requirements of Good Clinical Practice (GCP) and other corresponding laws and regulations (2). In other words, CRAs play their roles in monitoring and guaranteeing the quality of clinical trials. As the clinical trial industry gains momentum, an increasing number of people choose to serve as CRAs (3). As research shows, China and the United States each have nearly 30,000 CRAs respectively, whose professional quality can also affect the quality of clinical trials (4, 5).

The responsibilities a CRA assumes are defined both in The International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) and China's own GCP, but either unified access standards for this industry or corresponding industry norms are lacking in China at present. The current basic requirement for one to be a CRA is only to equip himself or herself with certain medical or pharmaceutical knowledge and receive GCP training. However, the yearly inspection results of clinical trial projects published by the National Medical Products Administration (NMPA) and its provincial branches reveal many problems related to monitoring, such as frequent replacement of CRAs, CRAs' unfamiliarity with clinical trial protocols, inconsistency between monitoring reports and factual conditions, and weak feasibility of monitoring schemes (6–8).

The conflict between the large number of practitioners and the unsatisfactory monitoring quality necessitates a relevant research to analyze the performance of CRAs so as to find out the difficulties in monitoring and improve monitoring quality in a targeted manner. But it is unfortunate that, after consulting a large number of literatures, our research group failed to find many articles on the systematic investigation into CRAs at present. On this basis, we initiated this research into the background, workloads and difficulties of CRAs.

2 Methods

2.1 Survey design and survey content

The survey questionnaire is released through Wenjuanxing,¹ inviting CRAs across the country to fill out the questionnaire. The calculated sample size yields 271 individuals by the Formula. Taking into account a dropout rate of 20%, the minimum sample size required for the study is adjusted to 339 individuals to maintain statistical power and account for potential attrition. The research period is 2 months, all survey questionnaires are forwarded and submitted on WeChat mobile or computer platforms.

$$\text{Formula : } n = \frac{z^2 * p * (1 - p)}{e^2}$$

In the context of statistical sampling, (n) denotes the sample size, (z) represents the z -score associated with the desired level of confidence, (p) signifies the sample proportion expressed as a decimal, and (e) indicates the margin of error also expressed as a decimal. When estimating the sample size with Power ($1 - \beta$) = 0.9, corresponding to a z -score of 1.645, and a margin of error (e) of 5%, assuming the worst-case scenario where the proportion (p) is 0.5 (i.e., 50% of individuals select a particular option), the calculated sample size yields 271 individuals. Taking into account a dropout rate of 20%, the minimum sample size required for the study is adjusted to 339 individuals to maintain statistical power and account for potential attrition.

The investigation was carried out in the form of a questionnaire which contained five sections. The first part represented the basic information collection of CRAs, including demographic information, educational background, length of service, employer background, salary, etc., which gave a preliminary introduction to the current structure of CRAs. The second pertained to the collection of work, including workloads, travel frequency, and training, etc. The third concerned CRAs' satisfaction with institutions, in which the work performance of management departments, ethics committees and investigators were scored by CRAs. The fourth was related to career satisfaction in such aspects as salary, promotion channels and internal training of the companies. The fifth was relevant to open questions, in which the CRAs were asked to put forward a wide range of suggestions for the industry.

2.2 Data processing and analysis

After the research period ends, terminate the questionnaire operation. Download the backend data in the option text format and save it in Excel format. Double check the data and input it. Exclusion criteria for questionnaire data: (1) There are obvious logical or data errors in the answers; (2) All the answers were similar.

In this study, all statistical analyses and graphing were performed using IBM SPSS 25.0 and GraphPad Prism 8. The general characteristics of the study population were analyzed using descriptive statistical methods. For continuous variables, we used the mean $\pm$ standard deviation for representation and one-way ANOVA to compare satisfaction scores across different groups. All statistical tests were conducted as two-tailed, with the significance level set at 0.05.

2.3 Ethics

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of West China Hospital of Stomatology Sichuan University (WCHSIRB-D-2021-550). Participants voluntarily click on the link to fill out the questionnaire. Before filling out the questionnaire, they have been informed of the research purpose and informed that "submitting answers" is considered informed consent. Participants can exit at any time during the questionnaire filling process.

3 Results

3.1 Basic information

After the 409 questionnaires collected within 2 months were examined, and 401 questionnaires were verified to be valid, with a validity rate of approximately 98.04%. Of the 401 CRAs from 59 cities of 26 provincial-level administrative regions in China, the average age was 27.86 (22–46); 71.32% were women, and 95.01% held bachelor's degrees or above, with most majoring in pharmacy, nursing and medicine, and the rest in engineering, chemistry and management, etc. Compared with CRAs in other countries, the gender and educational background of practitioners are similar, mostly female

¹ <https://www.wjx.cn>

with a bachelor's degree or above (6). When it came to previous work experience, 37.41% worked as CRAs upon graduation, 26.18% changed their careers to this occupation from clinical research coordinators (CRCs), 19.95% from R&D or sales positions in enterprises, 10.47% from hospitals as nurses, medical technicians and doctors, etc., and the rest from non-medical related positions, such as teachers, salesmen and animal experimenters. In the category of clinical trials, 74.31% were engaged in drug clinical trials while 23.19% were devoted to medical device clinical trials, and the rest were dedicated to *in vitro* diagnostics (IVDs), vaccines and scientific research projects. As for the types of employers, 59.10% of CRAs belonged to contract research organizations (CROs) and the rest came from sponsors. In terms of position level and compensation, 43.14% of the respondents worked as primary CRAs, and 56.11% earned 100,000–200,000 RMB per year. The annual income of Canada's CRA is \$40,000–\$70,000 (6), according to the PPP (Purchasing Power Parity) in Canada and China, it's indicated that the income have no difference between two countries (9). See Table 1 for details.

According to the survey results, the respondents, with an average length of employment of 2.80 years, had worked for 1.76 companies on average—that is, they had worked for each company for about 1.59 years. This group of data reflected the high turnover of this occupation (3, 6). The questionnaire asked the respondents to fill in the numbers of both the projects they had accomplished completely from project establishment to completion and those they had taken over halfway. The results showed that the former number averaged out at 2.13 while the latter at 10.12. One of the reasons why the latter was nearly five times as large as the former may be frequent job switch.

In terms of the types of CROs, foreign-funded enterprises accounted for 18.56%, Chinese enterprises for 57.81%, and joint ventures for 23.63%. On the part of sponsors, the proportions for foreign enterprises, Chinese enterprises and joint ventures were 15.24, 57.93, and 26.83%, respectively. Similar to sponsors, Chinese-funded CROs took up the largest proportion of enterprise types, demonstrating that currently the majority of clinical trials were carried out by Chinese local enterprises in China, and most of the trials were undertaken by professional CROs (10).

In respect of educational background, nearly 60% of the CRAs were from pharmacy majors, and 77.33% (116 people) of those who joined CRAs upon graduation were from pharmacy majors, showing that the CRA occupation has become quite attractive to pharmaceutical students. The fact that about a quarter of CRAs switched their occupations from CRCs may be attributed to the higher salary and professional identity of the CRAs (11). Seen comprehensively from educational background and previous work experience, no clear requirements existed for the access standards of the CRA occupation, hence even a large professional span occurred.

3.2 Overview of work

A CRA's daily work is to monitor the trial implementation in different research sites for one thing, and to organize project materials and write project reports in the companies for another. Therefore, the investigation of their work includes two basic sections: current workloads and travel frequency. Considering the professional characteristics of CRAs that due to the differences of each clinical trial, it is necessary for CRAs to keep updated on corresponding clinical

knowledge and clinical trial regulations, we have also included training information in the investigation (12).

According to the survey results (Table 2), each CRA was responsible for 4.5 projects on average at present which were distributed in 5.94 hospitals scattered in 3.44 cities of 2.54 provinces, and each of them visited hospitals for 8.32 days every month. If we take as a reference the standard working hours of 8 h per day for 5 days a week, more than 80% of them worked more hours than the standard ones, with 21.79% of them even working over 10 h a day, showing that it was common for CRAs to work overtime who were burdened with relatively heavy workloads. Before the COVID-19 epidemic, the majority of CRAs went on business trips for 1 to 2 weeks per month. But now 47.63% went on business trips for less than 3 days per month, and some even hardly did it. Seeing that CRAs' work were still greatly affected by COVID-19, it is speculated that subsequently sponsors or CROs would prefer to select or give priority to research sites that are located nearby or can be monitored remotely.

Because continuous training is a must for CRAs due to the nature of their work, 74.31% of them were willing to use their break time to study, relying mainly on self-study and company training, with 48.88% receiving training every month. As a whole, most CRAs were very willing to enrich their professional knowledge and improve their professional skills through multiple channels. However, it is also noted that the training organized by hospitals accounts for the lowest proportion, while the reality is that different hospitals had different management requirements and implemented different Standard Operating Procedures (SOP), and hospitals should hold training for CRAs or sponsors to explain the management process, project material list, and monitoring requirements, etc.

3.3 Satisfaction with institution sites

The clinical trials are initiated by investigators from research sites, with management departments supervising the whole process of the trial, and at the same time, the Ethics Committee acting as an independent third party to protect the rights and interests of subjects. CRAs go to various sites to monitor the trials and finish their main work in hospitals. Therefore, it is necessary to evaluate their satisfaction with the management and implementation of clinical trials in hospitals so as to reflect the problems encountered in monitoring (13). With four satisfaction grades (very satisfied, satisfied, dissatisfied and very dissatisfied), the respondents were invited to evaluate their satisfaction with investigators, institution sites and ethics committees.

As conductors of trials, investigator's professionalism and cooperation are directly linked to the quality of clinical trials (Table 3). The evaluation of investigators was divided into four dimensions including their GCP awareness, cooperation degree, familiarity with the protocol and understanding of the management process of clinical trials in hospitals. In terms of GCP awareness, 44.39% of CRAs were dissatisfied, and 11.47% being very dissatisfied. Despite a slight lack of awareness of GCP, 66.33% of CRAs thought that investigators were cooperative. More than half of CRAs held a negative attitude toward investigators' familiarity with the protocol, thinking that the investigators were not familiar with the protocol or not as familiar as they expected. 60.60% of CRAs regarded that researchers were not familiar with the management process of clinical trials in hospitals, reflecting

TABLE 1 The basic information of CRAs.

Classification	Number (N)	Proportion (%)
Gender		
Male	115	28.68
Female	286	71.32
Age		
21–25	93	23.19
26–30	237	59.10
31–35	61	15.21
36–40	8	2.00
>40	2	0.50
Educational backgrounds		
Below Junior College	2	0.50
Junior college	18	4.49
Undergraduate	316	78.80
Master	64	15.96
Doctor	1	0.25
Majors		
Pharmacy	240	59.85
Nursing	70	17.46
Medicine	43	10.72
Biology	20	4.99
Others	28	6.98
Previous work		
Working as CRAs upon graduation	150	37.41
CRC	105	26.18
In pharmaceutical Enterprises	80	19.95
In hospitals	42	10.47
Statistics	2	0.50
Others	22	5.49
Categories of clinical trials		
Drugs	298	74.31
Medical devices	93	23.19
IVDs	2	0.50
Vaccine	1	0.25
Others	7	1.75
Types of Enterprises		
CRO	237	59.10
Sponsor	164	40.90
Title Rank		
Primary CRAs	173	43.14
Intermediate CRAs	113	28.18
Advanced CRAs	63	15.71
Project manager	48	11.97
Project director	4	1.00

(Continued)

TABLE 1 (Continued)

Classification	Number (N)	Proportion (%)
Annual Income (RMB)		
Below 100,000	81	20.20
100,000–200,000	225	56.11
200,000–300,000	70	17.46
300,000–500,000	23	5.73
Above 500,000	2	0.50

insufficient training of relevant management rules for investigators provided by hospitals.

As management departments, the institutional research office are responsible for the project establishment, contract signing, trial drug/device management and project conclusion (Table 4). Also, as the main external communication departments, the onus is on institutional offices to elaborate on the management process of project operation, materials for project establishment and contact information of the institution so as to facilitate CRAs' communication. As to the feedback from CRAs, 63.34% thought that the management of institutional offices was transparent and satisfactory. Two-thirds of the CRAs were satisfied with the work efficiency of institutions' management staffs. However, the proportions of the people who were satisfied and dissatisfied were very close in terms of the evaluation of auxiliary departments, indicating much room for auxiliary departments to improve their services.

The Ethics Committee generally holds regular meetings to review clinical trials to ensure the scientific operation of projects as well as the rights and interests of subjects; and it keeps follow-up reviews in the course of project operation (Table 5). 80.30% of the ethics committees that the CRAs had contacted with held one meeting per month, the frequency of which could meet the needs of the project schedule. More than 80% of the CRAs accepted the opinions given by the ethics committees to the project.

3.4 Career satisfaction

This part of the survey aimed to learn about the CRAs' current satisfaction with the work and their subsequent career planning. Job satisfaction is related to employee retention rate, while low satisfaction leads to resignation intention and thus affects the rate. As Table 6 shows, only 49.63% of them were satisfied with their current salary. According to the survey of job profiles mentioned above, most CRAs bore relatively large workloads but received unsatisfactory salary, with 12.47% of them even very dissatisfied with their current salary.

86.28% of CRAs were optimistic about the future development of their careers, and 86.78% were willing to continue their careers as CRAs. If they chose to change their employers, the three aspects that would be paid most attention are as follows: salary accounting for the largest proportion of 92.27%, and company project resources as well as working atmospheres for the rest. Hence, enterprises could consider salary as the most favorable competitive advantage when recruiting CRAs in the future (14). Company project resources were the second factor that CRAs took into consideration, which manifested that they were more willing to choose companies with sufficient high-quality projects in order to realize the improvement of their own abilities

TABLE 2 Workloads, travel frequency, and training of CRAs.

Classification	Number (N)	Proportion (%)
Working hours per week		
Below 40 h	74	18.45
40–50 h	218	54.36
50–60 h	86	21.45
Above 60 h	23	5.74
Business trip days per month (Before COVID-19)		
3 days below	102	25.44
3–7 days	90	22.44
7–14 days	111	27.68
14–21 days	45	11.22
21 days above	6	1.50
Join CRAs after COVID-19	47	11.72
Business trip days per month (After COVID-19)		
3 days below	191	47.63
3–7 days	127	31.67
7–14 days	63	15.71
14–21 days	19	4.74
21 days above	1	0.25
Sources of training (multiple choices)		
Employer	367	91.52
Hospitals	55	13.72
Industry society	104	25.94
Self-study	277	69.08
Frequency of training		
Weekly	102	25.44
Monthly	196	48.88
Quarterly	34	8.48
Annually	31	7.73
Hold on demand	38	9.48
Whether willing to take trainings during personal break		
Unwilling	103	25.69
Willing	298	74.31

through the training at work. The proportion of working atmospheres, as the third factor, was about 10 percentage higher than that of promotion channels, which showed that CRAs were, compared with the promotion, more willing to choose a pleasant working environment with friendly colleague relationships and easygoing leaders. As supplements to the aforementioned factors of salary and working atmospheres, other additional factors that respondents offered included welfare, insurances and the quality of supervisors.

3.5 Differential analysis of the satisfaction

Furthermore, we used the one-way ANOVA to compare satisfaction scores with different educational backgrounds, ages, and

TABLE 3 CRAs' satisfaction with investigators.

Classification	Satisfaction degree	Number (N)	Proportion (%)
GCP awareness	Very satisfied	39	9.73
	Satisfied	138	34.41
	Dissatisfied	178	44.39
	Very dissatisfied	46	11.47
Cooperation in clinical trials	Very satisfied	77	19.20
	Satisfied	189	47.13
	Dissatisfied	119	29.68
	Very dissatisfied	16	3.99
Familiarity with the protocol	Very satisfied	43	10.72
	Satisfied	134	33.42
	Dissatisfied	167	41.65
	Very dissatisfied	57	14.21
Understanding of the management requirements of clinical trials in hospitals	Very satisfied	32	7.98
	Satisfied	126	31.42
	Dissatisfied	164	40.90
	Very dissatisfied	79	19.70

incomes. According to the Central Limit Theorem, data from large samples ($n > 30$) can be considered approximately normally distributed. The sample size in this study is much greater than 30, so it meets the principle of normal distribution required for analysis of variance. After the Levene test for homogeneity of variances, the p -values for all groups are greater than 0.05, indicating that the homogeneity of variances is satisfied, and a one-way analysis of variance can be conducted.

The results show that there was no difference in the satisfaction to investigators, institutional research office and ethics committees, but there were significant differences in the career ($p < 0.05$), suggests a significant educational impact on satisfaction for this group (Table 7). And Table 8 provides a comprehensive analysis of satisfaction scores in different age among CRAs. Our results indicates that there is no significant variation in investigators, institutional research office, ethics committees and career satisfaction scores attributable to age, suggesting a more uniform perception across different age groups. Similarly, we have analyzed the correlation between annual income brackets and satisfaction scores for CRAs (Table 9), the result presents that the different income CRAs have no difference in satisfaction, reminder that income is not the importance factor the overall contentment of CRAs within the industry.

3.6 Suggestions

In the last part of the research, the CRAs were invited to make some suggestions to the industry. According to our usual work experience, we put forward five suggestions and asked the CRAs to evaluate whether they were applicable. In addition, we consulted the respondents about their personal suggestions on the subsequent improvement of the industry so as to solve the difficulties encountered in their current work (Figure 1).

TABLE 4 CRAs' satisfaction with institutional research office.

Classification	Satisfaction degree	Number (N)	Proportion (%)
Management transparency	Very satisfied	91	22.69
	Satisfied	163	40.65
	Dissatisfied	122	30.42
	Very dissatisfied	25	6.24
Management staffs' efficiency	Very satisfied	70	17.46
	Satisfied	171	42.64
	Dissatisfied	134	33.42
	Very dissatisfied	26	6.48
Cooperation of auxiliary departments	Very satisfied	56	13.97
	Satisfied	146	36.41
	Dissatisfied	137	34.16
	Very dissatisfied	62	15.46

TABLE 5 CRAs' satisfaction with ethics committees.

Classification	Satisfaction degree	Number (N)	Proportion (%)
Frequency of meetings	Twice a month	52	12.97
	Once a month	322	80.30
	Once 2 months	6	1.49
	Once a quarter	4	1.00
	Hold on demand	17	4.24
Whether the frequency meets the project demands	Satisfy	256	63.84
	Dissatisfied	145	36.16
Ethical opinions	Very satisfied	154	38.40
	Satisfied	167	41.65
	Dissatisfied	70	17.46
	Very dissatisfied	10	2.49

It was suggested by more than 80% of the CRAs that it was necessary to establish nationally unified clinical trial application materials and implement a mutual ethical recognition system. These two aspects are the most time- and energy-consuming parts in the early stage of clinical trials. Firstly, most hospitals formulate inconsistent SOPs based on their own operation and management requirements. The repeated preparation of project application materials according to the requirements of different hospitals often wastes much of the energy of CRAs. Secondly, as for the ethical recognition system, most ethics committees hold one meeting per month in hospitals at present, as is mentioned above. Multi-site clinical trial projects need to pass the ethical approvals of all research sites involved. Because sponsors are concerned that the ethics committee of one site raises some suggestions on revision, they often wait for the ethical approvals by all sites before implementing the trial. The whole process is so time-consuming that it is necessary to implement a mutual recognition system of ethical results.

66.33% of CRAs thought it necessary to organize national CRA training. At present, the National Medical Products Administration

TABLE 6 CRAs' career satisfaction.

Classification	Number (N)	Proportion (%)
Current salary		
Very satisfied	5	1.25
Satisfied	194	48.38
Dissatisfied	152	37.90
Very dissatisfied	50	12.47
Promotion channels		
Very satisfied	52	12.97
Satisfied	279	69.58
Dissatisfied	59	14.71
Very dissatisfied	11	2.74
Training arranged by the company		
Very satisfied	76	18.95
Satisfied	239	59.60
Dissatisfied	76	18.95
Very dissatisfied	10	2.50
Opinions on the development of the industry		
Optimistic	346	86.28
Pessimistic	37	9.23
No idea	18	4.49
Follow-up plan		
Continue to work as a CRA for promotion	348	86.78
Switch to other positions related to clinical trials	42	10.48
Switch to other industries unrelated to clinical trials	11	2.74
Aspects focused on when hunting for a job (multiple choices)		
Salary	370	92.27
Company project resources	330	82.29
Working atmospheres	307	76.56
Promotion channels	264	65.84
Internal management, training, etc.	246	61.35
Office location	211	52.62
Frequency of business trips	179	44.64
Reputation of the company	136	33.92
Others	6	1.50

website offers no training programs for CRAs. Most CRAs are trained through their companies' internal training programs with different contents and difficulty levels, which spawn on uneven training results. The high turnover of CRAs brings about repeated training of similar contents across different companies, resulting in wastes of resources. In the future, it is hoped that unified CRA trainings will be carried out nationwide. 57.36% of CRAs suggested that a national unified CRAs grade evaluation be established while only 49.13% thought it necessary to organize a national certification examination. It is speculated that the CRAs do not want to raise the current access threshold but hope

TABLE 7 Differences in satisfaction among CRAs with different educational backgrounds.

Variable	Education level	N	Score	F	p
Investigators	Above Master	67	9.96 ± 2.86	1.916	0.149
	Bachelor	318	10.12 ± 2.64		
	Junior college or below	22	9.85 ± 2.87		
Institutional Research Office	Above Master	67	8.02 ± 2.13	1.614	0.200
	Bachelor	318	7.64 ± 2.03		
	Junior college or below	22	8.08 ± 2.16		
Ethics Committees	Above Master	67	6.57 ± 1.17	2.888	0.057
	Bachelor	318	6.84 ± 1.27		
	Junior college or below	22	6.49 ± 1.13		
Career satisfaction	Above Master	67	7.37 ± 1.02	3.038	0.049
	Bachelor	318	7.17 ± 1.01		
	Junior college or below	22	7.43 ± 0.98		

to establish a unified and peer-recognized grade evaluation, which may be helpful to obtain recognition of their abilities when they switch to new positions or new companies.

The suggestions put forward by the CRAs were as follows: (1) establishing a national CRA blacklist; (2) ranking institutions nationwide; (3) improving CRC quality; (4) improving research institution's electronic information system; (5) establishing remote monitoring channels; (6) enhancing recognition of the CRA occupation. Firstly, according to the aforementioned results, the average number of projects that each CRA took over was five times that completed. Because a large part of projects are taken over halfway, poor monitoring quality of the succeeded projects may occur, requiring the successors to constantly improve and make up for the problems left by their predecessors. When a national CRA blacklist is established, potential successors can initially evaluate the project quality and even refuse to take over the blacklisted CRA's projects. This method can boost the improvement of CRAs' own quality to a certain extent. Secondly, the national ranking list of research institutions is suggested to be set up. With the list as a reference, it is convenient for CRAs to screen research sites without the need to investigate one by one. And in turn, it can promote the improvement of the management quality of the institution itself. In addition, a CRC plays the role of a housekeeper in clinical trial projects and has such responsibilities as collation of clinical trial materials, communication with subjects, and arrangement of researchers' time, etc. Whether the housekeeper is serious or responsible or not affects the quality and progress of the trial, hence appealing to improve the quality of CRCs (15, 16). Further, it is imperative for "institutions to improve information systems so as to construct remote monitoring channels" during the COVID-19 epidemic at the moment. The epidemic forced CRAs not to travel as frequently and enter hospitals as freely as before, resulting in a reduction in the frequency of monitoring. If the hospital can establish a clinical trial management system, which provides remote monitoring and eliminates space limitation, it will not only improve monitoring efficiency but also effectively reduce the operating costs of the industry

TABLE 8 Differences in satisfaction among CRAs with different age.

Variable	Age	N	Score	F	p
Investigators	21–25	96	9.97 ± 2.87	1.309	0.271
	26–30	239	9.55 ± 2.89		
	>31	73	10.09 ± 2.81		
Institutional Research Office	21–25	96	8.03 ± 2.13	1.547	0.214
	26–30	239	7.70 ± 1.84		
	>31	73	8.15 ± 2.25		
Ethics Committees	21–25	96	6.57 ± 1.16	0.542	0.582
	26–30	239	6.47 ± 1.29		
	>31	73	6.62 ± 1.14		
Career satisfaction	21–25	96	7.37 ± 1.02	0.228	0.796
	26–30	239	7.41 ± 1.04		
	>31	73	7.34 ± 0.94		

TABLE 9 Differences in satisfaction among CRAs with different income.

Variable	Annual income	N	Score	F	p
Investigators	Below 100,000	83	9.96 ± 2.86	1.821	0.163
	100,000–200,000	226	10.35 ± 3.03		
	Above 300,000	100	10.00 ± 2.81		
Institutional Research Office	Below 100,000	83	8.02 ± 2.13	0.575	0.563
	100,000–200,000	226	8.24 ± 2.16		
	Above 300,000	100	7.99 ± 2.14		
Ethics Committees	Below 100,000	83	6.57 ± 1.17	0.554	0.575
	100,000–200,000	226	6.65 ± 1.33		
	Above 300,000	100	6.51 ± 1.08		
Career satisfaction	Below 100,000	83	7.37 ± 1.02	1.027	0.359
	100,000–200,000	226	7.23 ± 1.14		
	Above 300,000	100	7.39 ± 0.95		

(17). The last one is the suggestions to improve the professional recognition of CRAs. The reasons for this can be concluded as follows: CRAs from sponsors or CROs are sent to hospitals to participate in clinical trials, with few hospitals preparing office space for them. Moreover, non-hospital staff are in a relatively weak position when coordinating and communicating with relevant departments of hospitals, and they are prone to feel psychologically isolated, hence their lack of sense of belonging and professional identity.

4 Discussion

Through this investigation, we have a preliminary understanding of the occupational situation of CRAs. The majority of this increasingly young group are women and hold bachelor's degrees, with educational background and previous work experience related to pharmaceutical industries. However, some CRAs originally engaged in completely irrelevant occupations, or have neither related educational background nor work experience, indicating a low access threshold for working as CRAs. Other

countries have established CRA certification mechanisms, such as Association of Clinical Research Professionals (ACRP) (18). Presently, since practitioners in the medical industry, such as doctors, nurses, pharmacists, laboratory technologists, etc., have exacting qualification requirements, only after studying relevant majors and passing national qualification examinations, can they be qualified for corresponding positions. As for CRAs who are also part of the medical industry, firstly, there is a scarcity of educational resources shared by them. At present, almost no universities or vocational schools in China offer clinical trial majors except that a tiny number of medical schools arrange clinical trial-related courses in some medical majors. For example, the “clinical trial training” is a course set in the clinical pharmacy major of China Pharmaceutical University. Secondly, no CRA qualification examination or corresponding registration requirements are listed in the current planning of medical human resources. CRAs, as highly specialized practitioners, should not only have a basic command of medical knowledge but also be familiar with clinical trial regulations and requirements. It is necessary to manage the CRAs as a whole, through establishing applicable professional standards and talent evaluation system so as to guide the positive development of the industry. In summary, the lack of talent reserve and imperfect management lead to different quality of employees and even to the emergence of employees from non-medical related majors.

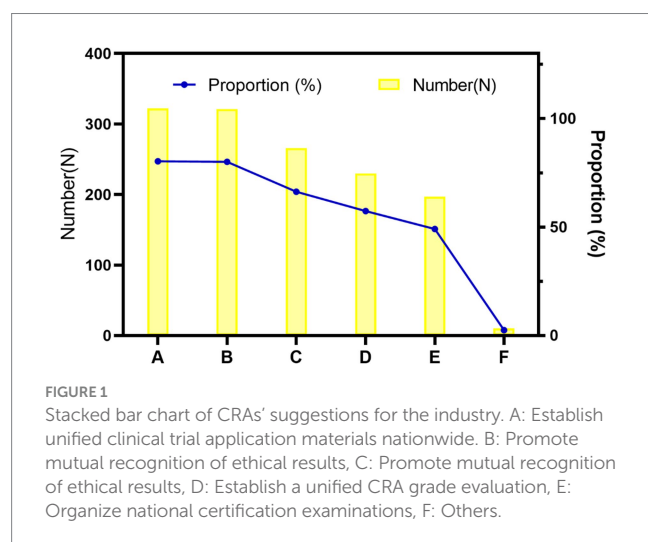
It is estimated that the relative maturity in drug clinical trials leads to drug CRAs up to about three quarters of all CRAs. The laws and regulations governing clinical trials originated from drug clinical trials. Not until 2016, did China have its exclusive “Standard for Quality Management of Medical Device Clinical Trials” for medical devices. Therefore, the development of drug clinical trials was earlier and more standardized than that of medical device in the whole industry, leading to difference in the number of CRAs engaging in drug trials and medical device trials. Surprisingly, we find in this survey that CRAs also engage in scientific research projects that are non-registered clinical researches. It is analyzed that the standardization of clinical trials steals the limelight, especially registration-oriented trials carried out in accordance with GCP specifications. With GCP’s mature management system as a reference,

other clinical studies have begun to add in CRAs and other positions to monitor the research quality, such as clinical studies initiated by government or relevant research societies (19, 20). It can be predicted that there will be a rise of CRAs in non-registered clinical research projects in the future.

Research shows that the annual income of high-income people in China was about 80,000 RMB in 2020 (21). According to the CRAs in the survey, 80% of them have an annual income of more than 100,000 yuan, belonging to high-income groups. Our result shows the 95.01% CRAs held bachelor’s degrees or above, corresponding to the relationship between education and income, i.e., higher education leads to higher income (22, 23). As the clinical trial business is booming now, the demand for CRAs is also increasing, in line with the law of supply and demand, the salaries of CRAs have marked increases (14). Salary also serves as the driving force for an increasing number of people, especially fresh college graduates, to choose to work as CRAs. At the same time, compensation plays the most important role in navigating CRAs’ future career planning. It is similar to the research results of CRA groups abroad, the CRA survey results in Canada show that low salary, unmanageable workload, lack of career advancement and professional develop and cooperation from medical teams are the main factors for resignation, with low salary being the most important factor (6).

CRA’s responsibility is to monitor the implementation of clinical trials in research sites to ensure the quality of the trials, the impediments to which can be summarized from three aspects: hospitals, enterprises and CRAs themselves. In terms of hospitals, investigators’ awareness of GCP remains to be improved and efforts dedicated to clinical trials to be reinforced, and CRAs also need to be provided with an office environment with satisfactory hardware. With respect to enterprises, the burdensome workload for some CRAs and the insufficient training for the project gives rise to undesirable monitoring quality. As for CRAs themselves, they are lacking in such professional knowledge as clinics, GCP, and regulations, etc.

In surveying CRAs’ satisfaction with institutions, more than half of them think that investigators’ awareness of GCP remains to be enhanced. Distinctions should be drawn between the more universalized clinical trials and the more individualized routine clinical diagnoses and treatments, which requires the training and increase of investigators’ GCP awareness. In this study, we did not conduct any research into the frequency of training for investigators in hospitals, but the feedback from CRAs and other research results revealed unsatisfactory training results (8). The training organized by hospitals that CRAs participate in accounts for the lowest proportion among all kinds of training sources. It is suggested that the training in hospitals be open to CRAs at the same time so that both investigators and CRAs can know about the management process of clinical trials. Moreover, since most of the training that CRAs receive in enterprises and self-study materials are from the perspective of the sponsor while the GCP training held by hospitals are from the standpoints of investigators and management departments, the role changing empowers CRAs to have a deeper understanding of the connotation of GCP and think from multiple angles during monitoring. In addition, hospitals’ project training can expound on more detailed clinical knowledge, serving as a supplement to the shortcomings of clinical knowledge of CRAs without clinical background.



CRA's high turnover due to high frequency of job-switch is also thought-provoking to us. Frequent replacement of CRAs can affect the quality of projects that might be called into question whether the project handover between former and replacing associates is comprehensive and whether the successors have a clear understanding of the information and materials of the projects and subjects (1). For enterprises, other invisible costs brought by the mobility of employees, such as recruitment and training costs, have caused certain losses to enterprises. As far as CRAs themselves are concerned, most are still enthusiastic about this industry and are willing to pay effort to acquire relevant knowledge while continuing their careers in this industry. To sum up, enterprises are suggested to focus on the following aspects so as to ensure the retention of their employees: (1) balancing the workloads of CRAs and avoiding excessive overtime; (2) assigning them to research sites nearby to reduce the frequency of business trips; (3) offering compensation and promotion channels matched with workloads and personal abilities; (4) arranging a possibly large amount of relevant training to provide employees with channels for growth (6).

According to the suggestions offered by the CRAs, they are more concerned about the convenience of project implementation, such as mutual recognition system of ethical results, construction of hospital information system, etc., all of which are inseparable from the overall improvement of the entire industry. Ethical approval can be given by endorsing the results of either the leading institution or a designated hospital. Compared with the current review mode, this practice requires less reviews and hence demands higher quality of ethical review—that is, it is necessary to strengthen the construction of ethics committees in hospitals. A full-fledged information system on the hospital side would allow CRAs to work from remote locations, yet it entails perfect collaboration between the HIS (Hospital Information System, HIS), LIS (Laboratory Information Management System, LIS) and PACS (Picture Archiving and Communication Systems, PACS) on the hospital side and the EDC (Electronic Data Capture System, EDC) on the enterprise side. This requires a strong information system on the hospital side to accurately capture the information about the participating subjects without leaking the information of other patients.

5 Conclusion

Overall, this paper is a preliminary exploration on the CRA occupation. Attention needs to be paid to the needs and opinions of the increasing CRA practitioners who join the continuously thriving pharmaceutical industry. The effective performance of CRAs is instrumental in effectively ensuring the quality of clinical trials and the safety of drugs to be marketed (13). The improvement of the occupational education of CRAs can not only ensure the quality of clinical trials but also resolve the shortage of human resources to some extent (10). Since there is still a gap between China's CRA development and that of developed countries at present, the subsequent development and quality improvement of China's CRA is closely linked to the overall improvement of other relevant practitioners in clinical trials, including the improvement of the management abilities of institutions, the quality construction of the ethics committees, and the consolidation of investigators' GCP awareness (15, 16). In addition, as employers, enterprises should also provide matching

compensation and benefits to CRAs and further enhance their professional identity, sense of belonging and career enthusiasm so as to generate more CRAs with high quality.

This survey is the preliminary exploration of the occupational situation of CRAs in China. We have known the specific difficulties of CRAs in clinical trial supervision, and put forward improvement suggestions, which provides support for improving the professional status of CRAs, thereby further improving the quality of clinical trials. However, due to resource and time constraints during the COVID-19 epidemic, we were unable to receive a large enough sample size and the sample was not representative enough. Likewise, although we have tested the reliability and validity of the questionnaire and the results are good, as non probabilist sample, there is a conflict between reliability and validity, may leading a possible bias in the interpretation of the results. While the survey scope of this study basically covers the whole country, and we have a preliminary understanding of the overall occupational status of CRAs. It's also provides us with a good foundation for further expanding the sample size and conducting in-depth investigations over a long enough period to understand this group.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Ethics Committee of West China Hospital of Stomatology Sichuan University. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because this study mainly conducted an online questionnaire survey, which was anonymous and obtained the consent of the participants, without involving written informed consent forms.

Author contributions

CD: Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing. QH: Data curation, Formal analysis, Methodology, Writing – review & editing. ZL: Methodology, Writing – review & editing. JL: Conceptualization, Funding acquisition, Methodology, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1499237/full#supplementary-material>

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Aidos Bolatov,
Astana Medical University, Kazakhstan
Kata Ivanišević,
University of Rijeka, Croatia

*CORRESPONDENCE

Cecilia Peñacoba-Puente
✉ cecilia.penacoba@urjc.es

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Evolution of burnout syndrome in Spanish healthcare professionals during and after the COVID-19 pandemic: psychosocial variables involved

Fernanda Gil-Almagro^{1,2,3}, F. Javier Carmona-Monge⁴,
Fernando J. García-Hedra¹ and Cecilia Peñacoba-Puente^{3*}

¹Intensive Care Unit, Hospital Universitario Fundación Alcorcón, Madrid, Spain, ²Department of Nursing, Universidad Francisco de Vitoria, Madrid, Spain, ³Psychology Department, Faculty of Health Sciences, Universidad Rey Juan Carlos, Madrid, Spain, ⁴Department of Anaesthesia, Hospital Universitario Santiago de Compostela, Santiago de Compostela, Spain

Introduction: Evidence shows that throughout the COVID-19 pandemic, healthcare workers have experienced high levels of burnout. The preceding literature also points to the need to consider the three elements of burnout independently, as they appear to have different evolutionary trends and possibly different buffering and amplifying variables, although these aspects have hardly been explored.

Methods: The aim of the present investigation is precisely to shed light on these latter issues. It is a prospective study, carried out in 256 healthcare workers in Spain during three time points in relation to the COVID-19 pandemic: (1) (T1) between 5 May and 21 June 2020 (final phase of the state of alarm declared in Spain on 14 March), (2) (T2) 6 months after the end of the state of alarm (January–April 2021), and (3) (T3) 1 year after this second evaluation (April–July 2022). The different components of burnout syndrome (emotional exhaustion, depersonalization and self-fulfillment) were assessed at the second and third time points. Together with sociodemographic and occupational data (age, gender, professional category, years of experience, hours of work), anxiety, depression, stress, family support, friends' support, and self-efficacy were assessed at the first time point. At the second time point, cognitive fusion and resilience were assessed. At the third time point, optimism and hopelessness were assessed.

Results: The results show significant decreases in burnout syndrome ($p < 0.001$). However, when observing the evolution of each of the dimensions, it can be seen that emotional exhaustion has significantly decreased ($p < 0.001$), while an increase in depersonalization ($p < 0.001$) and a decrease in self-fulfillment (all $p < 0.001$) are observed. The results of the repeated measures General Linear Models, after controlling for the effect of the covariates show that the evolution of emotional exhaustion is associated with the levels of depression at T1 ($p = 0.031$), of cognitive fusion at T2 ($p < 0.001$) and of resilience at T2 ($p = 0.039$). The evolution of depersonalization is associated with levels of hopelessness at T2 ($p = 0.042$). Finally, the evolution of self-fulfillment is associated with levels of optimism at T3 ($p = 0.043$) and hopelessness at T3 ($p = 0.019$).

Discussion: The results highlight the need to attend to the three components of burnout in a differentiated manner. Our results indicate that, during the

COVID-19 pandemic, although overall burnout levels tend to decrease, it is actually emotional exhaustion that decreases, but levels of depersonalization increase and self- fulfillment decreases. In addition, the data point to the different personality factors involved in each of the dimensions. While the evolution of emotional exhaustion seems to be more affected by the levels of symptomatology (i.e., depression) at the onset of the pandemic, and of the inability to handle intrusive thoughts (i.e., cognitive fusion), the evolution of depersonalization and self- fulfillment are more related to long-term cognitive-emotional personality variables such as optimism and hopelessness.

Practical implications: The results found have important practical implications for the prevention of each of the implicated components of the syndrome. Although further research is needed, emotional exhaustion is shown to be one of the dimensions affected in the short term and intervention programs aimed at reducing anxiety and depression at times of acute stress (onset of the COVID-19 pandemic), including thought management, seem fundamental. Depersonalization and decreased self-fulfillment do not seem to respond to the same pattern. They are shown as results of a chronification of a poor management of emotional exhaustion, and in the case of their appearance, given the variables associated with their evolution (i.e., optimism and hopelessness), therapies more focused on the meaning of existence, such as Acceptance and Commitment Therapy, could be useful.

KEYWORDS

burnout, healthcare worker, COVID-19, post-pandemic, emotional exhaustion, depersonalization, self-fulfillment

1 Introduction

The COVID-19 pandemic had a profound and lasting impact on healthcare workers (HCW) worldwide (1, 2). During this period there was an unprecedented surge of critically ill patients, and many HCW worked in high-risk environments, most of the time with limited resources, personal protective equipment (PPE), and overwhelming workloads. The emotional and physical toll was immense, leading to increased stress, burnout, and mental health challenges (insomnia, depression, anxiety) (3–6). HCW faced exposure to the virus, risking their own health and that of their families. The pandemic also highlighted systemic issues in healthcare systems, such as staffing shortages and underfunding, further straining workers (7). Despite these challenges, HCW showed remarkable resilience, adapting to new protocols and technologies to provide care in an evolving crisis.

Burnout syndrome has been a significant issue among HCW for decades, characterized by chronic workplace stress that has not been successfully managed. Before the COVID-19 pandemic, burnout was already widespread due to a combination of different factors such as heavy workloads, long hours, insufficient staffing, administrative burdens, and the emotional toll of caring for patients in high-pressure environments. HCW often experienced emotional exhaustion, feeling drained and unable to emotionally engage with their work. This was accompanied by depersonalization, being detached or even cynical about the patients they were treating. Additionally, a diminished sense of personal accomplishment was common (8–10).

However, the COVID-19 pandemic drastically exacerbated these pre-existing issues. Emotional exhaustion was increased as HCW were working in an unprecedented crisis, dealing with an

overwhelming influx of critically ill patients. The continuous exposure to death and suffering, combined with fears of contracting the virus or spreading it to loved ones, further intensified their stress levels. HCW faced constant moral dilemmas, such as choosing which patients received ventilators due to shortages, leading to feelings of guilt and helplessness (11, 12). The post-pandemic situation made evident the systemic flaws in healthcare systems worldwide, such as chronic underfunding, inadequate staffing, and lack of mental health support.

During the COVID-19 pandemic, the concepts of resilience and burnout became central to the experience of HCW. Resilience refers to the ability to adapt and recover from adversity, and many HCW demonstrated remarkable resilience despite the extreme pressures they faced. In terms of resilience, research highlights its critical role as a buffer against burnout. Workers who demonstrated higher resilience were better equipped to cope with pandemic-related stress. Personal resilience can be nurtured through various coping mechanisms, such as problem-focused and emotion-focused strategies, social support, physical self-care, and distancing from work. Organizational resilience also played a key role, with studies emphasizing the importance of leadership support, team cohesion, and access to mental health resources in fostering resilience among HCW. Individuals who were able to maintain their social connections and prioritize self-care were found to have lower rates of burnout and emotional exhaustion (13, 14).

However, the prolonged nature of the pandemic also led to an increase in hopelessness arising from a sense of helplessness in the face of relentless suffering and loss, coupled with the inability to see an end to the crisis. Research indicates that workers experiencing high levels of burnout were more likely to feel hopeless, as they became emotionally detached from their work and doubted their ability to make a

meaningful impact. This hopelessness was closely linked to feelings of moral distress, especially when HCW were forced to make difficult decisions about patient care due to resource constraints (15–18).

Despite these challenges, some studies offer a hopeful outlook, suggesting that workplace interventions aimed at improving psychological safety, promoting work-life balance, and providing emotional support can reduce burnout and prevent hopelessness. Addressing systemic issues, such as staffing shortages and access to mental health care, is essential for long-term resilience and recovery in post-pandemic healthcare environments. Moving forward, the research emphasizes the need for both individual coping strategies and structural reforms to support HCW in rebuilding resilience and overcoming burnout (19–22).

The aim of this research is to analyze the evolution of burnout syndrome in health professionals in Spain from the beginning of the COVID-19 pandemic until a year and a half later (the post-pandemic stage). The analysis of the evolution will be carried out by looking, in a differential way, at the three components involved (emotional exhaustion, depersonalization and self-fulfillment). On the other hand, the psychosocial variables, including personality and emotional symptomatology, involved in the evolution of each of the components of burnout will be analyzed.

In particular, and taking into account previous literature, the following hypotheses are put forward: (1) A decrease in burnout syndrome is expected over the time considered in the present research (from 6 months after the beginning of the COVID-19 pandemic to a year and a half later), (2) A different evolution is expected with respect to the three components of burnout with the most significant decreases occurring in the emotional exhaustion component, as it is hypothesized, at the same time, the component initially most affected by the COVID-19 pandemic, (3) Anxiety, depression, stress, cognitive fusion and hopelessness are expected to be risk variables. Thus, HCW with high scores on the above variables will show higher values of burnout (and its components) at each of the time points considered and will show a worse evolution, (4) Social support, resilience, self-efficacy and optimism will be shown to be protective variables. HCW with high scores on the above variables will show lower burnout scores (and in its components) at the time points considered, as well as a better evolution of the syndrome, (5) A differential role of the risk and protective variables considered on the different components of burnout syndrome is expected, hypothesizing a greater effect on emotional exhaustion with respect to the rest of the dimensions.

2 Methodology

2.1 Design

A prospective longitudinal study was carried out, with data collected at three distinct time points: (1) from May 1st to June 21st, 2020 (during the final phase of the state of alarm declared in Spain on March 14th), (2) 6 months after the state of alarm ended (from January to April 2021), and (3) 1 year after the second evaluation (from April to July 2022). During the first data collection period, Spain was under a state of alarm, which included a lockdown lasting until June 21st, 2020.

Burnout was assessed in participants during the second and third time points. Furthermore, various sociodemographic, occupational, and psychosocial variables were measured at all three time points (see the Instruments section for more details). Table 1 shows the evaluation periods and variables included in the study.

2.2 Procedure and participants

Data were gathered using a custom-designed online electronic questionnaire. Participants were asked to provide informed consent and their email addresses if they wished to participate in future phases of the study.

The sample consisted of HCW from the Spanish National Health System. A probabilistic convenience sampling method was employed with the following inclusion criteria: being a nurse, physician, or nursing care technician; working in a public or private healthcare service of the Spanish National Health System; being 18 years or older; and having direct contact with COVID-19 patients. Exclusion criteria included being on sick leave during the data collection period or working in healthcare management.

A minimum study population of 120 was required, based on reference figures for prospective studies. Considering the challenging context of the COVID-19 pandemic and the longitudinal design of the study, a larger initial sample size of 400 participants was targeted. In the first data collection phase, 1,374 HCWs were included. Of these, 881 participated in the second phase, and 259 continued through to the third phase, resulting in a final sample size significantly exceeding the initially estimated 120 participants.

To recruit participants, the questionnaire link was sent to HCW in the Spanish health system, both public and private, through

TABLE 1 Socio-demographic, occupational, and psychosocial variables collected at the three points in time of the study.

	Variables collected at different time point		
	1st evaluation period	2nd evaluation period	3rd evaluation period
	May 5th–June 21st (2020)	January 9th–April 9th (2021)	April 11th–July 15th (2022)
Symptoms	Anxiety, depression, stress	Burnout	Burnout
Sociodemographics	Age, gender, years of experience, working hours, professional category, service.		
Personality	Resilience Self-efficacy Social Support	Cognitive fusion	Optimism Hopelessness

social media platforms (Facebook, LinkedIn, Twitter, WhatsApp), and corporate emails from various public and private healthcare services. For the second and third phases, emails from participants in the first phase were used to invite them to continue their participation.

2.3 Ethical considerations

The study was approved by the Hospital Ethics and Research Committee. In addition, the present study has received the scientific endorsement of the Spanish Society of Intensive and Coronary Care Nursing (SEIUC). Participants were informed of the aim of the study prior to providing their written informed consent to take part. They were also informed that they may withdraw from the study at any point. They were also informed that their responses would be kept completely anonymous and used only for research purposes.

2.4 Variables and instruments

2.4.1 Sociodemographic and occupational variables [time point 1]

The research team created a customized questionnaire to gather this information. It included sociodemographic details such as age, gender, as well as work-related data like job category, department and years of professional experience.

Burnout [time point 2 and time point 3]: the Maslach Burnout Inventory-Human Services Survey (MBI-HSS) (23) was used in its Spanish version (24). This 22-item scale adopts a 7-point Likert-type response format ranging from 0 (never) to 6 (every day). The instrument assesses three dimensions or subscales of burnout (i.e., emotional exhaustion, depersonalization, and decreased self-fulfillment). In our study, Cronbach's α for the instrument used was 0.88 for the full scale. In relation to the subscales, Cronbach's α was 0.90 for emotional exhaustion, 0.72 for depersonalization and 0.84 for decreased self-fulfillment. According to the literature, the Maslach Bournout Inventory instrument defines a high emotional exhaustion for scores above 27, a high level of work depersonalization with scores above 10 and a low personal fulfillment with scores between 0 and 33, scores above 40 are considered to be a sign of high personal fulfillment (24–26).

Anxiety, depression and stress [time point 1]: the depression, anxiety and stress scale (DASS-21) (27) was used in its Spanish version (28), a scale designed to evaluate states of depression, anxiety and stress. Each dimension consists of seven items with a Likert-type response format of four alternatives from 0 (“it has not happened to me”) to 3 (“it has happened to me a lot” or “most of the time”). The score for each of the dimensions ranges from 0 to 21 points. Cronbach's alpha in our study is 0.82 for stress, 0.77 for anxiety and 0.80 for depression.

Social support [time point 1]: measured using the Spanish version (29) of the Multidimensional Scale of Perceived Social Support (MSPSS) (30), which is composed by 12 items divided into three dimensions: family, friends and significant others, with a 7-point Likert-type response scale (from 1 “completely disagree” to 7 “completely agree”). The final score comes from the sum of its three subscales. The instrument has good properties (31, 32), for our study its reliability was $\alpha = 0.85$ for

the general questionnaire, while for the subscales the α values obtained were 0.81, for family, 0.82 for friends and 0.79 for significant others.

Self-efficacy [time point 1]: the General Self-Efficacy Scale (GSES) (33) was used in its Spanish version (34), composed of 10 items that measure the perception of competence to handle life situations, with a 4-point Likert-type response format between 1 (“not at all true”) and 4 (“completely true”). The total score ranges from 10 to 40; a higher score indicates better levels of self-efficacy. Cronbach's alpha was 0.86 in our study.

Resilience [time point 1]: the Spanish adaptation of the Resilience Scale (RS-14) (35) was used, consisting of 14 Likert-type items with 7 response options, ranging from 1 (“strongly disagree”) to 7 (“strongly agree”). The total possible score ranges from 14 to 98, with higher scores reflecting greater levels of resilience. In our study, the reliability coefficient (α) was 0.94.

Cognitive fusion [time point 2]: the Spanish version (36) of the Cognitive Fusion Questionnaire (CFQ) (37) was administered. It is made up of 7 Likert-type items with 7 response options, ranging from 1 “never” to 7 “always,” that higher scale scores imply a higher degree of cognitive fusion. A Cronbach's α of 0.97 was obtained for our study.

Optimism [time point 3]: the Spanish version (38) of The Life Orientation Test-Revised (LOT-R) (39) was used to measure dispositional optimism. It is a 10-item on a 5-point scale from 0 (strongly disagree) to 4 (strongly agree) that assesses dispositional optimism through a single factor. Total score ranges from 0 to 24; higher scores indicate greater optimism. Previous studies have shown good psychometric qualities for this instrument (38, 39). The Cronbach's Alpha value in our sample is 0.79.

Hopelessness [time point 3]: the hopelessness questionnaire of Beck was used (40) in its Spanish version (41). The scale is designed to measure the cognitive, affective, and motivational dimensions of hopelessness during the last 7 days. The scale is a 20-item, self-administered questionnaire. All items are scored on a true–false rating scale. After recoding negatively worded items, the number of endorsed items is combined to a sum-score; the higher scores the greater hopelessness levels. The participants were classified into: no hopelessness (scores 0–3), mild hopelessness (scores 4–8), moderate hopelessness (scores 9–14) and severe hopelessness (scores 15–20) (40). Cronbach's α in this sample was 0.87.

2.5 Data analysis

In the descriptive analysis of the sample, summary statistics were applied as appropriate. The categorical variables were described by means of absolute frequencies (n) and relative (%) ones. Continuous variables were described using the mean and standard deviation. A Chi-square independence test was used to examine the association between categorical variables. *T*-test and one-way ANOVA were used to compare the distribution between 2 or more than 2 groups of continuous variables. Pearson's correlation was used to analyse the relationship between two continuous variables. To investigate changes in burnout and its dimensions, repeated measures ANOVAs were used. To examine whether the burnout evolution depends on psychosocial variables, different analyses using General Linear Models were employed using as an intrasubject variable the dimensions of burnout syndrome at each time point and as an intersubject factor the psychosocial and emotional symptomatology

TABLE 2 Socio-demographic and occupational characteristics of participants.

		<i>f</i> (%)	Mean (SD)
Age			43.68 (9.78)
Experience (years)			11.66 (9.20)
Gender	Man	48 (18.5%)	
	Woman	211 (81.5%)	
Professional category	Physician	65 (25.1%)	
	Nurse	153 (59.1%)	
	Nursing tec ¹	41 (15.8%)	
Speciality	ICU	96 (37.1%)	
	Hospitalization	73 (28.2%)	
	Emergencies	38 (14.7%)	
	Primary care	42 (16.2%)	
	Others	10 (3.8%)	

¹Nursing Technician.

TABLE 3 Changes in burnout dimensions (emotional exhaustion, depersonalization, self-fulfillment) across three time points.

	T2	T3	95% CI for the difference of means	<i>t</i>	<i>p</i>
	Mean (SD)	Mean (SD)			
Emotional exhaustion	26.81 (13.62)	22.28 (14.18)	[2.96/6.09]	5.689	<0.001
Depersonalization	7.32 (6.57)	9.16 (6.99)	[−2.63/−1.04]	−4.549	<0.001
Self-fulfillment	35 (8.67)	30.55 (9.99)	[3.16/5.73]	6.813	<0.001
Burnout (total)	69.13 (18.37)	62 (18.80)	[4.90/9.36]	6.301	<0.001

variables considered. For the establishment of high and low values for each of the psychosocial variables (dividing continuous variables into two categories), a statistical criterion was used. Specifically, the median of the variable's distribution was used as the cut-off point. All analyses were conducted using SPSS version 28 (IBM Corp, 2021).

3 Results

3.1 Description of the sociodemographic and occupational variables of the sample

Table 2 presents the sociodemographic, occupational, and health data for the 259 participating HCW. As shown in Table 2, most HCW were women (81.5%) and nurses (59.1%). The Critical Care Unit (CCU) was the most common service area (37%), followed by hospitalization (28.2%). The participants had about 10 years of work experience. A significant portion of the sample (75.7%) expressed high concern about contracting COVID-19 themselves or a family member. Additionally, approximately 20% sought psychological support.

3.2 Evolution of burnout syndrome and each of its dimensions

As can be seen in Table 3, the results show significant decreases in burnout syndrome ($p < 0.001$). Assessing the evolution of each

dimension of burnout, as shown in Table 3, emotional exhaustion has decreased significantly, while an increase in depersonalization ($p < 0.001$) and a decrease in self-fulfillment (all $p < 0.001$) can be observed.

3.3 Relationships between socio-demographic and occupational variables and burnout dimensions

Table 4 shows statistical results of the relationship between socio-demographic and occupational variables and the three dimensions of burnout at the second (Time 2) and third time (Time 3) points. The results show significant relationships between age, gender, cohabitation as a couple, occupational category and service. A graphical representation of these results is shown in Figure 1. As can be seen in Table 4 and Figure 1, the following results are worth noting:

Negative relationships are observed between age and both emotional exhaustion and depersonalization at Time 2. Women experience higher levels of emotional exhaustion at both Time 2 (Cohen's $d = 0.53$) and Time 3 (Cohen's $d = 0.31$). Living with a partner is related to higher levels of emotional exhaustion (Cohen's $d = 0.29$) and lower self-fulfillment scores (Cohen's $d = 0.27$) at Time 3. Higher emotional exhaustion is observed in nurses compared to technical support staff (Cohen's $d = 0.51$) at Time 2. Higher scores are observed in primary care compared to hospitalization in emotional exhaustion at both Time 2 (Cohen's $d = 0.75$) and Time 3 (Cohen's $d = 0.54$). Finally, higher depersonalization are observed in primary care than in CCU (Cohen's $d = 0.58$) at Time 2.

TABLE 4 Relationships between socio-demographic and occupational variables and burnout dimensions over the time periods.

	T2			T3		
	Emotional exhaustion	Depersonalization	Self-fulfillment	Emotional exhaustion	Depersonalization	Self-fulfillment
	R ² /Mean (SD)	R ² /Mean (SD)	R ² /Mean (SD)	R ² /Mean (SD)	R ² /Mean (SD)	R ² /Mean (SD)
Age	R ² = −0.186 <i>p</i> = 0.003	R ² = −0.175 <i>p</i> = 0.005	R ² = 0.067 <i>p</i> = 0.281	R ² = −0.081 <i>p</i> = 0.195	R ² = −0.102 <i>p</i> = 0.101	R ² = 0.045 <i>p</i> = 0.466
Gender						
Men (<i>n</i> = 48)	20.93 (13.98)	7.39 (7.02)	36.20 (9.80)	18.58 (15.39)	8.77 (7.13)	33.08 (9.73)
Women (<i>n</i> = 211)	28.15 (13.21)	7.30 (6.48)	34.72 (8.40)	23.12 (13.80)	9.25 (6.97)	29.97 (9.98)
	<i>p</i> = 0.001	<i>p</i> = 0.930	<i>p</i> = 0.286	<i>p</i> = 0.045	<i>p</i> = 0.668	<i>p</i> = 0.052
Cohabitation as a couple						
without a partner (<i>n</i> = 77)	26.97 (13.72)	7.54 (7.17)	35.02 (9.17)	19.37 (13.38)	8.40 (6.93)	32.46 (9.67)
with a partner (<i>n</i> = 182)	26.74 (13.62)	7.22 (6.32)	34.98 (8.48)	23.51 (14.37)	9.48 (7.01)	29.74 (10.04)
	<i>p</i> = 0.903	<i>p</i> = 0.721	<i>p</i> = 0.975	<i>p</i> = 0.032	<i>p</i> = 0.256	<i>p</i> = 0.045
Professional category						
Physician (<i>n</i> = 65) (1)	27.20 (13.60)	7.53 (6.56)	34 (9.92)	22.01 (14.63)	8.64 (6.78)	32.24 (9.18)
Nurse (<i>n</i> = 151) (2)	28.19 (13.40)	7.57 (6.77)	35.25 (7.80)	23.25 (13.78)	9.65 (7.03)	29.65 (9.97)
Technician (<i>n</i> = 43) (3)	21.39 (13.42)	6.09 (5.85)	35.62 (9.65)	19.20 (14.81)	8.20 (7.16)	31.13 (11.06)
	<i>p</i> = 0.015 (2, 3)	<i>p</i> = 0.409	<i>p</i> = 0.547	<i>p</i> = 0.270	<i>p</i> = 0.388	<i>p</i> = 0.199
Service						
CCU (<i>n</i> = 93) (1)	27.69 (13.19)	6.09 (5.94)	34.89 (8.28)	22.20 (14.92)	8.26 (7.02)	30.52 (10.79)
Hospitalization (<i>n</i> = 87) (2)	23.20 (13.88)	6.89 (6.76)	34.58 (10.31)	19.82 (13.01)	9.24 (7)	30.78 (9.20)
Emergencies (<i>n</i> = 34) (3)	25.41 (13.77)	8.61 (6.48)	36.02 (7.56)	22.50 (13.77)	9.79 (6.41)	27.94 (10.13)
Primary care (<i>n</i> = 45) (4)	32.88 (11.83)	9.86 (6.92)	35.20 (6.84)	27.29 (14.43)	10.52 (7.32)	32.13 (9.69)
	<i>p</i> = 0.001 (2, 4)	<i>p</i> = 0.009 (1, 4)	<i>p</i> = 0.872	<i>p</i> = 0.043 (2, 4)	<i>p</i> = 0.327	<i>p</i> = 0.328
Professional experience	R ² = −0.025 <i>p</i> = 0.684	R ² = −0.111 <i>p</i> = 0.073	R ² = 0.062 <i>p</i> = 0.322	R ² = −0.032 <i>p</i> = 0.603	R ² = −0.044 <i>p</i> = 0.477	R ² = 0.013 <i>p</i> = 0.832

Time 2	Time 3
Higher Emotional Exhaustion: ✓ Women ✓ Nurses ✓ Primary Care ✓ Younger ones	Higher Emotional Exhaustion: ✓ Women ✓ Living with a Partner ✓ Primary Care
Higher Depersonalization: ✓ Primary Care ✓ Younger ones	Lower Self-Fulfillment: ✓ Living with a Partner

FIGURE 1
Summary of the risk profiles (socio-demographic and occupational variables) for the different dimensions of burnout at different time points.

The largest effect sizes (Cohen's *d*), medium-high effect sizes, are observed at Time 2, especially with regard to the service in which the job is performed, professional category and gender.

3.4 Evolution of the three burnout dimensions including intersubject factor (anxiety, depression, stress, family support, support from friends, self-efficacy, cognitive fusion, resilience, optimism and hopelessness)

Table 5 shows the statistically significant results in relation to the evolution of the three dimensions of burnout, including as an inter-subject factor, the different symptomatology variables considered (anxiety, depression, stress), as well as the psychosocial variables (family support, support from friends, self-efficacy, cognitive fusion, resilience, optimism, and hopelessness). For a better understanding, Figure 2 shows graphically the psychosocial variables related to each of the burnout dimensions and their evolution over time.

As shown in Table 5, significant interactions between depression, cognitive fusion and resilience for the evolution of emotional exhaustion, hopelessness for the evolution of depersonalization, and optimism and hopelessness for the evolution of self-fulfillment were found. In all cases, low effect sizes are observed. In other words, the consideration of the different inter-subject factors, although statistically significant, does not contribute much to the variability in the evolution over time of the three dimensions of burnout.

Additionally, partial effects of the intersubject variables considered on burnout symptomatology are observed in each of the time points considered. The variables involved for each dimension of burnout are the same as those observed in the case of their evolution, showing a larger effect size.

As shown in Table 5, with respect to emotional exhaustion, in both Time 2 and Time 3, higher scores are observed in participants with greater cognitive fusion, greater depression and less resilience. Effect sizes are larger at Time 2.

With regard to depersonalization, as shown in Table 5, higher scores are observed in participants with higher hopelessness at both Time 2 and Time 3, in this case the effect size being higher at Time 3. Finally, with regard to self-fulfillment, Table 5 shown lower scores in participants with lower optimism and higher hopelessness, both at Time 2 and Time 3. In the case of self-fulfillment, effect sizes are larger at Time 2.

4 Discussion

The results of our study underscore the importance of differentially addressing the three components of burnout: emotional exhaustion, depersonalization, and self-fulfillment. The results allow us to test the hypotheses put forward in this respect. Indeed, as we hypothesized in hypothesis 1, a decrease in burnout is observed, and a differential evolution in each of the components of the syndrome is also found (hypothesis 2). The results found corroborate the hypotheses put forward, providing interesting nuances that should be explored in greater depth. Thus, one of the most novel aspects with respect to the evolution of the dimensions is the fact that while emotional exhaustion (indeed, the most affected component of burnout as hypothesized) decreases, in coherence with the general decrease in burnout syndrome, depersonalization increases and personal fulfillment decreases. On the other hand, depersonalization is affected to a similar extent to emotional exhaustion, although in opposite directions (while the former decreases, the latter increases).

The results found can be supported by a number of different studies who report that during the COVID-19 pandemic, health care professionals suffered an increase in burnout over the previously recorded prevalence, mainly due to increased emotional exhaustion (42), however, these levels seem to decrease in the studies recorded after the passage of the pandemic due again to a decrease in emotional exhaustion. Likewise, over time after the COVID-19 pandemic, some studies point to a higher prevalence of depersonalization and low personal fulfillment (43). Other authors still report high levels of emotional exhaustion 4 years after the onset of the pandemic (44). However, there is a lack of longitudinal studies on burnout carried out on health professionals, making it impossible to contrast the evolution of burnout within a single study, and the present study is particularly relevant because of its longitudinal nature. These findings highlight the complexity of burnout syndrome, as its different components have shown different evolutionary trajectories.

Our study assesses the influence that different sociodemographic and occupational variables have on the different components of burnout. With regard to age, it is the younger professionals who report greater emotional exhaustion and depersonalization during the 6 months after the onset of the COVID-19 pandemic. This is in line with what has been stated by other authors, who, during the COVID-19 pandemic, have assessed younger professionals as a group at risk of suffering greater psycho-emotional disturbance (1). As evidenced by our results, female gender and nursing category are also risk factors for a high prevalence of emotional exhaustion at the onset of the pandemic (45, 46). A novel finding of our study is to point out

TABLE 5 Evolution of the three burnout dimensions over the time periods including psychosocial variables as intersubject factor (only significant interaction results are shown).

	T2 Mean (SD)	T3 Mean (SD)	P (T2/T3)				
Emotional exhaustion							
Depression (L)	21.06 (12.04)	18.11 (13.09)	0.001				
Depression (H)	33.57 (12.23)	27.19 (13.90)	<0.001				
	$P < 0.001$ $\eta^2 = 0.780$	$P < 0.001$ $\eta^2 = 0.654$					
Factor				$F = 34.655$	$P < 0.001$	$\eta^2 = 0.119$	$1-\beta = 1$
Factor*Depression				$F = 4.695$	$P = 0.031$	$\eta^2 = 0.018$	$1-\beta = 0.579$
Cognitive fusion (L)	19.41 (11.51)	17.92 (13.77)	0.166				
Cognitive fusion (H)	35.39 (10.52)	27.34 (12.97)	<0.001				
	$P < 0.001$ $\eta^2 = 0.827$	$P < 0.001$ $\eta^2 = 0.660$					
Factor				$F = 38.061$	$p < 0.001$	$\eta^2 = 0.129$	$1-\beta = 1$
Factor*Cog. Fusion				$F = 18.004$	$p < 0.001$	$\eta^2 = 0.065$	$1-\beta = 0.988$
Resilience (L)	29.79 (13.21)	23.83 (14.31)	<0.001				
Resilience (H)	22.84 (13.20)	20.21 (13.81)	0.025				
	$P < 0.001$ $\eta^2 = 0.564$	$P = 0.042$ $\eta^2 = 0.470$					
Factor				$F = 28.840$	$P < 0.001$	$\eta^2 = 0.101$	$1-\beta = 1$
Factor*Resilience				$F = 4.320$	$P = 0.039$	$\eta^2 = 0.017$	$1-\beta = 0.544$
Depersonalization							
Hopelessness (L)	6.08 (5.76)	7.26 (6.28)	0.022				
Hopelessness (H)	9.25 (7.29)	12.12 (7.04)	<0.001				
	$p < 0.001$ $\eta^2 = 0.451$	$p < 0.001$ $\eta^2 = 0.571$					
Factor				$F = 24.153$	$p < 0.001$	$\eta^2 = 0.086$	$1-\beta = 0.998$
Factor* Hopelessness				$F = 4.185$	$p < 0.042$	$\eta^2 = 0.016$	$1-\beta = 0.531$
Self-fulfillment							
Optimism (L)	33.18 (8.65)	27.36 (9.59)	$P < 0.001$				
Optimism (H)	36.66 (8.39)	33.48 (9.48)	$P = 0.001$				
	$P < 0.001$ $\eta^2 = 0.761$	$P < 0.001$ $\eta^2 = 0.596$					
Factor				$F = 48.076$	$p < 0.001$	$\eta^2 = 0.158$	$1-\beta = 1$
Factor* Optimism				$F = 4.121$	$P = 0.043$	$\eta^2 = 0.016$	$1-\beta = 0.525$
Hopelessness (L)	36.25 (8.73)	33.03 (9.57)	$P < 0.001$				
Hopelessness (H)	33.03 (8.26)	26.67 (9.44)	$P < 0.001$				
	$P < 0.001$ $\eta^2 = 0.854$	$P < 0.001$ $\eta^2 = 0.755$					
Factor				$F = 52.221$	$p < 0.001$	$\eta^2 = 0.169$	$1-\beta = 1$
Factor* Hopeless.				$F = 5.61$	$P = 0.019$	$\eta^2 = 0.021$	$1-\beta = 0.656$

L, Low levels; H, High levels.

as a risk group for high emotional exhaustion and depersonalization those professionals who performed their work in Primary Care, both in the medium and long term. These findings contrast with the existing literature, which states that those professionals with a higher risk of suffering psychoemotional alteration are those who work in

highly complex areas such as emergencies or CCU, or those who work on the front line with infectious-contagious patients (47, 48). This association found in our study could be justified by the massive transfer of health personnel working in primary care to specific centers developed to care for all those COVID-19 patients who could

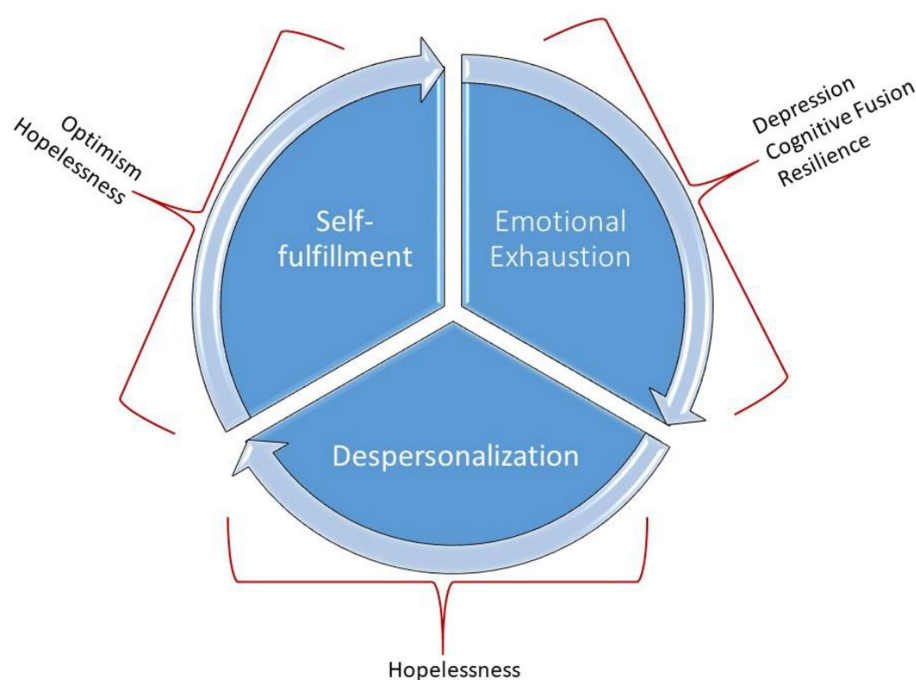


FIGURE 2

Graphical representation of the psychosocial variables that influence the different dimensions of burnout and its evolution over time.

not be offered hospital care due to lack of human and logistic resources, causing work overload and added stress for HCW in primary care.

Emotional exhaustion, along with self-fulfillment, was the component in our study that showed the greatest reduction during the period studied. Emotional exhaustion has undoubtedly been one of the most studied dimensions of burnout, as it is initially the most affected component (49–51), as our findings show. This exponential increase in emotional exhaustion at the onset of the COVID-19 pandemic in HCW has been attributed to increased workload, lack of resources, fear of contagion, and generalized uncertainty (49–51). The longitudinal nature of this research allows us to provide interesting information on the evolution of the dimensions. Our data seem to indicate that as the pandemic progressed and health systems began to adapt better to the situation, emotional exhaustion decreased significantly. According to the existing literature, emotional exhaustion is closely related to levels of depressive symptomatology, especially in the early stages of the pandemic (49, 52). In our study, levels of depression assessed at the onset of the pandemic correlated significantly with emotional exhaustion 6 months after their beginning, reinforcing the importance of mental health at the onset of the crisis. This finding is consistent with previous research highlighting how the emotional impact of pandemic onset was critical for the emergence of depressive symptoms in HCW (53).

With regard to hypotheses 3 and 4, concerning risk and protective variables, respectively, our results support the relevance of some but not all variables. Our findings support hypothesis 5, which proposed a differential role of the mentioned variables in the components of burnout syndrome, hypothesizing a greater effect on emotional exhaustion with respect to the rest of the dimensions.

Thus, with particular regard to the previous hypotheses, depression, cognitive fusion and resilience show a key role, within our study, for the

evolution of emotional exhaustion. Those participants who showed high scores for depression and cognitive fusion and low scores for resilience presented a worse evolution for emotional exhaustion. This is consistent with previous studies that relate cognitive fusion (54) and depression (49, 52) to emotional exhaustion, and low levels of resilience with burnout (55, 56).

In contrast to emotional exhaustion, within our study, depersonalization showed an increase during the data analysis period, which again corroborates hypothesis 2, which states the different evolution of each of the dimensions of burnout. This finding is of concern, as depersonalization implies emotional disconnection and dehumanizing treatment of patients, which may have serious implications for the quality of health care (57). Once again, our study shows that primary care professionals are those who report the highest degree of depersonalization during the second time period, although these data are not sustained over time. Previous studies have documented increases in depersonalization in situations of chronic stress, such as the COVID-19 pandemic (58), but our study suggests that this dimension of burnout may be more related to long-term cognitive-emotional factors, such as hopelessness. Hopelessness had already been associated in the existing literature with burnout, however, the literature tends to focus again on total burnout with all its dimensions as a whole or on emotional exhaustion (59). During the pandemic, constant exposure to critically ill patients, scarcity of resources, and accumulated fatigue may have contributed to the development of feelings of hopelessness (15). The chronification of depersonalization, as suggested by the longitudinal nature of our study, implies that HCW are not regaining their ability to reconnect emotionally with their patients, even after emotional exhaustion levels have decreased. The dimension of self-fulfillment shows a markedly significant decrease

in our study. Cyclical models of burnout (57) propose the decline in self-fulfillment as the final stage of the syndrome, following emotional exhaustion and depersonalization, conclude in a feeling of incompetence and lack of achievement at work, which negatively affects self-esteem and personal satisfaction (60). The evolution of self-fulfillment in our study is significantly associated with optimism and hopelessness, suggesting that HCW who lack a positive view of the future may feel less competent and less satisfied with their job accomplishments. The role of optimism in burnout prevention has been extensively studied (61). Existing literature documents that optimistic individuals tend to cope with stress in a more adaptive way, finding solutions to problems (62). Our results confirm this association, as professionals who reported higher levels of optimism showed a better evolution in terms of personal fulfillment. On the contrary, those experiencing reduced optimism and higher levels of hopelessness have more difficulties in maintaining their self-fulfillment.

4.1 Limitations

The current study has several limitations that should be acknowledged. The sampling method was a non-probabilistic convenience sample, which focused on specific communities and thus lacks generalizability to the broader population. Other limitations relate to the use of self-reports as an assessment method, considering the limitations involved. On the other hand, it is worth noting the possible bias due to sample drop-out. Future lines of research could help to address some of these limitations, especially with regard to the use of self-reports. Although these are essential for the assessment of psychosocial variables, additional behavioral measures associated with burnout, such as absenteeism, sick leave and career drop-out, could be incorporated. Additionally, this study has considered some of the possible psychosocial variables that may be involved. Undoubtedly, there are other additional variables to consider such as positive or negative affectivity, tolerance to ambiguity or emotional regulation, among others. Future research should consider some of the above mentioned psychosocial variables, and their influence on burnout and its evolution in HCW.

4.2 Practical implications

The results of this study have important implications for burnout interventions in health care, especially in the context of health policy and practice. On the one hand, the results suggest the need for specific interventions, by considering each of the components of the syndrome. Although further research is needed, emotional exhaustion is shown to be one of the dimensions affected in the short term and intervention programs aimed at reducing depression at times of acute stress (onset of the COVID-19 pandemic), including thought management, seem fundamental. Training programmes that foster resilience and the ability to manage intrusive thoughts (cognitive fusion) could be implemented to address this dimension of burnout (63, 64). Depersonalization and decreased self-fulfillment do not seem to respond to the same pattern and indicate the need for additional interventions. From the cyclical models of burnout (57), it could be hypothesized that both are shown as results of a chronification of a poor management of emotional exhaustion, and in the case of appearing, given the variables associated with its evolution

(optimism and hopelessness) therapies more focused on the meaning of existence, such as Acceptance and Commitment Therapy, could be useful. Strategies that promote optimism and reduce hopelessness, such as cognitive and emotional skills training programmes, may be beneficial (65). Interventions aimed at increasing optimism, such as cognitive-behavioral therapies and interventions based on positive psychology, could be useful in improving self-fulfillment among HCW, especially in times of prolonged stress (66, 67). Moreover, the fact that hopelessness plays a crucial role in the decline of self-fulfillment reinforces the idea that addressing these cognitive-emotional factors may be of interest to prevent the chronification of burnout.

On the other hand, it is crucial that health policies include ongoing psychological support measures for health workers, especially in times of crisis such as the COVID-19 pandemic (68). These policies could include the creation of peer support networks and the implementation of organizational wellbeing programmes that address workload and work-life balance (69). Peer support networks allow health professionals to share experiences and strategies for managing stress and burnout. For example, some hospitals have implemented mentoring programmes where more experienced employees support new employees, helping them to adapt to the work environment and manage stress (68). The organizational wellbeing programmes are designed to support the mental and physical health of employees. They may include access to counseling services, physical exercise programmes, and workshops on stress management and resilience (63). An example is the Mayo Clinic's wellness programme or the Cleveland Clinic's "Be Well" Program, which offers a variety of resources to support employee wellness, including psychological counseling and fitness programmes (63). On the other hand, work-life balance policies seek to ensure that employees have a healthy work-life balance. They may include flexible work options, family leave, and childcare support (68). Examples of such initiatives include the Mayo Clinic's "My Time" Initiative or the Massachusetts General Hospital's "Recharge Days (70).

Similarly, the establishment of patient care policies is a preventive measure to be considered. These policies establish standards for the daily care of patients, including specific procedures for managing medical situations, such as exposure to body fluids or medical emergencies (71). As an example, in the case of the COVID-19 pandemic, a hospital may have a policy detailing how to act in the event of an infectious disease outbreak, ensuring that all employees follow specific protocols to minimize the risk of transmission. These aspects are of particular relevance in the context at hand, given that fear of contagion was a precipitating factor for emotional symptomatology in HCW at the onset of the pandemic (72).

In summary, a multifaceted approach that considers the different dimensions of burnout and associated psychosocial factors is essential to improve the mental health of healthcare professionals and their ability to cope with future crises.

5 Conclusion

The findings of our study are relevant for several reasons. Firstly, the longitudinal nature of the study entails an analysis of the long-term evolution of burnout, providing an approach to the current state of health care professionals. On the other hand, the three-dimensional approach to burnout allows us to study the evolution of each variable separately, noting that while emotional exhaustion decreases

throughout the study, depersonalization increases and personal accomplishment decreases, which underlines the need for specific intervention approaches for each component. These findings reinforce the importance of psychosocial variables, both short- and long-term, in the evolution of burnout, and suggest that interventions should be tailored to the temporal and emotional context of professionals.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Hospital Universitario Fundación Alcorcón. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

FG-A: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. JC-M: Data curation, Investigation, Methodology, Writing – original draft. FG-H: Data curation, Investigation, Writing – original draft. CP-P: Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Kim Walker,
University of Aberdeen, United Kingdom
Alys Burns,
University of East Anglia, United Kingdom

*CORRESPONDENCE

Yanyan Yu
✉ yyy19870312@126.com

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Knowledge, attitude, and practice towards occupational burnout among doctors and nurses in intensive care unit

Xiahui Lu¹, Dawei Li², Hu Luo³, Lishan Wang¹, Yan Lou¹ and
Yanyan Yu^{1*}

¹Department of Critical Care Medicine, Zhejiang Medical & Health Group Hangzhou Hospital, Hangzhou, China, ²Department of Critical Care Medicine, The Sixth Medical Center of the PLA General Hospital, Beijing, China, ³Department of Respiratory and Critical Care Medicine, First Affiliated Hospital of Army Medical University, Chongqing, China

Background: Occupational burnout is prevalent among doctors and nurses. This study aimed to investigate the knowledge, attitude, and practice (KAP) of ICU doctors and nurses regarding occupational burnout.

Methods: A cross-sectional study was conducted between December 2023 and June 2024 at the Zhejiang Medical & Health Group Hangzhou Hospital in Zhejiang Province. Demographic information and KAP scores were collected through distributed questionnaires. Occupational burnout was measured by the Maslach Burnout Inventory-General Survey (MBI-GS).

Results: This study included 105 doctors and 165 nurses, with an average age of 32.23 ± 7.38 years. Among all the participants, 6 (2.22%) reported no occupational burnout, 230 (85.19%) experienced moderate occupational burnout, and 34 (12.59%) reported severe occupational burnout. The mean knowledge, attitude, and practice scores were 9.64 ± 4.21 (possible range: 0–18), 29.01 ± 3.15 (possible range: 7–35), and 16.96 ± 4.29 (possible range: 6–30), respectively. Multivariate logistic regression revealed that a higher knowledge score was independently associated with more proactive practice (OR = 1.33, 95% CI: [1.18, 1.50], $p < 0.001$). Structural equation modeling showed that knowledge positively influenced both ($\beta = 0.33$, $p < 0.001$) and practice ($\beta = 0.37$, $p < 0.001$), while practice negatively impacted the MBI-GS ($\beta = -0.92$, $p < 0.001$).

Conclusion: Most ICU doctors and nurses exhibited moderate occupational burnout, with insufficient knowledge, positive attitude, and moderate practice toward occupational burnout. Implementing strategies to increase knowledge and promote active practical engagement is essential to effectively mitigate occupational burnout among ICU staff.

KEYWORDS

ICU, healthcare worker, occupational burnout, knowledge, attitude, practice

Background

Burnout is defined by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment, phenomena increasingly prevalent among healthcare professionals worldwide (1). Notably, occupational burnout prevalence rises to 51% among medical and surgical residents (2) and peaks at 80% in physicians (3). Nurses also experience significant rates, ranging from 15 to 60% (4). In addition to compromising personal health, occupational burnout adversely impacts healthcare workers' perceived competence, and medical performance, and increases the likelihood of medical errors (5, 6). Staff in intensive care units (ICUs)—including registered nurses, medical equipment technicians, and physicians—encounter particularly severe challenges. These roles demand higher performance and understanding, placing intense pressure on ICU personnel (7, 8).

The stress is compounded by a disproportionate ratio of ICU patients to the limited number of available staff, leading to significant psychological strain and deteriorating mental health among healthcare workers (9). Factors contributing to this include high workload, inadequate organizational support, insufficient rewards, workplace violence, and heavy emotional loads, all of which heighten the risk of anxiety, depression, sleep disorders, and burnout syndrome (10, 11). Consequently, regular screening for occupational burnout among ICU clinicians is crucial to safeguard their well-being (12).

The Knowledge, Attitude, and Practice (KAP) survey serves as a diagnostic tool, shedding light on a group's understanding, beliefs, and behaviors regarding a specific subject, especially in the context of health literacy. This model is based on the idea that knowledge enhances attitude, which in turn, shapes behaviors (13–15). Furthermore, the sequence of the KAP model plays a crucial role in modifying the practice patterns of physicians (16). ICU healthcare professionals are subject to particularly severe stressors due to the demanding nature of their work environments, which include excessive workloads and substantial emotional burdens. Despite existing data from other healthcare populations (17, 18), there is still a lack of research specifically exploring the KAP of occupational burnout among ICU doctors and nurses in China. By understanding the specific experiences and responses of this group to occupational burnout, targeted interventions can be developed to enhance their well-being, improve patient care, and reduce medical errors. This study aims to investigate the KAP of ICU doctors and nurses concerning occupational burnout.

Methods

Study design and participants

This cross-sectional study was conducted on ICU doctors and nurses from December 2023 to June 2024 at Zhejiang Medical &

Health Group Hangzhou Hospital, Zhejiang Province. Ethical approval for this study was granted by the Medical Ethics Committee of Zhejiang Medical & Health Group Hangzhou Hospital (Approval number: 202311270950000578476). Informed consent was obtained from all study participants. Inclusion criteria: (1) ICU medical doctors and nurses, including those from the Emergency Intensive Care Unit (EICU), General Intensive Care Unit (GICU), Cardiac Intensive Care Unit (CICU), Central Intensive Care Unit (CICU), Respiratory Intensive Care Unit (RICU), Gastrointestinal Intensive Care Unit (GICU), and Oncology Intensive Care Unit (OICU); (2) Doctors and nurses who have been on continuous duty for at least six months at the time of participating in the questionnaire survey; (3) Only doctors and nurses are included. Exclusion criteria: (1) Interns and rotating personnel; (2) Personnel who perform only administrative tasks in the ICU and do not participate in clinical or emergency rescue duties.

Questionnaire introduction

The questionnaire design was informed by existing literature (19–21). Following the completion of the initial draft, feedback was sought from two seasoned experts: a psychologist with 15 years of experience and an intensivist with 10 years. Based on their suggestions, the questionnaire was refined by adjusting inappropriate descriptions and modifying the response options for several demographic questions. A preliminary survey was administered to 46 participants, resulting in an overall Cronbach's α coefficient of 0.866, which indicates good internal consistency.

The final questionnaire, presented in Chinese, encompasses five sections: demographic information [including age, gender, education level, marital status, family status, monthly income, occupation, years of work experience, average weekly working hours, engagement in teaching and research tasks, job satisfaction rating, PHQ-9 depression screening (22), and GAD-7 anxiety self-assessment (23)], knowledge, attitude, practice, and the Maslach Burnout Inventory-General Survey (MBI-GS) (24, 25). Body mass index (BMI) was calculated as $\text{BMI} = \text{weight (kg)} / \text{height (m)}^2$. The knowledge section comprises 9 items, scored from 0 to 18, with responses scored as 2 for 'very familiar', 1 for 'heard of it', and 0 for 'unclear'. The attitude section includes 7 questions on a five-point Likert scale, scoring from 7 to 35, where points are allocated from 5 ('strongly agree') to 1 ('strongly disagree'). The practice section contains 6 questions, scored from 6 to 30, where points are assigned from 1 ('never') to 5 ('always'). Scores above 70% of the maximum in each dimension are considered indicative of sufficient knowledge, positive attitude, and proactive practice (26).

The MBI-GS comprises 15 items. The scoring is calculated as follows: Total burnout score = $0.4 \times \text{average emotional exhaustion score} + 0.3 \times \text{average cynicism score} + 0.3 \times \text{average personal accomplishment score}$. Total scores within the ranges of 0 ~ 1.49, 1.50 ~ 3.49, and 3.50 ~ 6 correspond to no occupational burnout, moderate occupational burnout, and severe occupational burnout, respectively (24). The primary outcome measures of this study were the KAP scores and burnout scores.

Abbreviations: KAP, Knowledge, attitude, and practice; MBI-GS, Maslach Burnout Inventory-General Survey; ICUs, Intensive care units; BMI, Body mass index; SD, Standard deviation; ANOVA, Analysis of variance.

Questionnaire distribution

An online questionnaire was developed using the Sojump website,¹ and a QR code was generated for data collection via WeChat. Participants scanned the QR code to access and complete the questionnaire. To ensure quality and completeness, each IP address was allowed only one submission, and all items were mandatory. If participants encountered any issues, research group members were available to provide assistance. All participants completed the questionnaire independently, with researchers only available to provide clarification in cases where participants had technical difficulties with the online survey platform. During the response process, research assistants clarified questions to ensure respondents fully understood the questionnaire and the survey's intent. The research team reviewed all questionnaires for completeness, consistency, and validity.

Sample size

The minimum required sample size was calculated using the guideline of 10 times the number of KAP items, as recommended by survey sample size estimation methods. Consequently, the minimum sample size was determined to be 220 (27). To account for an anticipated 20% rate of invalid responses, the adjusted minimum sample size was increased to 264.

Statistical analysis

Data analysis was conducted using Stata 14.0 (Stata Corporation, College Station, TX, United States). The normal distribution of continuous data was checked using the Kolmogorov–Smirnov test. Continuous variables conforming to the normal distribution were described using mean $\pm$ standard deviation (SD), and comparisons between groups were performed using t-tests or analysis of variance (ANOVA). Those with a skewed distribution were presented as medians (ranges) and analyzed using the Wilcoxon–Mann–Whitney U-test or the Kruskal–Wallis analysis of variance. Categorical variables were presented as n (%). Pearson correlation analysis was employed to assess the correlations between knowledge, attitude, practice, and burnout scores. Univariate and multivariate logistic regression were performed to explore the risk factors associated with proactive practice, with 70% of the highest possible score used as the cut-off value (26). The variables with $p < 0.05$ in the univariate analyses were included in the multivariate analyses. A structural equation modeling analysis was conducted to test the hypotheses that (H1) knowledge directly affects attitude, (H2) knowledge directly affects practice, (H3) knowledge indirectly affects practice through attitude, and (H4) KAP directly affects occupational burnout (measured by the MBI-GS). Model fit was evaluated using the Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR),

Tucker–Lewis Index (TLI), and Comparative Fit Index (CFI). Two-sided p -values < 0.05 were considered statistically significant.

Results

A total of 293 questionnaires were collected, with 14 cases excluded due to invalid responses, resulting in 270 valid cases and a validity rate of 92.15%. Among them, 179 (66.30%) were female. The average age of the participants was 32.23 ± 7.38 years. Among the participants, 154 (57.04%) maintained a BMI within the normal range, 154 (57.04%) held a Bachelor's Degree, 157 (58.15%) were married, 134 (49.63%) had children, and 165 (61.11%) were nurses. Financially, 93 (34.44%) reported a monthly income of 7,000–9,999 yuan. A significant proportion, 115 (42.59%), had 3–10 years of work experience, 134 (49.63%) worked 41–48 h weekly, 218 (80.74%) worked night shifts, 121 (44.81%) undertook teaching tasks, and 76 (28.15%) engaged in scientific research tasks. Additionally, 154 (57.04%) regularly exercised, and 108 (40%) experienced frequent sleep disorder symptoms. Also, 117 (43.33%) scored 5–9 on the depression scale, and 102 (37.78%) exhibited mild anxiety. Among all the participants, 6 (2.22%) reported no occupational burnout, 230 (85.19%) experienced moderate occupational burnout, and 34 (12.59%) reported severe occupational burnout (Tables 1–3). The three primary job-related issues identified were excessive workload, insufficient salary, and a stressful environment in the ICU (Figure 1).

The mean knowledge, attitude, practice, and occupational burnout scores were 9.64 ± 4.21 (possible range: 0–18), 29.01 ± 3.15 (possible range: 7–35), 16.96 ± 4.29 (possible range: 6–30), 2.73 ± 0.73 , respectively. Detailed analysis of the KAP dimensions revealed notable gaps. For instance, doctors and nurses demonstrated limited awareness of evidence-based stress reduction strategies (knowledge gap), a tendency to undervalue self-care in managing burnout (attitude misconception), and infrequent application of coping mechanisms in daily practice (practice gap). These deficiencies indicate critical areas for intervention. Meanwhile, their attitude scores were more likely to vary depending on marital status ($p = 0.001$), childbirth status ($p = 0.003$), job position ($p = 0.006$), monthly income ($p = 0.015$), years of working experience ($p < 0.001$), weekly working hours ($p = 0.016$), work night shifts ($p = 0.013$), teaching task ($p = 0.005$), research tasks ($p = 0.014$), and occupational burnout score ($p = 0.048$). Further, their practice scores were more likely to vary depending on education ($p = 0.031$), job position ($p = 0.002$), weekly working hours ($p < 0.001$), habit of exercising ($p = 0.001$), symptoms of sleep disorders ($p = 0.001$), weekly sleep time ($p = 0.013$), depression score ($p = 0.001$), anxiety rating ($p < 0.001$), and occupational burnout score ($p = 0.002$). Moreover, their occupational burnout scores were more likely to vary depending on education ($p = 0.001$), childbirth status ($p = 0.021$), weekly working hours ($p = 0.002$), work night shifts ($p = 0.049$), average number of night shifts ($p = 0.037$), habit of exercising ($p = 0.002$), symptoms of sleep disorders ($p < 0.001$), weekly sleep time ($p = 0.013$), depression score ($p < 0.001$), and anxiety rating ($p < 0.001$) (Tables 1–3).

The responses to the knowledge dimension highlighted notable gaps among ICU healthcare professionals. Only 13.7% were “very familiar” with the definition of occupational burnout (K1), and 17.41% understood its mental health implications, such as anxiety and depression (K3). Additionally, knowledge about physical health consequences (e.g., musculoskeletal disorders, type 2 diabetes) and

¹ <https://www.wjx.cn/>

TABLE 1 Demographics characteristic of ICU doctors and nurses.

N = 270	N (%)	Knowledge score		Attitude score		Practice score		Burnout score	
		Mean $\pm$ SD	P	Mean $\pm$ SD	P	Mean $\pm$ SD	P	Mean $\pm$ SD	P
Total score		9.64 $\pm$ 4.21		29.01 $\pm$ 3.15		16.96 $\pm$ 4.29		2.73 $\pm$ 0.73	
Gender			0.239		0.642		0.613		0.788
Male	91 (33.70)	10.01 $\pm$ 4.42		29.15 $\pm$ 3.16		17.02 $\pm$ 3.92		2.700 $\pm$ 0.64	
Female	179 (66.30)	9.45 $\pm$ 4.10		28.93 $\pm$ 3.14		16.92 $\pm$ 4.47		2.751 $\pm$ 0.76	
Age (years)	32.23 $\pm$ 7.38								
BMI	22.39 $\pm$ 3.29		0.578		0.049		0.411		0.019
Lean	31 (11.48)	9.64 $\pm$ 4.66		27.87 $\pm$ 3.72		16.70 $\pm$ 4.04		2.413 $\pm$ 0.53	
Normal	154 (57.04)	9.48 $\pm$ 4.18		28.86 $\pm$ 3.03		17.28 $\pm$ 4.62		2.746 $\pm$ 0.73	
Overweight	71 (26.3)	10.19 $\pm$ 4.14		29.61 $\pm$ 3.06		16.67 $\pm$ 3.59		2.836 $\pm$ 0.73	
Obesity	14 (5.19)	8.57 $\pm$ 3.99		30 $\pm$ 2.68		15.28 $\pm$ 4.15		2.786 $\pm$ 0.74	
Education			0.138		0.111		0.031		0.011
Junior College	43 (15.93)	8.46 $\pm$ 4.88		27.97 $\pm$ 3.75		17.62 $\pm$ 5.19		2.588 $\pm$ 0.63	
Bachelor's degree	175 (64.81)	9.73 $\pm$ 3.96		29.22 $\pm$ 2.93		17.25 $\pm$ 4.04		2.674 $\pm$ 0.67	
Master's degree or above	52 (19.26)	10.30 $\pm$ 4.32		29.11 $\pm$ 3.17		15.38 $\pm$ 3.98		3.054 $\pm$ 0.85	
Marital status			0.002		0.001		0.753		0.389
Unmarried/ Divorced/ Widowed	113 (41.85)	8.82 $\pm$ 4.37		28.24 $\pm$ 3.03		17.22 $\pm$ 4.59		2.774 $\pm$ 0.76	
Married	157 (58.15)	10.23 $\pm$ 4.00		29.55 $\pm$ 3.12		16.76 $\pm$ 4.06		2.705 $\pm$ 0.69	
Any children			0.006		0.003		0.595		0.297
No	136 (50.37)	9.09 $\pm$ 4.31		28.46 $\pm$ 3.06		17.27 $\pm$ 4.77		2.765 $\pm$ 0.79	
Yes	134 (49.63)	10.2 $\pm$ 4.05		29.55 $\pm$ 3.13		16.62 $\pm$ 3.72		2.702 $\pm$ 0.64	

potential solutions (e.g., work-life balance) was limited (K5 and K9), with only 15.56 and 18.52%, respectively, being “very familiar” with these topics (Table 4). Regarding attitudes, the majority agreed or strongly agreed that burnout is common (84.07%) and a bad sign (85.19%) (A1 and A2). However, a significant proportion of participants underestimated their own capacity for addressing burnout, as 50.37% held neutral or negative views on the potential for self-regulation to alleviate burnout (A5) (Table 5). The responses in the practice dimension revealed low engagement in proactive burnout prevention strategies. Only 6.3% had attended training on burnout prevention (P1), and 15.19% proactively sought psychological support (P5). Furthermore, while 49.63% reported regularly monitoring their work status and emotions (P2), fewer than 35% engaged in effective environmental or lifestyle adjustments, such as regular exercise or improving work-life balance (P3) (Table 6).

Correlation analysis revealed a positive correlation between knowledge and attitude ($r = 0.4017$, $p < 0.001$), and between knowledge and practice ($r = 0.3118$, $p < 0.001$). Additionally, there was a negative correlation between practice and occupational burnout scores ($r = -0.3359$, $p < 0.001$) (Table 7).

Multivariate logistic regression for practice dimension showed that knowledge score (OR = 1.33, 95% CI: [1.18, 1.50], $p < 0.001$) was independently associated with proactive practice (Table 8).

Structural equation modeling was conducted to evaluate the relationships between knowledge, attitudes, practices, and occupational burnout (measured by MBI). The fit indices of the structural equation modeling reached the desired range, indicating good model fit results (Supplementary Table S1). The total, direct, and indirect effects of key variables are detailed in Supplementary Table S2. Knowledge directly influenced attitudes ($\beta = 0.32$, 95% CI: 0.24–0.40, $p < 0.001$). Knowledge significantly affected practice both directly ($\beta = 0.36$, 95% CI: 0.23–0.49, $p < 0.001$) and indirectly via attitudes ($\beta = -0.02$, 95% CI: -0.07 – 0.03 , $p = 0.416$). This indicates that knowledge is a critical determinant of both attitudes and practices, reinforcing the importance of targeted educational interventions to improve these dimensions. However, among KAP, only practice showed a direct inverse impact on occupational burnout ($\beta = -0.92$, 95% CI: -1.20 – 0.63 , $p < 0.001$), underscoring that the more positive and effective the practice is, the lower the burnout score (Supplementary Table S2; Figure 2).

Discussion

This study reveals that ICU doctors and nurses experience moderate occupational burnout levels, highlighting a disparity

TABLE 2 Work-related elements of ICU doctors and nurses.

N = 270	N (%)	Knowledge score		Attitude score		Practice score		Burnout score	
		Mean ± SD	P	Mean ± SD	P	Mean ± SD	P	Mean ± SD	P
Job position			0.020		0.006		0.002		<0.001
Doctor	105 (38.89)	10.26 ± 4.05		29.62 ± 3.01		15.80 ± 3.58		2.973 ± 0.76	
Nurse	165 (61.11)	9.24 ± 4.27		28.61 ± 3.16		17.68 ± 4.54		2.581 ± 0.65	
Monthly income (yuan)			0.151		0.015		0.359		0.245
<7,000	70 (25.93)	9.77 ± 4.07		28.58 ± 3.36		17.71 ± 4.92		2.627 ± 0.74	
7,000–9,999	93 (34.44)	8.84 ± 4.19		28.50 ± 3.01		16.84 ± 4.16		2.720 ± 0.72	
10,000–19,999	89 (32.96)	10.24 ± 4.13		29.92 ± 2.89		16.77 ± 4.05		2.871 ± 0.73	
>20,000	18 (6.67)	10.27 ± 4.90		28.72 ± 3.37		15.44 ± 2.97		2.542 ± 0.50	
Years of working experience			<0.001		<0.001		0.223		0.062
≤2 years	51 (18.89)	9.56 ± 4.67		28.49 ± 3.23		18.11 ± 4.94		2.882 ± 0.82	
3–10 years	115 (42.59)	8.57 ± 4.14		28.25 ± 3.02		16.95 ± 4.27		2.611 ± 0.68	
11–20 years	75 (27.78)	10.62 ± 3.11		30.08 ± 2.86		16.33 ± 3.88		2.822 ± 0.72	
≥21 years	29 (10.74)	11.48 ± 5.01		30.13 ± 3.20		16.51 ± 3.88		2.729 ± 0.66	
Weekly working hours			0.057		0.016		<0.001		<0.001
≤40	38 (14.07)	9.02 ± 5.11		27.63 ± 3.29		18.81 ± 4.41		2.429 ± 0.69	
41–48	134 (49.63)	9.21 ± 4.12		29 ± 3.15		17.42 ± 4.33		2.626 ± 0.64	
49–56	56 (20.74)	10.07 ± 3.33		29.39 ± 2.76		16.46 ± 3.76		2.820 ± 0.57	
≥57	42 (15.56)	11 ± 4.44		29.76 ± 3.16		14.42 ± 3.53		3.237 ± 0.91	
Work night shifts			0.002		0.013		0.243		0.872
Yes	218 (80.74)	9.36 ± 4.10		28.82 ± 3.03		16.83 ± 4.40		2.736 ± 0.73	
No	52 (19.26)	10.80 ± 4.51		29.78 ± 3.49		17.44 ± 3.74		2.726 ± 0.66	
The average number of night shifts per month			0.012		0.147		0.114		0.083
≤4	65 (24.07)	10.58 ± 4.43		29.4 ± 3.43		17.76 ± 3.84		2.67 ± 0.62	
4–10	92 (34.07)	9.48 ± 4.46		28.58 ± 3.09		16.92 ± 4.73		2.644 ± 0.78	
≥11	113 (41.85)	9.23 ± 3.81		29.12 ± 2.99		16.51 ± 4.11		2.844 ± 0.72	
Teaching tasks			0.008		0.005		0.629		0.784
Yes	121 (44.81)	10.41 ± 4.24		29.55 ± 3.15		16.83 ± 4.25		2.729 ± 0.69	
No	149 (55.19)	9.02 ± 4.09		28.56 ± 3.07		17.05 ± 4.33		2.738 ± 0.74	
Scientific research tasks			0.004		0.014		0.871		0.066
Yes	76 (28.15)	10.78 ± 3.50		29.75 ± 2.77		16.89 ± 3.75		2.895 ± 0.76	
No	194 (71.85)	9.19 ± 4.38		28.71 ± 3.24		16.97 ± 4.49		2.671 ± 0.69	

between their generally positive attitude towards occupational burnout and their actual knowledge and practice.

In our study, the occupational burnout scores among ICU doctors and nurses revealed a concerning trend: a vast majority, 85.19%, experienced moderate occupational burnout, while 12.59% suffered from severe occupational burnout, and only a minimal 2.22% displayed no signs of occupational burnout. This distribution underscores a significant prevalence of occupational burnout within this cohort, aligning with findings from other studies that also report high levels of occupational burnout among healthcare professionals (28, 29). Factors contributing to these high rates include prolonged working hours, high patient morbidity and mortality, and frequent exposure to critical care stressors. Additionally, personal factors such as younger age, fewer years of professional experience, and inadequate coping mechanisms significantly influence the risk of occupational burnout. For example, a national cross-sectional study in mainland China identified high workload, low physical activity, and insufficient vacation days as key contributors to occupational burnout (28). Another study emphasized that the challenging nature of ICU environments, which include daily encounters with death and ethical dilemmas, further exacerbates stress levels (29). Moreover, factors like personality traits and psychological conditions, such as depression, were highlighted in a study of critical care and emergency nurses in Andalusia, underscoring the complex

TABLE 3 Lifestyle and psychological factors of ICU doctors and nurses.

N = 270	N (%)	Knowledge score		Attitude score		Practice score		Burnout score	
		Mean $\pm$ SD	P	Mean $\pm$ SD	P	Mean $\pm$ SD	P	Mean $\pm$ SD	P
Exercising habit			0.002		0.059		0.001		0.121
Yes	154 (57.04)	10.33 $\pm$ 4.22		29.34 $\pm$ 3.22		17.75 $\pm$ 4.34		2.655 $\pm$ 0.63	
No	116 (42.96)	8.73 $\pm$ 4.04		28.56 $\pm$ 2.98		15.88 $\pm$ 3.99		2.838 $\pm$ 0.82	
Weekly exercise time			0.085		0.717		0.212		0.677
1 h or less than 1 h	70 (25.93)	11.08 $\pm$ 4.13		29.7 $\pm$ 3.13		18.45 $\pm$ 4.88		2.678 $\pm$ 0.70	
1–3 h	62 (22.96)	9.48 $\pm$ 4.29		29.16 $\pm$ 3.03		17.09 $\pm$ 3.87		2.616 $\pm$ 0.57	
3–5 h	31 (11.48)	10.41 $\pm$ 3.65		29.41 $\pm$ 3.14		17.25 $\pm$ 4.18		2.611 $\pm$ 0.57	
Over 5 h	9 (3.33)	9.11 $\pm$ 5.41		28.66 $\pm$ 5.29		16.44 $\pm$ 3.71		2.934 $\pm$ 0.76	
Sleep disorders			0.759		0.145		0.001		<0.001
Frequent	108 (40)	9.70 $\pm$ 4.32		29.39 $\pm$ 2.94		16.40 $\pm$ 4.61		2.953 $\pm$ 0.82	
Occasionally	112 (41.48)	9.59 $\pm$ 4.08		28.74 $\pm$ 3.01		16.63 $\pm$ 3.90		2.643 $\pm$ 0.57	
None	50 (18.52)	9.62 $\pm$ 4.34		28.76 $\pm$ 3.77		18.86 $\pm$ 3.93		2.463 $\pm$ 0.66	
Weekly sleep time (hours)			0.218		0.442		0.013		0.051
≤ 42	74 (27.41)	10.39 $\pm$ 4.24		29.33 $\pm$ 3.05		17.02 $\pm$ 5.39		2.734 $\pm$ 0.79	
43–49	135 (50)	9.31 $\pm$ 4.25		28.95 $\pm$ 3.05		16.45 $\pm$ 3.89		2.805 $\pm$ 0.70	
≥ 50	61 (22.59)	9.45 $\pm$ 4.03		28.72 $\pm$ 3.45		17.98 $\pm$ 3.41		2.576 $\pm$ 0.67	
Your satisfaction rating for the current job is	6.79 $\pm$ 1.96								
Depression score			0.360		0.076		0.001		<0.001
0–4	91 (33.7)	9.62 $\pm$ 4.45		28.50 $\pm$ 3.61		18.08 $\pm$ 4.45		2.519 $\pm$ 0.63	
5–9	117 (43.33)	9.34 $\pm$ 4.08		28.98 $\pm$ 2.80		16.70 $\pm$ 3.86		2.613 $\pm$ 0.53	
10–14	45 (16.67)	10.33 $\pm$ 3.93		29.91 $\pm$ 2.86		16.33 $\pm$ 4.51		3.017 $\pm$ 0.77	
15–19	17 (6.3)	10 $\pm$ 4.65		29.47 $\pm$ 3.04		14.23 $\pm$ 4.07		3.963 $\pm$ 0.83	
20–27	/								
Anxiety rating			0.630		0.085		<0.001		<0.001
None 0–4	137 (50.74)	9.49 $\pm$ 4.49		28.64 $\pm$ 3.33		17.78 $\pm$ 4.35		2.514 $\pm$ 0.61	
Mild 5–9	102 (37.78)	9.61 $\pm$ 3.77		29.19 $\pm$ 2.93		16.35 $\pm$ 4.04		2.778 $\pm$ 0.62	
Moderate 10–14	17 (6.3)	10.29 $\pm$ 4.08		30.29 $\pm$ 2.54		17.17 $\pm$ 4.11		3.136 $\pm$ 0.58	
Major 15–21	14 (5.19)	10.5 $\pm$ 4.87		29.57 $\pm$ 3.03		13 $\pm$ 2.77		4.068 $\pm$ 0.91	
Burnout score			0.007		0.048		0.002		
No burnout (0–1.49)	6 (2.22)	16 $\pm$ 3.52		32.66 $\pm$ 3.61		23.66 $\pm$ 7.68			
Moderate burnout (1.5–3.49)	230 (85.19)	9.50 $\pm$ 4.16		28.89 $\pm$ 3.19		17.04 $\pm$ 4.04			
Severe burnout (3.5–6)	34 (12.59)	9.47 $\pm$ 3.88		29.14 $\pm$ 2.28		15.17 $\pm$ 4.00			

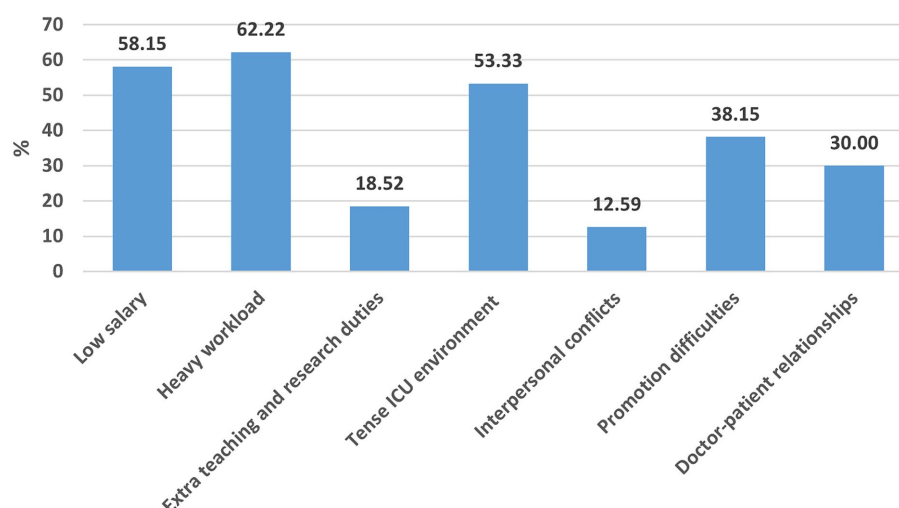


FIGURE 1

The main issues in the current job of ICU doctors and nurses, including heavy workload, low salary, tense ICU environment, promotion difficulties, doctor-patient relationships, extra teaching and research duties, and interpersonal conflicts, have been identified as key factors contributing to burnout.

TABLE 4 Knowledge dimension distribution.

Items	Very familiar, <i>n</i> (%)	Heard of it, <i>n</i> (%)	Unsure, <i>n</i> (%)
1. Occupational burnout is a syndrome caused by long-term work stress that cannot be effectively controlled.	37 (13.7)	186 (68.89)	47 (17.41)
2. Occupational burnout manifests as constant feelings of exhaustion or depletion, negativity or apathy towards work, and a sense of detachment, leading to decreased work efficiency.	40 (14.81)	194 (71.85)	36 (13.33)
3. Occupational burnout is closely associated with adverse mental health effects such as anxiety and depression.	47 (17.41)	184 (68.15)	39 (14.44)
4. Occupational burnout is related to physical health problems such as insomnia, anxiety, musculoskeletal disorders, and type 2 diabetes.	42 (15.56)	172 (63.7)	56 (20.74)
5. Healthcare workers are a high-risk group for occupational burnout.	70 (25.93)	169 (62.59)	31 (11.48)
6. Long working hours are the most common cause of occupational burnout.	72 (26.67)	171 (63.33)	27 (10)
7. Low salary, lack of autonomy at work, and an uncomfortable work environment can all lead to occupational burnout.	84 (31.11)	158 (58.52)	28 (10.37)
8. Occupational burnout can significantly impact workers' social and personal lives.	72 (26.67)	168 (62.22)	30 (11.11)
9. Occupational burnout can be improved by adjusting work-life balance or mindset.	50 (18.52)	174 (64.44)	46 (17.04)

TABLE 5 Attitude dimension distribution.

Items	Strongly agree, <i>n</i> (%)	Agree, <i>n</i> (%)	Neutral, <i>n</i> (%)	Disagree, <i>n</i> (%)	Strongly disagree, <i>n</i> (%)
1. I believe burnout is a very common problem.	94 (34.81)	133 (49.26)	38 (14.07)	5 (1.85)	/
2. I believe burnout is a very bad sign.	108 (40)	122 (45.19)	35 (12.96)	5 (1.85)	/
3. I am concerned about the health problems caused by occupational burnout.	129 (47.78)	116 (42.96)	20 (7.41)	5 (1.85)	/
4. I believe that ICU healthcare workers are more likely to experience occupational burnout compared to other departments.	125 (46.3)	106 (39.26)	32 (11.85)	6 (2.22)	1 (0.37)
5. I believe occupational burnout is an emotion that can be improved through self-regulation.	32 (11.85)	102 (37.78)	85 (31.48)	41 (15.19)	10 (3.7)
6. I believe that hospitals should take measures to reduce occupational burnout among ICU healthcare workers.	148 (54.81)	109 (40.37)	13 (4.81)	/	/
7. I am willing to learn more about occupational burnout.	70 (25.93)	154 (57.04)	40 (14.81)	4 (1.48)	2 (0.74)

TABLE 6 Practice dimension distribution.

Items	Always, <i>n</i> (%)	Often, <i>n</i> (%)	Sometimes, <i>n</i> (%)	Rarely, <i>n</i> (%)	Never, <i>n</i> (%)
1. I have attended training on burnout prevention.	3 (1.11)	14 (5.19)	41 (15.19)	100 (37.04)	112 (41.48)
2. I pay attention to my work status and emotions.	36 (13.33)	98 (36.3)	104 (38.52)	28 (10.37)	4 (1.48)
3. I will take measures in my daily life to improve the working environment and reduce work stress, such as regular work and rest and strengthening exercise.	28 (10.37)	64 (23.7)	112 (41.48)	58 (21.48)	8 (2.96)
4. After work, I have a fulfilling spare time life.	20 (7.41)	61 (22.59)	132 (48.89)	57 (21.11)	/
5. I will proactively seek psychological support and counseling to deal with burnout.	10 (3.7)	31 (11.48)	67 (24.81)	89 (32.96)	73 (27.04)
6. When I encounter something upsetting at work, I will actively express my opinions and try my best to change the environment.	15 (5.56)	56 (20.74)	107 (39.63)	80 (29.63)	12 (4.44)

TABLE 7 Correlation analysis.

	Knowledge dimension	Attitude	Practice	Burnout score
Knowledge dimension	1			
Attitude	0.4017 ($P < 0.001$)	1		
Practice	0.3118 ($P < 0.001$)	0.0495 ($p = 0.4177$)	1	
Burnout score	0.0131 ($p = 0.8303$)	0.1421 ($p = 0.0195$)	−0.2317 ($P < 0.001$)	1

interplay of individual and systemic factors in occupational burnout prevalence (30).

Notably, the study identifies demographic variables significantly influencing these aspects. For instance, married doctors and nurses and those with children reported higher knowledge and more positive attitude compared to their single, divorced, or widowed counterparts, aligned with previous finding (29). This could be attributed to possibly greater life experience and responsibilities, which might enhance their understanding and coping strategies concerning occupational stress, as familial responsibilities could heighten awareness and adaptive mechanisms against workplace stress (31).

Interestingly, higher educational attainment correlated with increased occupational burnout scores, particularly among those with a Master's degree or higher. This could reflect a scenario where higher educational levels are associated with greater work expectations and responsibilities, potentially leading to occupational burnout (32). Additionally, doctors scored higher in knowledge yet lower in practice compared to nurses, possibly due to the different nature of their job demands and training, which might emphasize diagnostic and theoretical knowledge over practical coping strategies.

Besides, our study revealed that higher levels of occupational burnout significantly impact the KAP related to occupational burnout among ICU doctors and nurses. Specifically, workers experiencing severe occupational burnout demonstrated lower knowledge and practice scores compared to those with partial or no occupational burnout. This suggests that as occupational burnout increases, the capacity to engage with and apply knowledge effectively diminishes, potentially due to cognitive overload or emotional exhaustion. Extensive weekly work hours were associated with higher knowledge scores yet also the highest occupational burnout scores, which could be a result of increased awareness due to direct exposure to stressors yet a concurrent inability to implement effective coping mechanisms due to time constraints.

During the pandemic has revealed that longer working hours correlate with significantly elevated occupational burnout and stress levels (33–35). Although extended hours may offer increased experience and knowledge, they paradoxically heighten the risk of occupational burnout through sustained exposure to stress. Physical exercise emerged as a significant protective factor, associated with better knowledge, improved practice, and lower occupational burnout scores. This aligns with the recommendations by Abdullah S et al., who suggest that physical activity and mindfulness training can be effective interventions for addressing occupational burnout (36). A systematic review involving 11,500 medical students from 13 countries demonstrates an association between physical activity and reduced burnout, as well as improved quality of life among medical students (37). Besides, yoga appears to be effective in the management of stress in doctors and nurses (38).

The results from our multivariate logistic regression, correlation analyses, and structural equation modeling collectively highlight the interconnected nature of KAP in influencing occupational burnout among ICU doctors and nurses. The logistic regression analysis suggests that enhanced knowledge facilitates more proactive practice, a finding echoed in broader healthcare literature, which consistently shows that better educational grounding leads to improved workplace behaviors (39). Similarly, correlation analyses in our study demonstrate a positive relationship between increased knowledge and both improved attitude and practice toward managing occupational burnout, underscoring a trend observed in other study where enhanced understanding directly affects both the emotional and practical responses to workplace stress (40). Further, the structural equation modeling results provide a nuanced view, illustrating that knowledge not only impacts attitude directly but also mediates the relationship between practice and occupational burnout,

TABLE 8 Univariate and multivariate analysis for practice dimension.

Practice	Univariate analysis		multivariate analysis	
	OR (95%CI)	<i>P</i>	OR (95%CI)	<i>P</i>
Knowledge score	1.25 (1.14,1.37)	<0.001	1.33 (1.18,1.50)	<0.001
Attitude score	1.11 (0.99,1.24)	0.062		
Gender				
Male				
Female	1.50 (0.69,3.24)	0.301		
Age (years old)	0.94 (0.89,1.00)	0.052		
Body mass index				
Lean				
Normal	1.00 (0.35,2.87)	0.988		
Overweight	0.56 (0.16,1.95)	0.37		
Obesity	0.4 (0.04,3.78)	0.424		
Education				
Junior College				
Bachelor's degree	0.55 (0.24,1.25)	0.155	0.75 (0.25,2.27)	0.618
Master's degree or above	0.20 (0.05,0.79)	0.022	0.67 (0.08,5.30)	0.709
Marital status				
Unmarried/Divorced/Widowed				
Married	0.53 (0.26,1.06)	0.074		
Do you already have children?				
No				
Yes	0.47 (0.23,0.97)	0.043	1.15 (0.37,3.55)	0.798
Job position				
Doctor				
Nurse	3.96 (1.59,9.86)	0.003	1.91 (0.45,8.00)	0.374
Monthly income (yuan)				
<7,000				
7,000–9,999	0.65 (0.28,1.48)	0.308		
10,000–19,999	0.50 (0.20,1.22)	0.13		
>20,000	0.23 (0.02,1.92)	0.177		
Years of working experience				
≤2 years				
3–10 years	0.47 (0.20,1.07)	0.074	0.44 (0.14,1.38)	0.16
11–20 years	0.30 (0.11,0.81)	0.019	0.25 (0.05,1.27)	0.096
≥21 years	0.21 (0.04,1.03)	0.056	0.15 (0.01,1.26)	0.082
Weekly working hours				
≤40				
41–48	0.63 (0.26,1.52)	0.306	1.33 (0.41,4.24)	0.626
49–56	0.31 (0.09,1.03)	0.057	0.73 (0.15,3.45)	0.702
≥57	0.16 (0.03,0.80)	0.026	0.44 (0.05,3.57)	0.443
Work night shifts				
Yes				
No	1.13 (0.48,2.65)	0.762		

(Continued)

TABLE 8 (Continued)

Practice	Univariate analysis		multivariate analysis	
	OR (95%CI)	<i>P</i>	OR (95%CI)	<i>P</i>
The average number of night shifts per month				
≤4				
4–10	0.65 (0.28,1.53)	0.332		
≥11	0.47 (0.20,1.11)	0.087		
Teaching tasks?				
Yes				
No	1.28 (0.64,2.59)	0.476		
Scientific research tasks				
Yes				
No	1.87 (0.78,4.46)	0.155		
Exercising habit				
Yes				
No	0.49 (0.23,1.04)	0.063		
Weekly exercise time				
1 h or less than 1 h				
1–3 h	0.49 (0.19,1.25)	0.139		
3–5 h	0.43 (0.13,1.48)	0.185		
Over 5 h				
Sleep disorders				
Frequent				
Occasionally	0.79 (0.34,1.86)	0.599	0.48 (0.16,1.40)	0.181
None	2.84 (1.21,6.62)	0.016	1.66 (0.55,5.01)	0.367
Weekly sleep duration (in hours)				
≤42				
43–49	0.45 (0.20,1.00)	0.051		
≥50	0.68 (0.27,1.68)	0.406		
Your satisfaction rating for the current job is	1.40 (1.13,1.73)	0.002	1.26 (0.98,1.63)	0.069
Depression score				
0–4				
5–9	0.31 (0.13,0.70)	0.005	0.42 (0.15,1.15)	0.094
10–14	0.51 (0.19,1.37)	0.185	0.75 (0.20,2.78)	0.671
15–19	0.20 (0.02,1.66)	0.139	0.60 (0.05,7.01)	0.686
Anxiety rating				
0–4				
Mild 5–9	0.48 (0.22,1.06)	0.072		
Moderate 10–14	0.96 (0.25,3.59)	0.952		
Severe 15–21				

suggesting that knowledge serves as a crucial lever in reducing occupational burnout through behavioral changes. These analyses together reinforce the notion that comprehensive, knowledge-based interventions are vital. They should aim not only at increasing awareness but also at actively changing how doctors and

nurses perceive and respond to stress, thereby fostering a more resilient workforce.

By utilizing the KAP framework, this study identifies specific knowledge gaps, particularly its psychological and physiological effects. Despite being healthcare providers, many still lack full

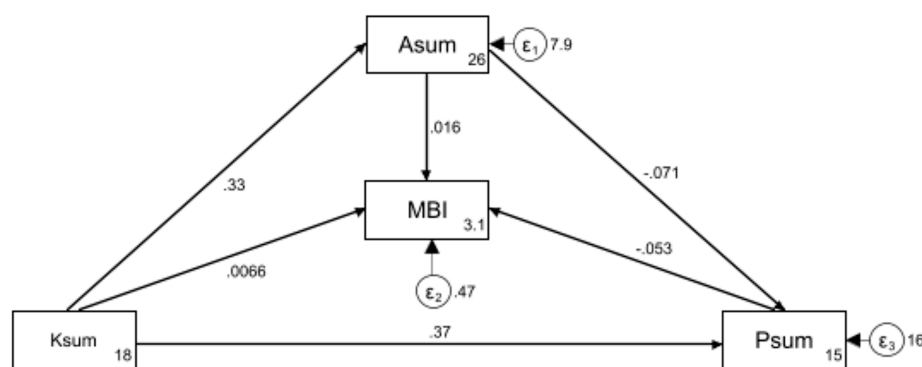


FIGURE 2

Structural equation modeling illustrating the direct and indirect relationships between knowledge (Ksum), attitude (Asum), practice (Psum), and occupational burnout (measured by MBI). Path coefficients indicate the strength and direction of these relationships, with arrows representing the paths between variables.

awareness of burnout's severe outcomes, highlighting the need for targeted educational interventions. While most professionals recognize burnout as common and harmful, many underestimate their ability to manage it. This gap between awareness and self-efficacy should be addressed to improve burnout prevention. Additionally, proactive burnout prevention practices are underutilized. Only 6.3% of participants received burnout prevention training, and just 5.19% sought psychological support. These findings suggest a lack of standardized approaches to managing burnout, even in hospitals with mental health services.

To effectively address the prevalent issue of occupational burnout among ICU doctors and nurses in China, a multifaceted strategy that leverages both technology and organizational support is essential. Developing an online education platform utilizing popular social media channels such as WeChat could provide accessible, engaging content that enhances understanding and management of occupational burnout (41, 42). This platform could feature interactive modules and real-time feedback mechanisms that allow workers to assess their occupational burnout levels and receive personalized coping strategies. Additionally, incorporating mental health support into existing digital communication tools could offer a confidential space for workers to seek professional advice and peer support. Organizational efforts should also focus on optimizing the work environment to reduce unnecessary stressors (43, 44). This could involve streamlining administrative processes and creating dedicated relaxation spaces within the hospital, equipped with amenities such as massage chairs and soothing music. In addition, providing gym or yoga studio memberships to healthcare workers as part of employee benefits could encourage active exercise habits, better managing stress and occupational burnout. Moreover, providing career development opportunities and educational subsidies can further empower healthcare workers by enhancing their professional skills and job satisfaction.

This study has several limitations. First, its cross-sectional design prevents the determination of causal relationships between variables. Additionally, this design captures data at a single point in time, which may not reflect the dynamic nature of occupational burnout that evolves over time due to individual, organizational, or external factors affecting ICU practice. Second, the study's reliance on self-reported data may introduce bias, as participants might overestimate their

knowledge or underreport their levels of occupational burnout. Third, while cross-sectional studies, including ours, inherently limit the ability to evaluate the effectiveness of interventions, this research provides unique insights into occupational burnout from the perspective of the KAP framework, which can serve as a basis for future intervention studies. Fourth, while the multiple data points have enabled us to identify possible links between variables, these findings may be closely tied to factors such as cultural norms or support networks, which require further exploration through qualitative methods. As the survey was conducted using electronic questionnaires, we were unable to determine the total number of individuals who were invited to participate. Therefore, the response rate could not be accurately assessed. Another limitation of this study is the potential response bias, as those experiencing burnout may be more likely to participate, potentially leading to overreporting of burnout and underreporting of related knowledge and practices. Finally, the focus on a single hospital limits the generalizability of the findings to other settings or regions. Despite these limitations, this study's strengths include a robust sample size and the use of validated instruments like the MBI-GS, which enhance the reliability of the findings. Additionally, the comprehensive analysis techniques, including correlation analysis, multivariate logistic regression, and structural equation modeling, provide a deep understanding of the factors influencing occupational burnout among ICU doctors and nurses. By applying the KAP framework, this study offers a unique perspective, addressing one aspect of burnout and laying the groundwork for targeted interventions. Future research should incorporate larger sample sizes and employ longitudinal study designs to capture the evolving nature of occupational burnout over time. Additionally, combining these approaches with qualitative methods could provide deeper insights into contextual factors such as cultural norms, organizational dynamics, and individual coping mechanisms, enhancing the understanding of occupational burnout among ICU doctors and nurses.

Conclusion

In conclusion, the majority of ICU doctors and nurses exhibit moderate levels of occupational burnout, with inadequate

knowledge but a generally positive attitude toward managing occupational burnout. This study underscores the direct and indirect impact of knowledge on practice and occupational burnout levels. Given the clear linkage between knowledge and proactive practice, it is crucial for healthcare institutions to enhance educational and training programs focused on occupational burnout prevention and management strategies among ICU workers.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Author contributions

XL: Data curation, Formal analysis, Writing – original draft, Writing – review & editing. DL: Data curation, Formal analysis, Writing – original draft, Writing – review & editing. HL: Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. LW: Data curation, Formal analysis, Software, Visualization, Writing – original draft, Writing – review & editing. YL: Data curation, Investigation, Writing – original draft, Writing – review & editing. YY: Data curation, Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2025.1480052/full#supplementary-material>

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EDITED BY

Mansoor Malik,
Johns Hopkins Medicine, United States

REVIEWED BY

Yaritza Perez-Soto,
Physicians Regional Medical Group,
United States
Thirimon Moe-Byrne,
University of York, United Kingdom
Luis Miguel Ferreira,
Escola Superior de Enfermagem do Porto,
Portugal

*CORRESPONDENCE

Jia Yao

✉ ldyy_yaoj@lzu.edu.cn

Wenbo Meng

✉ mengwb@lzu.edu.cn

[†]These authors have contributed equally to this work and share first authorship

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Enhancing patient satisfaction and reducing nurse workload: the impact of multimedia health education in a prospective single-center randomized controlled trial

Liping Yang^{1,2,3†}, Zilan Qin^{1,2,3†}, Jia Yao^{2,4*}, Huan Xu¹, Jinhui Tian^{2,5}, Yanxian Ren^{1,2,4†}, Haiping Wang^{1,2,4} and Wenbo Meng^{1,2,4*}

¹Department of General Surgery, The First Hospital of Lanzhou University, Lanzhou, Gansu, China, ²The First Clinical Medical School of Lanzhou University, Lanzhou, Gansu, China, ³School of Nursing, Lanzhou University, Lanzhou, Gansu, China, ⁴Gansu Province Key Laboratory of Biological Therapy and Regenerative Medicine Transformation, Lanzhou, Gansu, China, ⁵Evidence-Based Medicine Centre, Lanzhou University, Lanzhou, Gansu, China

Introduction: Health education is an important part of nursing care. Verbal health education is a common practice in surgical wards, which is time-consuming and laborious. Thus, this study aims to evaluate whether multimedia health education reduces nurses' workload without compromising patient and family satisfaction in a surgical context.

Methods: We conducted a parallel-group, prospective randomized controlled trial at the Hepatobiliary Surgery Institute of Lanzhou University's First Hospital between July 2019 and May 2022. Eligible patients (≥ 18 years) with general surgical conditions and acceptable for surgery were randomly assigned (1:1) to receive a multi-media health education group or a standard health education group. Randomization was performed by an independent statistician using a computer-generated randomization list. The nurses' workload and satisfaction were the main outcomes; the anxiety level of patients and the variables affecting nurse workload were the secondary outcomes.

Results: A total of 184 eligible participants were randomly assigned to receive multimedia health education and standard health education. The results showed that multimedia health education can shorten the time [15.21 (0.63) vs. 16.94 (3.96)] nurses spend on health education during patient admissions, the difference being statistically significant ($p < 0.001$), but it did not lower the satisfaction levels of nurses [73.46 (2.36) vs. 67.16 (5.52)], patients [53.35 (2.09) vs. 47.86 (5.00)], their families [53.35 (2.28) vs. 47.86 (4.53)] and doctors [73.33 (2.40) vs. 68.07 (4.92)] regarding health education ($p < 0.001$); in fact, it increased their satisfaction.

Conclusion: Multi-media health education could reduce nurses' workload and enhance patient satisfaction but not increase complications.

Clinical trial registration: <https://www.clinicaltrials.gov/>, identifier [NCT03989401].

KEYWORDS

multi-media health education, surgical patients, workload of nurses, patient's satisfaction, anxiety level

Introduction

Health education has become one of the most important aspects of nursing care. Nurses need to possess a wealth of medical knowledge to effectively execute health education while also fostering patient cooperation for treatment and care. Various studies (1, 2) have shown that surgical procedures often cause severe physical and mental stress to patients. This is the reason why many medical experts and clinical psychologists all over the world are interested in health education for perioperative patients (3). The fear, anxiety, and pain that patients experience during surgery, as well as other complications brought on by surgical trauma, can be significantly reduced by high-quality health education (4, 5).

Additionally, a significant component of nursing work in the medical management of patients is health education (6). Health education methods that address the perioperative needs of patients can not only pique their interest in the subject but also aid them in understanding the disease and receiving training in the healing process. This is crucial for the healing and also to avoid further complications (4, 7–9).

Currently, health education is primarily delivered in the department of surgery through face-to-face verbal guidance and communication, which is time-consuming and labor-intensive. Studies have shown that the increase in nurse workload not only poses a potential threat to nursing quality, but is also closely related to patient mortality, rescue failure rate, and hospital stay (10). Additionally, verbal instruction is influenced by the nurse's capacity for expression and acknowledgment (3, 6), and because patients vary in terms of age, gender, education level, emotional state, and physical conditions, their responses to the health education are different.

Multimedia health education is a health education model combined with audio-visual stimulation and patients' participation; it uses the combination of images, words and explanations to make it simpler for patients to understand and also makes health education knowledge more systematic and complete, avoids omissions, addresses patient concerns, and makes health education work procedural, standardized and specific (4, 5, 9, 11, 12). Multimedia health education can expand the scope of information dissemination, making it easier for patients and their families to access more health information. Audio-visual materials are characterized by scientific accuracy, engaging content, timeliness, practicality, and readability, which encourage patients to watch and learn. Moreover, these materials enable patients to relate the information to their own conditions and behaviors, thereby enhancing the effectiveness of health education (4, 5, 8, 9). Some studies (4, 5, 11, 12) have shown that multimedia health education can enhance patients' and family members' understanding of perioperative care, promote adequate preoperative preparation, and reduce the incidence of surgical cancelations. Additionally, preoperative multimedia education

contributes to positive surgical outcomes, significantly alleviates patient anxiety, improves satisfaction with medical services, and effectively reduces postoperative pain (13–15). Although there are some comparatively effective health education strategies (11–15) that are helpful for the management of perioperative patients, prevention of perioperative complications. Multimedia health education can enhance the effectiveness of verbal health education, making it easier for patients to consolidate, understand, and retain the educational content while reducing the time and frequency required for nurses to deliver education (14–17). However, whether this approach can be both easily and profoundly accepted by patients has become a topic worth exploring in the field of nursing.

In this prospective, single-center, randomized controlled trial, we aim to evaluate whether the application of multimedia health education reduces nurses' workload without compromising the satisfaction of surgical patients and their families in the surgical context.

Materials and methods

Ethical approval

The ethics committee of the First Hospital of Lanzhou University gave its approval to the research protocol (registry number: LDYYLL2019-203). Written informed consent was given by each patient or their legal representative. The trial was registered prior to patient enrollment at clinicaltrials.gov (NCT03989401, Principal investigator: Jia Yao, Date of registration: July 3, 2019).

Study design and participants

This study, which was carried out at the Hepatobiliary Surgery Institute of Lanzhou University's First Hospital, was a prospective randomized controlled trial with two arms (intervention group and control group), the intervention group received multimedia health education, while the control group received face-to-face oral health education. The following criteria were required for inclusion: (1) age between 18 and 75 years old; (2) general surgery diseases requiring surgical treatment; (3) education history of at least primary school level; (4) patients with clear awareness, be able to cooperate clinical data collection; (5) adequate communication ability; and (6) informed consent obtained. As exclusion criteria, we determined that patients with visual or hearing impairment, mental illness, dementia or other mental disorders, cardiac, brain or nephropathy complications, those unable to care for themselves, emergency or critically ill patients, and participants of prior studies would be excluded from the study.

Randomization

Patients were randomly assigned (1:1) to the multimedia health education intervention group or the control group (oral health education). An impartial statistician used a computer generated randomization list to perform the randomization. Office nurses used a series of sequentially numbered, sealed, and opaque envelopes to implement allocation. After the participants had finished the baseline assessment, the envelope was opened in front of them, and the patients were informed of their assignment. Satisfaction was assessed by clinical nurses who know the patient distribution.

Interventions

Multimedia health education

Except for multimedia health education, the participants in the intervention group received the same level of clinical care as those in the control group (standard general surgical nursing care). After the patient has finished the admission process, the clinical responsible nurses have brought patients and/or their family members into the ward, explained how to use the multimedia video player for health education, and turned on the television to play the video on admission. Other wards could not hear the video sound. The following topics are covered in the health education video: (1) hospital and ward environment; (2) primary clinical staff; (3) safety precautions; (4) preoperative planning; (5) visiting, ward round and leave system; (6) regular medical checkups and precautions; (7) dietary advice and precautions; (8) rehabilitation advice and precautions; (9) issues with medication knowledge and patient identification (4, 5, 9, 18–20). The health education video was filmed and produced by our research team in the research department. Nurses and doctors from the research team played the roles of doctors, nurses, and patients in the video, which has a total duration of 14 min. Additionally, the participants and their families should be advised to consult doctors or nurses if they have any doubts.

Standard health education

At the time of admission, trained clinical nurses conducted a face-to-face verbal health evaluation with the control group. The verbal health education had the same information as the video did, and the nurses also advised the participants to speak with the doctor or nurse if they had any questions.

Each participant who was placed in wards with only one bed was instructed not to share their admission health education with other patients in other wards in order to minimize the possibility of cross-contamination between the two groups of the trial. In addition, patients and their families can watch the video repeatedly.

Outcomes

The main outcomes were the workload of nurses on admission (the duration of health education per nurse, times of health education of nurse, inquiry times on health education content of patients and family members on the day of admission) and the

satisfaction of patients, families, doctors and nurses with health education. Patients, family members, doctors and nurses were required to fill in the satisfaction questionnaires within 24 h after admission.

The level of patient anxiety before and after receiving health education was a secondary outcome. Additional monitored parameters include the incidence of catheter slippage and pressure ulcers.

Statistical analysis

Based on the results of the prior studies (19, 20), the satisfaction of the intervention group is 98.22 ± 1.15 , while the satisfaction of the control group is 97.03 ± 2.49 . Thus, 184 participants were needed using the formula for a two-sample mean comparison, with a power of 90% and a two-sided α of 0.05.

Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as numbers and percentages. Tests of paired *t*-test, independent *t*-test, ANOVA, χ^2 test and Fisher's exact test were used to compare differences between groups. The Poisson regression model was used to analyze the related factors influencing the workload of health education on admission for nurses, and the results are presented as regression coefficient (β) with a 95% confidence interval [CI]. The multivariable model evaluated variables for which the *p*-value in the univariate analysis was less than 0.10. All tests were two-sided, and a *p* value of <0.05 was considered statistically significant. SPSS software (SPSS version 22.0) was employed for the analysis.

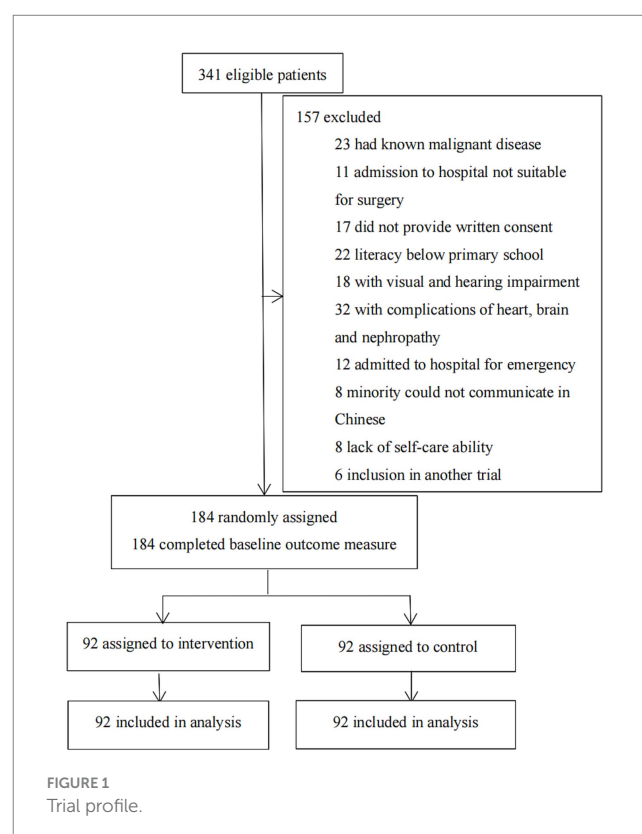


TABLE 1 Baseline demographics and clinical characteristics.

Variables	Intervention group (n = 92)	Control group (n = 92)	p
Age (years)	54.39 ± 13.27	53.71 ± 12.37	0.64
Sex, n (%)			0.88
Male	55 (59.8%)	54 (58.7%)	
Female	37 (40.2%)	38 (41.3%)	
Height (cm), mean (SD)	167.85 ± 7.84	170.00 ± 7.74	0.41
Weight (kg), mean (SD)	65.28 ± 10.14	68.20 ± 10.84	0.06
Nation			0.52
Hans	88 (50.6%)	86 (49.4%)	
Minority	4 (49.4%)	6 (50.6%)	
Occupation, n (%)			0.34
Unemployed	5 (5.4%)	4 (4.3%)	
Retiree	23 (25.0%)	17 (18.5%)	
Worker	9 (9.8%)	5 (5.4%)	
Farmer	23 (25.0%)	24 (26.1%)	
Private owner	9 (9.8%)	9 (9.8%)	
Government employee	21 (22.8%)	33 (35.9)	
Student	2 (2.2%)	0 (0.0%)	
Educational Level, n (%)			0.23
Below junior high school	37 (40.2%)	25 (27.2%)	
High school or technical secondary school	11 (12.0%)	20 (21.7%)	
Junior college	28 (30.4%)	27 (29.3%)	
Bachelor's degree or above	16 (17.4%)	20 (21.75%)	
Diagnosis, n (%)			0.76
Intestinal disease	1 (1.1%)	1 (1.1%)	
Biliary Tract Diseases	44 (44.7%)	50 (54.3%)	
Liver Diseases	8 (8.7%)	4 (4.3%)	
Cancer	29 (31.5%)	28 (30.4)	
Gastric diseases	1 (1.1%)	1 (1.1%)	
Pancreatic Diseases	4 (4.3%)	6 (6.5%)	
Other	5 (5.4%)	2 (2.2%)	
Patients' anxiety level on admission, mean (SD)	43.47 ± 11.39	43.77 ± 13.09	0.87
Marital status, n (%)			0.16
Unmarried	3 (3.3%)	0 (0.0%)	
Married	87 (94.6%)	88 (95.7%)	
Divorced (Widowed)	2 (2.2%)	4 (4.3%)	
Atopy history, n (%)			1.00
Yes	12 (13.0%)	12 (13.0%)	
No	80 (87.0%)	80 (87.0%)	
Past medical history, n (%)			0.42
Yes	24 (26.1%)	29 (31.5%)	
No	68 (73.9%)	63 (68.5%)	
Operation method, n (%)			0.42
Minimally Invasive Surgery	62 (67.4%)	67 (72.8%)	

(Continued)

TABLE 1 (Continued)

Variables	Intervention group (<i>n</i> = 92)	Control group (<i>n</i> = 92)	<i>p</i>
Open surgery	30 (32.6%)	25 (27.2%)	0.66
Medical payment method, <i>n</i> (%)			
Urban employees' basic medical insurance	51 (55.4%)	57 (62.0%)	
Medical insurance for rural residents	31 (33.7%)	27 (31.5%)	
Commercial insurance	10 (10.9%)	8 (8.7%)	0.61
Living environment, <i>n</i> (%)			
City	68 (73.9%)	71 (77.2%)	
Countryside	24 (26.1%)	21 (22.8%)	
Family income (yuan/month), <i>n</i> (%)			0.82
≤3,000	13 (14.1%)	15 (15.8%)	
3,000–5,000	20 (21.7%)	17 (20.1%)	
≥5,000	59 (64.1%)	60 (64.1%)	
Number of caregivers (person), <i>n</i> (%)			0.31
1	74 (80.4%)	79 (85.9%)	
2	18 (19.6%)	12 (13.0%)	
3	0 (0.0%)	1 (1.1%)	
Age of caregivers (years), <i>n</i> (%)			0.40
≤29	4 (4.3%)	9 (9.8%)	
30–39	23 (25.0%)	23 (25.0%)	
40–49	36 (39.1%)	38 (23.9%)	
≥50	29 (31.5%)	22 (23.9%)	

Results

From July 29, 2019, to June 1, 2022, 341 consecutive patients who were admitted to the Hepatobiliary Surgery Institute at the First Hospital of Lanzhou University were evaluated for eligibility. Following the screening, 157 patients were disqualified (Figure 1). 184 patients who were left were split evenly (1:1) between the multimedia health education group and the standard health education group. The baseline characteristics of the two groups were similar ($p > 0.05$; Table 1). In the intervention group ($n = 30$, 32.6%) more patients underwent open surgery than in the control group ($n = 25$, 27.2%). Additionally, since February 2020, in order to cooperate with the national COVID-19 prevention and control policy, the one-on-one escort system has been strictly implemented in the ward, except in special cases.

The findings revealed that using multimedia health education can shorten the time nurses spend on health education during patient admissions [15.21 (0.63) vs. 16.94 (3.96), $p < 0.001$] and reduce the number of times patients and their families spend seeking health education information [1.21 (0.62) vs. 2.73 (0.92), $p < 0.001$]. Additionally, the control group's nurses had to repeatedly explain admission related information to the patients and their families [3.25 (0.89) vs. 1.21 (0.62), $p < 0.001$].

To create satisfaction questionnaires, previous research was consulted (18–20). A team of four experts with backgrounds in

medicine, nursing, psychology and outcome measurement evaluated the questionnaires before they were used in the trial. The questionnaire of patients and their families consisted of 11 questions with a total score ranging from 11 (dissatisfaction) to 55 (high satisfaction). The Cronbach's coefficient (α) of this questionnaire was 0.927, expert validity (scale-level content validity index) was 0.93, and Kaiser Meyer Olkin (KMO) was 0.929 (See Supplementary 1). The satisfaction questionnaire for doctors and nurses consisted of 15 questions with a total score ranging from 15 (dissatisfaction) to 75 (high satisfaction). The Cronbach's coefficient (α) of this questionnaire was 0.915, expert validity (scale-level content validity index) was 0.95, and Kaiser Meyer Olkin (KMO) was 0.886 (See Supplementary 2). The results of satisfaction scores showed that use of multimedia health education did not lower the satisfaction levels of patients [53.35 (2.09) vs. 47.86 (5.00), $p < 0.001$], family members [53.35 (2.28) vs. 47.86 (4.53), $p < 0.001$], nurses [73.46 (2.36) vs. 67.16 (5.52), $p < 0.001$] and doctors [73.33 (2.40) vs. 68.07 (4.92), $p < 0.001$] regarding health education (Table 2).

The Zung Self-Rating Anxiety Scale (SAS) (21) was used to assess patient anxiety levels before and after receiving health education (See Supplementary 3). This scale has high internal consistency in this study sample ($\alpha = 0.92$, 95% CI 0.88–0.95). At admission, there was no difference in anxiety scores between the two groups [43.47 (11.39) vs. 43.77 (13.09), $p = 0.87$]. The anxiety scores of the two groups

TABLE 2 Main outcomes of health education on admission.

Variables	Intervention group	Control group	<i>p</i>
The duration of health education on the day of admission per nurse (min), mean (SD)	15.21 ± 0.63	16.94 ± 3.96	<0.001
Times of health education for patients on the day of admission, mean (SD)	1.21 ± 0.62	3.25 ± 0.89	<0.001
Inquiry times on health education content of patients' family members, mean (SD)	1.21 ± 0.62	2.73 ± 0.92	<0.001
Satisfaction scores of nurses about health education, mean (SD)	73.46 ± 2.36	67.16 ± 5.52	<0.001
Satisfaction scores of patients about health education, mean (SD)	53.35 ± 2.09	47.86 ± 5.00	<0.001
Satisfaction scores of family members about health education, mean (SD)	53.35 ± 2.28	47.86 ± 4.53	<0.001
Satisfaction scores of doctors about health education, mean (SD)	73.33 ± 2.40	68.07 ± 4.92	<0.001

decreased following health education, but there was no statistically significant difference between the two groups [9.20 (6.20) vs. 7.76 (6.50), $p = 0.13$]. According to subgroup analysis, there was a statistically significant difference between anxiety scores of male patients before and after health education [9.40 (6.19) vs. 6.07 (4.31), $p < 0.001$], junior college students [9.89 (6.38) vs. 6.55 (4.46), $p = 0.03$], and patients having open surgery [9.27 (6.97) vs. 5.52 (6.00), $p = 0.041$] (Table 3).

Additionally, multimedia health education does not raise the frequency of adverse events in comparison to standard health education ($p > 0.05$; Table 4).

The results of a univariate analysis indicated that factors influencing nurses' workload include nation [95% CI: 0.00–0.82, $p = 0.048$], high school or technical secondary school education [95% CI: 0.07–0.64, $p = 0.014$], sequence of patients of the admission day [95% CI: 0.03–0.23, $p = 0.013$] and healthy education methods [95% CI: 1.12–1.68, $p < 0.0001$]. The results of multivariate regression analysis revealed that factors influencing nurses' workload included healthy education method [95% CI: 1.09–1.67, $p < 0.0001$]. Patients who received oral health education had 1.38 more inquiries than those who received multimedia health education (Table 5).

In a subgroup analysis, doctors, nurses, patients and their families were found to be more satisfied with senior nurse health education ($p < 0.001$; Figures 2, 3). However, there was no significant difference in the duration of health education between nurses with high seniority and those with low seniority ($p = 0.20$). Senior nurses took less time than junior nurses to complete health education for patients and to inquire about the health education of patient family members ($p < 0.001$; Figure 4). The satisfaction with nurse health education was also higher among patients and their families who had been hospitalized earlier in the same shift (Figure 5).

Discussion

Health information sharing with patients is an important component of treatment plans, which is required and obligated. This information must also be clear, impartial and appropriate. The focus of information must be on the serious risks associated with interventions, any potential alternative strategies and the effects of rejection (22).

Postoperative complications and patient anxiety levels can be decreased with good health education (4, 13, 14, 23, 24). However,

whether multimedia health education can significantly reduce the workload of nurses has not been studied yet. In our study, we found that using multimedia health education can shorten the time nurses spend on health education during patient admissions and reduce the number of times patients and their families spend seeking health education information ($p < 0.001$). Our study's results were consistent with the results of Chang et al.'s study (25) that fewer hours were spent by nurses on health education for the multimedia CD group in comparison with the printed material group. Furthermore, the use of multimedia health education did not lower the satisfaction levels of doctors, nurses, patients, and their families regarding health education; in fact, it increased their satisfaction ($p < 0.001$). Most surgical patients experience varying degrees of psychological stress during the perioperative period (26, 27); good health education can significantly reduce the perioperative patient fear and pain caused by surgical trauma and achieve disease prevention (27–29), as evidenced by high satisfaction scores of patients in the multimedia video health education group. Our study's findings align with previous research (18, 19), indicating that alternative health education approaches tend to outperform oral health education in terms of patient satisfaction.

In our study, we discovered that the anxiety level of patients included in the study was low and that there was no significant change in the anxiety score following health education ($p = 0.13$). The results of this study were different from the results of Wang Y et al.'s study (14), mainly because patients with serious complications were excluded from this study. However, when compared to female patients, the anxiety score of male patients improved more significantly in the multimedia group ($p < 0.001$). This might be the case because stress may affect male and female brains differently. Furthermore, we discovered that patients with open surgery and a junior college degree experienced a greater reduction in anxiety scores ($p < 0.05$), which was statistically significant as compared to the control group.

Medical management includes health education as a crucial component. The use of patient-needs-oriented health education techniques during the perioperative period can not only increase patient interest in health education but also improve their level of disease management (16, 30–34). Our study demonstrated that the incidence of complications was not increased by multimedia health education. The main reason was that the video presentation was easier to understand than the straightforward verbal presentation. Patients can learn more about the process (31) by participating in multimedia health education and by developing disease self-management abilities (32).

TABLE 3 Anxiety levels before and after health education on admission.

Variables	Intervention group			Control group		
	Before	After	B-A	p	before	after
Total anxiety level	43.47 ± 11.39	34.27 ± 12.46	9.20 ± 6.20	<0.001	43.77 ± 13.09	36.01 ± 13.80
Sex				0.70		
Male	44.84 ± 11.60	35.44 ± 12.51	9.40 ± 6.19		43.63 ± 13.96	37.56 ± 14.38
Female	41.43 ± 10.92	32.54 ± 12.36	8.89 ± 6.28		43.97 ± 11.93	33.82 ± 12.81
Educational Level				0.75		
Below junior high school	45.84 ± 11.65	36.57 ± 13.26	9.27 ± 6.60		43.04 ± 9.83	33.76 ± 11.83
High school or technical secondary school	46.82 ± 12.72	39.36 ± 13.92	7.45 ± 5.30		46.50 ± 14.12	39.75 ± 13.82
Junior college	42.43 ± 10.74	32.54 ± 11.70	9.89 ± 6.38		42.41 ± 13.79	35.85 ± 14.20
Bachelor's degree or above	37.50 ± 9.14	28.50 ± 8.42	9.00 ± 5.76		43.80 ± 15.11	35.30 ± 16.09
Living environment				0.99		
City	42.28 ± 10.55	33.09 ± 11.16	9.19 ± 6.15		43.63 ± 13.85	36.31 ± 14.17
Countryside	46.83 ± 13.16	37.63 ± 15.35	9.21 ± 6.46		44.24 ± 10.41	35.00 ± 12.75
Operation method				0.94		
Minimally Invasive Surgery	39.77 ± 8.94	30.61 ± 9.69	9.16 ± 5.85		42.52 ± 11.88	33.93 ± 12.52
Open surgery	51.10 ± 12.23	41.83 ± 14.22	9.27 ± 6.97		47.12 ± 15.68	41.60 ± 15.71

Before: Patient's anxiety level before health education; After: Patient's anxiety level after health education; B-A: Before-After.

TABLE 4 Adverse events during hospitalization.

Variables	Intervention group	Control group	p
Incidence of catheter slippage, n (%)			1.00
Yes	1 (1.1%)	2 (2.2%)	
No	91 (98.9%)	90 (97.8%)	
Incidence pressure ulcer, n (%)			1.00
Yes	0 (0.0%)	1 (1.1%)	
No	92 (100%)	91 (98.9%)	

There may be significant differences in the content and outcomes of nurse education at various levels as a result of differences in the professional level, language expressive ability and emotional communication ability of nurses (5, 6). Additionally, because senior nurses have more clinical experience than junior nurses (6), our study found that doctors, nurses, patients and their families were more satisfied with the health education provided by senior nurses in the control group than by junior nurses.

Our study also found that with the increase of patients in the same shift, the satisfaction score of patients and their families gradually decreased, which may be related to nurse compassion fatigue and patience consumption. In addition, our study also found that the health education methods were the influencing factors of nurse health education workload. The effect of health education on other postoperative outcomes and the influencing factors of nurses' workload are subjects suitable for future research.

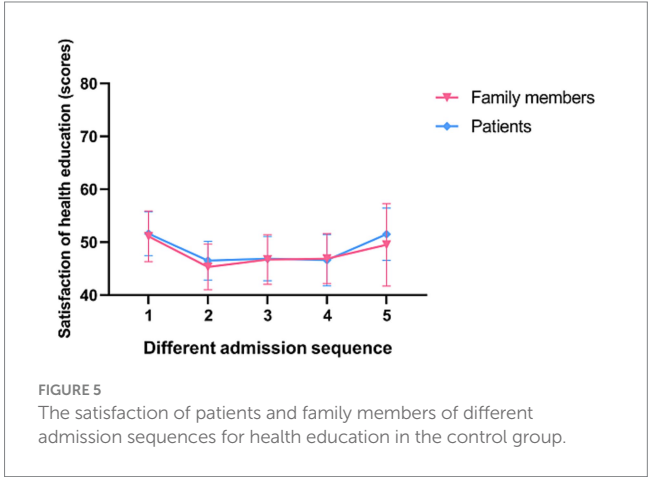
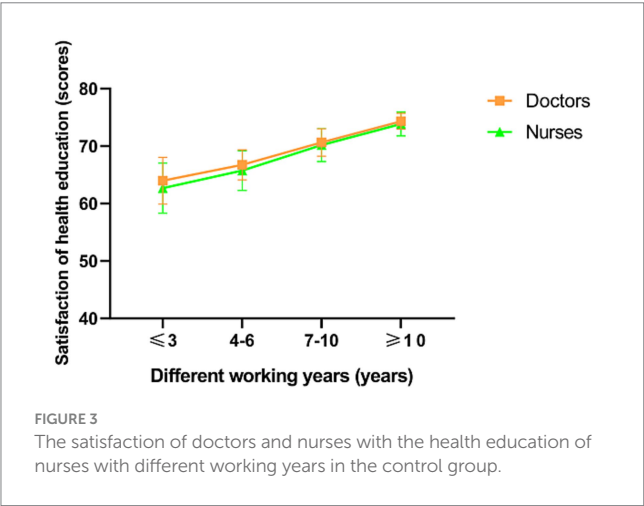
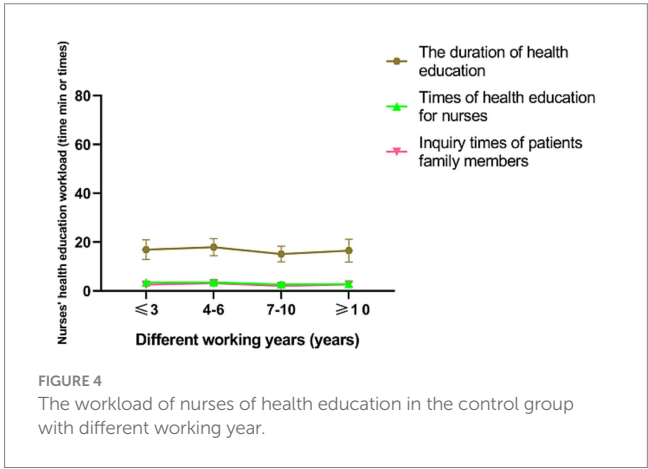
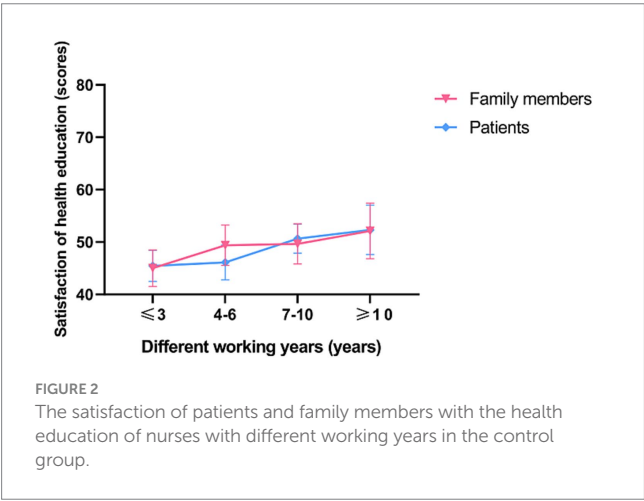
The implementation of Enhanced recovery after surgery (ERAS) protocols in surgical wards requires patients and their families to have a profound theoretical understanding of the essence of ERAS. Multimedia video health education can enhance patients' awareness and comprehension of ERAS, thereby improving their qualification rate of ERAS knowledge. Furthermore, this educational approach can elevate patients' recovery speed and quality to a higher level. In addition, the scarcity of nursing human resources is a prevalent issue faced by most countries presently. Exploring how to address the shortage of nursing personnel through the utilization of information technology, without compromising patients' healthcare experiences, constitutes a significant area of research. This study provides a reference basis for the practice of the above clinical measures.

Our study also had limitations. The main limitations of this study were as follows: (1) no multicenter study was conducted, and no information based health education was adopted for medical patients; (2) no specific health education methods were implemented for the different diseases and populations; (3) the research results of this study are not reproducible as they require consideration of specific periods in specific countries, the characteristics of the hospital's level.

In conclusion, our randomized trial demonstrated that multimedia health education could reduce the workload of nurses and enhance patient satisfaction, but not increase complications. It is worth promoting and applying in clinical nursing work.

TABLE 5 Poisson regression analysis of the influence factors of the health education workload on admission.

Variables	Univariable analysis			Multivariable analysis		
	Coefficients	95%CI	p	Coefficients	95%CI	p
Age	0.00	−0.01, 0.01	0.899			
Sex (male vs. female)	0.09	−0.14, 0.32	0.449			
Nation (Minority vs. Hans)	0.41	0.00, 0.82	0.048	0.42	−0.03, 0.86	0.068
Educational level						
Below junior high school	0			0		
High school or Secondary Special School	0.35	0.07, 0.64	0.014	0.25	−0.06, 0.56	0.109
College degree and above	0.21	−0.06, 0.49	0.128	0.13	−0.16, 0.43	0.382
Past medical history	0.14	−0.09, 0.38	0.232			
Operation method(Open vs. Minimally Invasive)	0.04	−0.20, 0.28	0.763			
Medical payment method(medical insurance vs. Self funded)	−0.05	−0.41, 0.32	0.793			
Living environment(Countryside vs. City)	0.12	−0.13, 0.37	0.328			
Age of caregivers						
≤29	0					
30–39	−0.33	−0.77, 0.10	0.135			
40–49	−0.23	−0.64, 0.18	0.277			
≥50	−0.23	−0.66, 0.19	0.283			
Nurses' work years	−0.01	−0.03, 0.01	0.212			
Sequence of patients on the admission day	0.13	0.03, 0.23	0.013	−0.03	−0.14, 0.08	0.641
Healthy education methods	1.40	1.12, 1.68	<0.0001	1.38	1.09, 1.67	<0.0001



Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the First Hospital of Lanzhou University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LY: Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – original draft. ZQ: Investigation, Writing – original draft. JY: Conceptualization, Investigation, Methodology, Supervision, Validation, Visualization, Writing – review & editing. HX: Investigation, Writing – original draft. JT: Investigation, Project administration, Writing – review & editing. YR: Investigation, Writing – review & editing. HW: Formal analysis, Investigation, Writing – review & editing. WM: Conceptualization, Investigation, Methodology, Supervision, Validation, Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2025.1400061/full#supplementary-material>

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EDITED BY

Ryuji Furihata,
Kyoto University, Japan

REVIEWED BY

Semra Bulbuloglu,
Istanbul Aydın University, Türkiye
Carol Nash,
University of Toronto, Canada

*CORRESPONDENCE

Yaoqin Lu
✉ lyq_superior@163.com

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Association of work ability with job burnout and sleep quality among biosafety laboratory personnel in Xinjiang, China: a cross-sectional study

Keke Ju¹, Ruikai Wu², Jing Yu², Lei Ding³, Mengjie Xia⁴,
Jiwen Liu² and Yaoqin Lu^{4*}

¹Shaanxi Provincial People's Hospital, Xi'an, Shanxi, China, ²School of Public Health, Xinjiang Medical University, Ürümqi, China, ³The Scientific and Educational Department of the Health Commission of the Autonomous Region, Ürümqi, China, ⁴Urumqi City Center for Disease Control and Prevention, Ürümqi, China

Background: In recent years, the importance of biosafety research has garnered significant attention due to its critical implications for public health and safety. Biosafety Laboratory (BSL) personnel face numerous challenges as they work with high-risk pathogens, including high-pressure environments, stringent safety protocols, and the risk of infection. Research indicates that occupational stress and burnout significantly affect the physical and mental well-being of laboratory personnel, potentially diminishing their work efficiency and capabilities. This study aims to investigate the effects of occupational burnout and sleep quality on the work ability of BSL personnel in Xinjiang, ultimately providing valuable insights for enhancing biosafety and improving work efficiency.

Methods: In July 2022, a cluster sampling method was employed to survey the staff of BSL in Xinjiang. The study utilized the Maslach Burnout Inventory, the Pittsburgh Sleep Quality Index, and the Work Ability Index to assess the levels of occupational burnout, sleep quality, and work ability among the BSL personnel. Statistical analyses were performed using R Studio 4.2.2 and AMOS 26.0. Through t-tests, analysis of variance, and logistic regression analyses, the study explored the current status and influencing factors of work ability among Xinjiang BSL personnel, as well as the interactive and mediating effects of occupational burnout and sleep quality on work ability.

Results: The prevalence of occupational burnout was 67.4%, while the prevalence of sleep disorders was 38.9%. Interaction analysis revealed that BSL personnel experiencing both occupational burnout and sleep disorders faced a risk of impaired work ability 21.43 times greater than those without burnout and with good sleep quality (OR = 21.43, 95%CI: 14.30–32.12). Structural equation modeling indicated that occupational burnout indirectly impacts work ability through its effect on sleep quality. The indirect effect was significant with a path coefficient of $\beta = -0.28$ (0.64×-0.43), $p < 0.01$.

Conclusion: The overall work ability of staff in BSL in Xinjiang is relatively good. Occupational burnout and sleep quality are significant risk factors affecting the work ability of BSL personnel. Improving occupational burnout and sleep quality can enhance the work ability of BSL personnel both directly and indirectly.

KEYWORDS

biosafety laboratory personnel, occupational burnout, sleep quality, work ability, relationship

Introduction

In recent years, biosafety research has garnered widespread attention as a critical area for safeguarding public health and safety. Biosafety Laboratory (BSL) serve as facilities for conducting experiments with highly pathogenic microorganisms (1). The primary functions of these laboratories include: pathogen research, which involves studying various pathogens (such as bacteria, viruses, fungi, and parasites) to understand their characteristics, pathogenic mechanisms, and modes of transmission (2); vaccine and drug development, aimed at creating new vaccines and treatments to prevent or cure diseases caused by these pathogen (3); and biomarker research, which focuses on discovering and validating biomarkers for early disease diagnosis and prognosis assessment (4). The work conducted in BSL is crucial for protecting human health and the environment, particularly when dealing with high-risk pathogens. However, BSL personnel face significant occupational stress from multiple sources, primarily due to their complex responsibilities and stringent biosafety regulations. They must manage various high-risk tasks while adhering strictly to biosafety standards, which poses challenges to their mental and physical health. Brandon Djukic's research reveals a continuous rise in burnout among laboratory technicians. Since 2010, stress levels have significantly increased, with a nearly 2018% rise, while emotional exhaustion has risen by 14%. This trend highlights the potential impact of the work environment on the mental health of technicians and underscores the urgent need for attention (5).

In modern society, stress is widely recognized as a significant factor affecting psychological health. Workplace stress is nearly unavoidable due to the demands of the work environment. Across various professional groups, such as teachers (6), nurses (7), and doctors (8), there is a documented positive correlation between occupational stress and burnout. Occupational burnout is a condition resulting from factors such as job stress, which leads to changes in psychological and health states that deviate from normal functioning (9). Maslach describes burnout as a multidimensional state characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment (10). Burnout not only negatively impacts workers' mental and physical health but also severely impairs their work performance (11). Research indicates that severe burnout is closely related to sleep quality, with dissatisfaction with sleep patterns linked to emotional exhaustion and depersonalization among healthcare workers (12). Due to the unique nature of laboratory work, including high stress and irregular working hours, BSL (Biosafety Level) personnel are often at risk of diminished sleep quality. Poor sleep can lead to fatigue, reduced concentration, and slower reaction times, thereby negatively affecting work efficiency and quality.

At the 12th meeting of the Central Committee for Comprehensive Deepening Reform held in February 2020, General Secretary Xi Jinping explicitly stated that biosafety should be incorporated into the national security system. He emphasized the systematic planning of national biosafety risk prevention and control, as well as the development of a governance system, to comprehensively enhance the country's biosafety governance capabilities. This policy addresses the

weaknesses in the national biosafety system, aligns with public sentiment and social concerns, and plays a significant role in maintaining world peace. However, despite the gradual strengthening of biosafety measures, infections in biological laboratories continue to occur occasionally. According to relevant studies, these laboratory infection incidents are largely caused by human factors (13, 14). For instance, when laboratory staff encounter events such as infectious liquid spills or needle punctures, improper handling measures or irregular operations can potentially increase the risk of inhalation or contact infections (15).

Since the 19th century, incidents of laboratory-acquired infections have been frequently reported. Reports on accidents involving human pathogens and toxins in Canadian laboratories from 2016 to 2022 indicate that the root causes of exposure incidents are primarily related to standard operating procedures (n=211, 24%), human factors (n=183, 21%), and equipment issues (n=114, 13%) (16) or instance, in 1956, a laboratory in the former Soviet Union experienced an incident where nine ampoules containing Venezuelan equine encephalitis virus-infected mouse brains were broken. The incident was not managed according to the appropriate accident response protocols, resulting in 24 staff members were infected. In 1961, a laboratory in Moscow engaged in hemorrhagic fever research accidentally exposed wild mice from an epidemic area to the indoor environment due to operational errors, leading to aerosolized hemorrhagic fever virus contamination of the air and causing 113 laboratory staff infections and illnesses. Between 2003 and 2004, Singapore and Taiwan experienced laboratory leaks of Severe Acute Respiratory Syndrome (SARS) virus, leading to infections among laboratory personnel and sparking global concern over biosafety issues (17).

Therefore, the work capability of laboratory personnel is directly related to the safety of the laboratory. Evaluating staff work capability is crucial for preventing laboratory-acquired infections during public health emergencies. This study aims to investigate the levels of occupational burnout and sleep conditions among BSL personnel in various regions of Xinjiang, and to explore the impact of psychological health on the work performance of BSL employees. By conducting this research, we seek to gain a comprehensive understanding of the occupational health status of BSL personnel, thereby providing scientific evidence and new insights for improving work efficiency and enhancing biosafety measures.

The main innovations of this study are reflected in three aspects: Firstly, this research investigates the occupational mental health status of biosafety laboratory personnel in Xinjiang, filling a gap in the existing literature regarding the psychological health of this specific occupational group, both domestically and internationally, and highlighting the mental health issues faced by workers in the biosafety field within this unique context. Second, the study explores the potential benefits of assessing the mental health of biosafety laboratory personnel, emphasizing the impact of mental health improvement on individual work performance and the overall safety of the laboratory, thereby providing theoretical support for the development of occupational health intervention measures. Finally, this research employs innovative methodologies, including structural equation modeling and additive interaction analysis, to delve into the effects of

occupational burnout and sleep quality on work capacity. Through path analysis, it reveals the interaction effects between these two factors, offering new insights into understanding this complex relationship and serving as an important reference for future research in related fields.

Methods

Participants and procedure

In July 2022, this study conducted a cluster sampling survey of Biosafety Level (BSL) personnel in the Xinjiang region. The participants included staff from disease control centers, hospital laboratories, and nucleic acid testing facilities, covering four prefecture-level cities, five districts, and five autonomous prefectures in Xinjiang. Before the survey commenced, we provided participants with a detailed explanation of the study's purpose and invited them to voluntarily complete the questionnaire via the "Wenjuanxing" platform¹. Trained personnel with relevant medical and psychological knowledge offered centralized guidance to respondents through the platform. Prior to the survey, we clarified the objectives, content, and requirements of the study to the participants, ensuring their understanding of the questionnaire's nature, which encompassed occupational mental health and work capability. This study emphasized that participation was entirely voluntary, and participants had the right to withdraw at any time without affecting their work or training in the laboratory. Furthermore, we assured participants that their personal information and responses would be kept strictly confidential and used solely for research purposes, with no disclosure to third parties. To ensure the validity of the data, we excluded questionnaires with a completion rate below 100%, as well as those containing irregular, patterned, or obviously fraudulent responses.

The reasons for selecting cluster sampling are as follows: First, representativeness. This study was conducted during a biosafety training period for biosafety laboratory personnel, which effectively covered participants from multiple laboratories across Xinjiang, ensuring demographic diversity and representativeness of the sample and reflecting the overall mental health and work capability status of the workforce. Second, efficiency. Cluster sampling is relatively time and resource-efficient, especially when dealing with a dispersed and numerous laboratory workforce. Collecting data during a centralized meeting allows for the rapid acquisition of a large number of valid samples. Lastly, environmental consistency. By conducting the survey in the same training session, we ensured that participants completed the questionnaires in similar contexts and situations, thereby reducing the interference of external variables on the results and enhancing the internal validity of the study.

The inclusion criteria were as follows: (1) current employees working in BSL environments; (2) Individuals aged over 18 years with more than 1 year of experience in Biosafety Level (BSL) work and without a history of psychoactive substance use; (3) individuals who understood the purpose of the study and voluntarily participated. A total of 1930 BSL personnel members were invited to complete the

questionnaire, with 1933 responses actually received. Three responses with irregular answers were excluded. Ultimately, 1930 participants were included in the study, resulting in a response rate of 97.4%. The study was approved by the Ethics Committee of the Urumqi Center for Disease Control and Prevention (Approval No. 20201125).

Measures

Respondent information investigation

The Respondent Information investigation included 14 demographic and job-related variables, including gender, the level of BSL, age, education level, working years, professional title, marital status, monthly income (in RMB), shift work, chronic diseases (hypertension, coronary heart disease, diabetes), exercise frequency (per week).

Job burnout investigation

The Maslach Burnout Inventory-General Survey (MBI-GS) was developed by Maslach and Jackson (10, 18) in 1981 to assess the degree of occupational burnout by measuring emotional exhaustion, depersonalization, and depersonalization in the work environment. This study uses the Chinese version of the MBI-GS scale, which consists of 15 items and covers three dimensions: emotional exhaustion (EE, five items), depersonalization (four items) and Reduced Personal Accomplishment (six items). Each item on the scale is measured using a 7-point Likert scale, ranging from 0 ("Never") to 6 ("Always"). The total score is calculated as follows: Total Score = $0.4 \times \text{Mean Emotional Exhaustion (EE)} + 0.3 \times \text{Mean Reduced Personal Accomplishment (CY)} + 0.3 \times \text{Mean Reduced Personal Accomplishment (PA)}$. A total score ranging from 0 to 1.49 indicates no burnout, 1.50 to 3.49 indicates mild to moderate burnout, and 3.50 to 6 indicates severe burnout (19, 20). The Cronbach's alpha coefficient of the scale in this study is 0.833, indicating good reliability.

Sleep quality investigation

Pittsburgh Sleep Quality Index (PSQI) was developed by (21) to assess retrospective sleep quality and sleep disturbances over the past month. It comprises seven dimensions of sleep quality, covering the following aspects: including the subjective sleep quality, sleep latency, sleep continuity, habitual sleep efficiency, sleep disorders and hypnotic drugs, daytime function seven factors. The total score is the sum of the scores from the seven dimensions, ranging from 0 to 21. According to domestic standards (22), a cumulative score greater than 7 indicates the presence of sleep problems. In this study, the Cronbach's alpha coefficient for this scale is 0.872, indicating good reliability.

Reasons for Choosing the Pittsburgh Sleep Quality Index (PSQI) as the Sleep Quality Assessment Tool in this study:

- 1 Wide Applicability: The PSQI is an internationally recognized tool for evaluating sleep quality, having undergone extensive empirical research that validates its reliability and validity. It effectively reflects the individual's sleep status, enhancing the credibility and comparability of the results in this study (23, 24).
- 2 Comprehensive Evaluation: The PSQI extends beyond merely assessing sleep quality; it encompasses several related dimensions, including sleep latency, sleep duration, sleep

¹ <https://www.wjx.cn/vm/rX4XJXc.aspx#>

efficiency, sleep disturbances, frequency of sedative use, and daytime functioning (25). This multidimensional evaluation approach provides a holistic perspective for exploring the relationship between occupational mental health and work capability.

- 3 Convenience: The PSQI questionnaire is structured in a clear and straightforward manner, making it suitable for rapid implementation in large-scale surveys (26). This facilitates the efficient collection of substantial and valid data, aligning well with the design requirements of this study.
- 4 Cultural Adaptability: The PSQI has been validated across various cultural contexts and is applicable to diverse populations (27–29), making it particularly suitable for use among personnel in biosafety laboratories in the Xinjiang region.

In addition to the PSQI, several other commonly used assessment tools for sleep disorders exist, such as:

- 1 Hamilton Anxiety Scale (HAM-A): This tool is used to evaluate individual anxiety symptoms and their impact on sleep (30).
- 2 Epworth Sleepiness Scale (ESS): Primarily aimed at assessing the degree of daytime sleepiness, this scale indirectly reflects nighttime sleep quality (31).
- 3 Stanford Sleepiness Scale (SSS): This scale evaluates individuals' sleep habits and related issues, making it suitable for a deeper understanding of the specific manifestations of sleep disorders (32).

Work ability investigation

The Work Ability Index (WAI) is a tool used in clinical occupational health and research to assess work ability during health examinations and workplace surveys (33). This scale includes a total of 7 items covering physiological, psychological, and disease-related aspects, with a total of 10 questions. The questionnaire consists of seven parts (part, score range), which are the current work ability compared with the lifetime best (part 1, 0–10), work ability related to professional needs (part 2, 2–10), the number of current diseases diagnosed by doctors (part 3, 1–7), estimated work disabilities caused by diseases (part 4, 1–6), the sick leave in the past year (part 5, 1–5), the prediction of working ability in 2 years from now (part 6, 1, 4 or 7), and mental resources (part 7, 1–4). The score of WAI was obtained by adding the scores of seven parts, which ranged from 7 to 49. The total scores of WAI were divided into four grades: poor (7–27), medium (28–36), good (37–43), and excellent (44–49). In order to facilitate the matching analysis of participants with PSA method, this study classified the good and excellent working ability as good (37–49 points), and the poor and medium working ability as poor (7–36 points). In this study, the Cronbach's alpha coefficient for this scale is 0.666.

In this study, the reasons for choosing the Work Ability Index (WAI) as the assessment tool for work ability primarily include the following points:

- 1 Comprehensive Assessment: The WAI is an integrative scale that evaluates an individual's work ability from multiple dimensions, including cognitive, emotional, and social capacities (34). This comprehensive assessment approach facilitates a thorough understanding of the work ability status of personnel in biosafety laboratories.

- 2 Rigorous Structure: The WAI was developed collaboratively by multiple experts and has undergone rigorous testing and validation, demonstrating high reliability and validity (35). This ensures the reliability and accuracy of the assessment results.
- 3 Practicality: The design of the WAI scale is straightforward, easy to understand, and use, making it particularly suitable for completing large-scale survey assessments within a short period. This aligns with the study's need for efficient and rapid data collection (36).
- 4 Cultural Adaptability: The WAI has been widely applied across various countries and regions and is adaptable to different cultural backgrounds (37). Given that personnel in biosafety laboratories in the Xinjiang region may possess specific cultural characteristics, the choice of WAI better accommodates the assessment needs of this group.

In addition, there are several other commonly used methods for evaluating work ability, such as:

- 1 Holland's Self-Directed Search (SDS): The tool is widely used for career planning, job counseling, and professional development, helping individuals identify career paths that are suitable for them (38).
- 2 Myers-Briggs Type Indicator (MBTI): MBTI is widely used in team building, career development, leadership training, and interpersonal communication, helping individuals identify and enhance their work abilities (39).
- 3 Career Adapt-Ability Scale (CAAS): It is commonly used in career counseling, educational assessment, and organizational human resource management, helping individuals identify their career development needs and formulate corresponding action plans. At the same time, this scale also assists organizations in evaluating employees' adaptability, thereby optimizing team structure and employee training (40).

Although multiple assessment tools are available, the WAI has emerged as the preferred choice for this study due to its comprehensiveness, rigorous structure, practicality, and cultural adaptability. It effectively aids in the analysis of the relationship between the occupational mental health status of biosafety laboratory personnel and their work ability.

Statistical analysis

Data analysis was conducted using R Studio (version 4.2.2). Descriptive statistics included frequencies (N) and proportions (%). Measurement data were summarized using means $\pm$ standard deviations ($\bar{x} \pm s$). Comparisons between two independent group means were performed using independent samples t-tests, while comparisons among multiple group means were conducted using one-way ANOVA. Logistic regression was employed to further analyze factors affecting work ability among BSL employees, with job burnout and sleep quality included in the model to assess their interaction effects. The interaction effect was calculated using the Excel table developed by Andersson (41), which provided odds ratios (OR) and 95% confidence intervals for job burnout, sleep quality, and the coexistence of both factors. Additionally, the evaluation metrics for

TABLE 1 Participant characteristics.

Index	Groups	N (%)
Sex	Male	480 (24.9)
	Female	1,450 (75.1)
The level of BSL	One	220 (11.4)
	Two	1,651 (85.5)
	Three	59 (3.1)
Age	18 ~ <30	996 (51.6)
	30 ~ 39	631 (32.7)
	40 ~ 49	216 (11.2)
	≥50	87 (4.5)
Education	Vocational or Below	112 (5.8)
	Associate Degree	869 (45)
	Bachelor's Degree	891 (46.2)
	Graduate or Above	58 (3)
Working years	≤5	912 (47.3)
	6 ~ 10	429 (22.2)
	11 ~ 20	326 (16.9)
	21 ~ 30	190 (9.8)
	≥31	73 (3.8)
Professional title	Primary	1,483 (76.8)
	Middle	319 (16.5)
	Senior	128 (6.6)
Marital status	Unmarried	759 (39.3)
	Married	1,171 (60.7)
Monthly income (In RMB)	≤4,000	859 (44.5)
	>4,000	1,071 (55.5)
Hypertension	Yes	76 (3.9)
	No	1854 (96.1)
Coronary heart disease	Yes	35 (1.8)
	No	1895 (98.2)
Diabetes	Yes	24 (1.2)
	No	1906 (98.8)
Shift assignment	Day shift	588 (30.5)
	Night shift	1,342 (69.5)
	Never	613 (31.8)
Exercise (peer weak)	1 ~ 2 times	886 (45.9)
	3 ~ 4 times	303 (15.7)
	5 times or above	128 (6.6)
Job burnout	Yes	1,300 (67.4)
	No	630 (32.6)
Sleep quality	Good sleep quality	1,179 (61.1)
	Sleep disorder	751 (38.9)

the interaction included the Relative Excess Risk due to Interaction (RERI), Attributable Proportion due to Interaction (AP), and the Synergy Index (S). An interaction was considered absent if the confidence intervals for RERI and AP included 0, and for S included 1 (42). Lastly, structural equation modeling was performed using

AMOS 21.0 to analyze the path relationships between job burnout, sleep quality, and work ability among BSL employees. Model evaluation and correction were carried out using the Bollen-Stine *p*-value correction.

Results

Characteristics

Among the 1,930 BSL employees, 1,450 were female, accounting for 75.1% of the total workforce. There were 1,651 employees at the second level, representing 85.5% of the total. Employees under the age of 30 numbered 996, constituting 51.6% of the workforce. The numbers of employees with associate and bachelor's degrees were 869 and 891, respectively, corresponding to 45.0 and 46.2%. Detailed data are presented in Table 1.

Survey on job burnout, sleep quality, and work ability among BSL employees

67.4% of BSL employees exhibit signs of job burnout. Sleep disorders affect 38.9% of employees, with an average sleep quality score of 10.58 ± 2.41 . The work ability index for BSL employees is 38.83 ± 6.43 . Among the four levels of work ability, the majority of employees are categorized as having moderate (28.1%) and good (41.2%) work ability. Fewer employees fall into the poor category (5.2%), while 25.5% are classified as having excellent work ability. This indicates that most oil workers have moderate to good work ability, with a smaller proportion exhibiting very poor work ability. Detailed data can be found in Table 2.

Comparison of WAI score among different sub-groups

The work ability index among BSL employees shows significant statistical differences based on gender, age, educational level, years of service, job title, marital status, monthly income, chronic conditions (such as hypertension, coronary heart disease, diabetes), and frequency of exercise (all *p*-values <0.05). Specifically: males have a higher work ability index than females; work ability decreases with age; a higher level of education is associated with a higher work ability index; increasing years of service are linked to a lower work ability index; employees with lower job titles have a higher work ability index; those who exercise weekly have a significantly higher work ability index compared to those who do not exercise; and unmarried employees, those without chronic diseases, those without job burnout, and those with good sleep quality have a higher work ability index compared to other groups. Detailed data are presented in Table 3.

Multivariate logistic regression analysis of work ability among BSL personnel

Binary logistic regression analysis was conducted with work ability (where good and excellent = 0, poor and medium = 1) as the dependent variable and all statistical variables as independent variables. The results

TABLE 2 Scores of occupational burnout, sleep quality, and work ability.

Variables	Scores	N (%)
Job burnout	1.87 ± 0.86	1930 (100.0)
No burnout	0.94 ± 0.42	630 (32.6)
Moderate burnout	2.22 ± 0.46	1,235 (64.0)
Severe burnout	4.10 ± 0.50	65 (3.4)
Sleep quality	6.78 ± 3.72	1930 (100.0)
Good sleep quality	4.36 ± 1.99	1,179 (61.1)
Sleep disorder	10.58 ± 2.41	751 (38.9)
Work ability	38.83 ± 6.43	1930 (100.0)
Poor	23.03 ± 3.66	100 (5.2)
Medium	33.00 ± 2.43	543 (28.1)
Good	40.33 ± 1.95	795 (41.2)
Excellent	46.04 ± 1.63	492 (25.5)

indicated that educational level, years of service, chronic diseases (hypertension, coronary heart disease), weekly exercise frequency, occupational burnout, and sleep quality were included in the regression model. Specifically, the findings are as follows: Educational levels of college (OR = 0.523, 95% CI: 0.322–0.848), undergraduate (OR = 0.393, 95% CI: 0.239–0.646), and postgraduate or higher (OR = 0.204, 95% CI: 0.086–0.486) serve as protective factors for work ability. A years of service range of 21–30 years (OR = 2.224, 95% CI: 1.288–3.839) is associated with poorer work ability. Hypertension (OR = 2.015, 95% CI: 1.105–3.674), coronary heart disease (OR = 3.404, 95% CI: 1.208–9.588), and occupational burnout (OR = 6.468, 95% CI: 4.728–8.848) are identified as risk factors for work ability. Weekly exercise frequencies of 1–2 times (OR = 0.676, 95% CI: 0.526–0.869), 3–4 times (OR = 0.626, 95% CI: 0.438–0.895), and more than 5 times (OR = 0.531, 95% CI: 0.319–0.885) are associated with better work ability. Sleep quality (OR = 3.318, 95% CI: 2.646–4.161) is also a significant factor affecting work ability. The results suggest that higher educational levels and more frequent exercise are protective factors for BSL employees’ work ability. Specifically, higher education levels and increased weekly exercise frequency are linked to better work ability. Conversely, years of service, chronic diseases, occupational burnout, and sleep disorders are risk factors for work ability, with years of service between 21 and 30 years, hypertension, coronary heart disease, occupational burnout, and sleep disorders all contributing to reduced work ability among BSL employees. Detailed data are presented in [Table 4](#).

The interaction effect of job burnout and sleep quality on the impact on work ability

Logistic regression analysis was conducted with work ability (where good and excellent = 0, poor and medium = 1) as the dependent variable, using employees with no burnout and good sleep as the reference group. The results revealed that BSL employees with only occupational burnout had a 3.301-fold higher risk of impaired work ability compared to those without burnout (OR = 3.301, 95% CI: 1.856–5.871). BSL employees with only sleep disorders faced a 6.452-fold higher risk of impaired work ability compared to those with good sleep (OR = 6.452, 95% CI: 4.317–9.644). Employees with both

TABLE 3 Comparison of WAI score among different sub-groups.

Index	Groups	WAI scores	t/F-value	P-value
Sex	Male	39.71 ± 6.70	3.494	<0.01
	Female	38.53 ± 6.31		
The level of BSL	One	38.18 ± 7.06	2.988	0.051
	Two	38.96 ± 6.30		
	Three	37.39 ± 7.20		
Age	18 ~ <30	39.38 ± 6.50	11.908	<0.01
	30 ~ 39	38.82 ± 6.07		
	40 ~ 49	37.47 ± 6.33		
	≥50	35.90 ± 7.12		
Education	Vocational or Below	34.62 ± 7.96	18.037	<0.01
	Associate Degree	38.95 ± 6.70		
	Bachelor's Degree	39.16 ± 5.80		
	Graduate or Above	39.98 ± 5.16		
Working years	≤5	39.54 ± 6.40	13.197	<0.01
	6 ~ 10	39.41 ± 5.90		
	11 ~ 20	37.53 ± 6.37		
	21 ~ 30	37.37 ± 6.66		
	≥31	36.05 ± 7.25		
Professional title	Primary	39.16 ± 6.36	11.542	<0.01
	Middle	38.18 ± 6.38		
	Senior	36.58 ± 6.73		
Marital status	Unmarried	39.34 ± 6.31	2.807	<0.01
	Married	38.50 ± 6.48		
Monthly income (In RMB)	≤4,000	38.98 ± 6.51	0.953	0.341
	>4,000	38.70 ± 6.36		
Hypertension	Yes	34.24 ± 7.13	−6.421	<0.01
	No	39.02 ± 6.33		
Coronary heart disease	Yes	31.17 ± 6.27	−7.208	<0.01
	No	38.97 ± 6.34		
Diabetes	Yes	32.96 ± 7.33	−4.526	<0.01
	No	38.90 ± 6.38		
Shift assignment	Day shift	39.01 ± 6.30	0.837	0.403
	Night shift	38.75 ± 6.48		
	Never	37.18 ± 6.02	21.767	<0.01
Exercise (peer weak)	1 ~ 2 times	39.36 ± 6.37		
	3 ~ 4 times	39.89 ± 6.77		
	5 times or above	40.52 ± 6.36		
Job burnout	Yes	36.78 ± 6.22	25.256	<0.01
	No	43.05 ± 4.49		
Sleep quality	Good sleep quality	40.84 ± 5.63	18.284	<0.01
	Sleep disorder	35.66 ± 6.33		

occupational burnout and sleep disorders had a 21.430-fold higher risk of impaired work ability compared to those with neither condition (OR = 21.430, 95% CI: 14.300–32.118). Interaction analysis showed an

TABLE 4 Multivariate logistic regression analysis of work ability.

Variable	Comparison group	B	SE	Wald χ^2	p-value	Odd ratio (95%CI)
Education	Vocational or Below			19.397	<0.01	
	Associate Degree	−0.649	0.247	6.895	<0.01	0.523 (0.322 ~ 0.848)
	Bachelor's Degree	−0.934	0.253	13.602	<0.01	0.393 (0.239 ~ 0.646)
	Graduate or Above	−1.588	0.442	12.916	<0.01	0.204 (0.086 ~ 0.486)
Working years	≤5			16.011	<0.01	
	21 ~ 30	0.799	0.279	8.228	<0.01	2.224 (1.288 ~ 3.839)
Hypertension	Yes	0.701	0.306	5.225	<0.05	2.015 (1.105 ~ 3.674)
Coronary heart disease	Yes	1.225	0.528	5.372	<0.05	3.404 (1.208 ~ 9.588)
Exercise (peer weak)	Never			13.503	<0.01	
	1 ~ 2 times	−0.391	0.128	9.357	<0.01	0.676 (0.526 ~ 0.869)
	3 ~ 4 times	−0.468	0.182	6.585	<0.05	0.626 (0.438 ~ 0.895)
	5 times or above	−0.632	0.260	5.912	<0.05	0.531 (0.319 ~ 0.885)
Job burnout	Yes	1.867	0.160	136.349	<0.01	6.468 (4.728 ~ 8.848)
Sleep quality	Sleep disorder	1.199	0.115	107.856	<0.01	3.318 (2.646 ~ 4.161)

TABLE 5 The interaction effect of job burnout and sleep quality on the impact on work ability.

Variable	Variable	Additive interaction analysis				
		[Work ability of (poor, medium)] (n, %)	Odds ratio (95%CI)	RERI (95%CI)	AP (95%CI)	S (95%CI)
Job burnout	Sleep quality					
No	No	33 (6.48%)	1	12.676	59.152%	2.635
No	Yes	27 (22.31%)	3.301 (1.856 ~ 5.871)	(6.668 ~ 18.684)	(47.796% ~ 70.508%)	(1.932 ~ 3.594)
Yes	No	200 (29.85%)	6.452 (4.317 ~ 9.644)			
Yes	Yes	383 (60.79%)	21.430 (14.300 ~ 32.118)			

S value of 2.635 (95% CI: 1.932–3.594), indicating that the risk of impaired work ability for BSL employees with both occupational burnout and sleep disorders is 2.635 times the sum of the risks associated with each condition individually. The RERI value was 12.676, and the API (%) value was 59.152%, demonstrating a significant additive interaction between the two conditions. Detailed data can be found in [Table 5](#).

Structural equation model of career burnout, sleep quality, and work ability

Structural equation model fit results

This study constructed a structural equation model with sleep quality and work ability as endogenous variables and occupational burnout as an exogenous variable (see [Figure 1](#)). The evaluation indices for the fit of the structural equation model include: absolute fit indices such as the chi-square value (χ^2), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), and root mean square error of approximation (RMSEA); and incremental fit indices such as the normed fit index (NFI), incremental fit index (IFI), and comparative fit index (CFI) (43). The initial model's fit indices did not meet the standards, and the model analysis showed a p -value of 0, indicating poor model fit. Typically, a significant p -value may be due to two reasons:

either a very large sample size or poor model fit (44). To address this issue, the study employed a bootstrap procedure with 5,000 repetitions. The results of the Bollen-Stine bootstrap test showed: (1) The model fit better in 5000 bootstrap samples; (2) It fit about equally well in 0 bootstrap samples; (3) It fit worse or failed to fit in 0 bootstrap samples; (4) Testing the null hypothesis that the model is correct, $p = 0$. These results indicate that after 5,000 bootstrap replications, the model exhibited good fit in 5000 instances and poor fit in 0 instances. Therefore, we can reject the null hypothesis, suggesting that the significant p -value was due to the large sample size rather than poor model fit. Consequently, this study evaluated and adjusted the model using Bollen-Stine p -value correction, and the corrected indices all met the standards. The fit indices before and after correction are presented in [Table 6](#).

Path coefficients between job burnout, sleep quality, and work ability

The results of the structural equation model analysis indicate that both occupational burnout and sleep quality have direct effects on work ability. Specifically, higher levels of occupational burnout and poorer sleep quality are associated with lower work ability, with standardized path coefficients (β) of −0.37 and −0.43, respectively. Additionally, occupational burnout also indirectly affects work ability

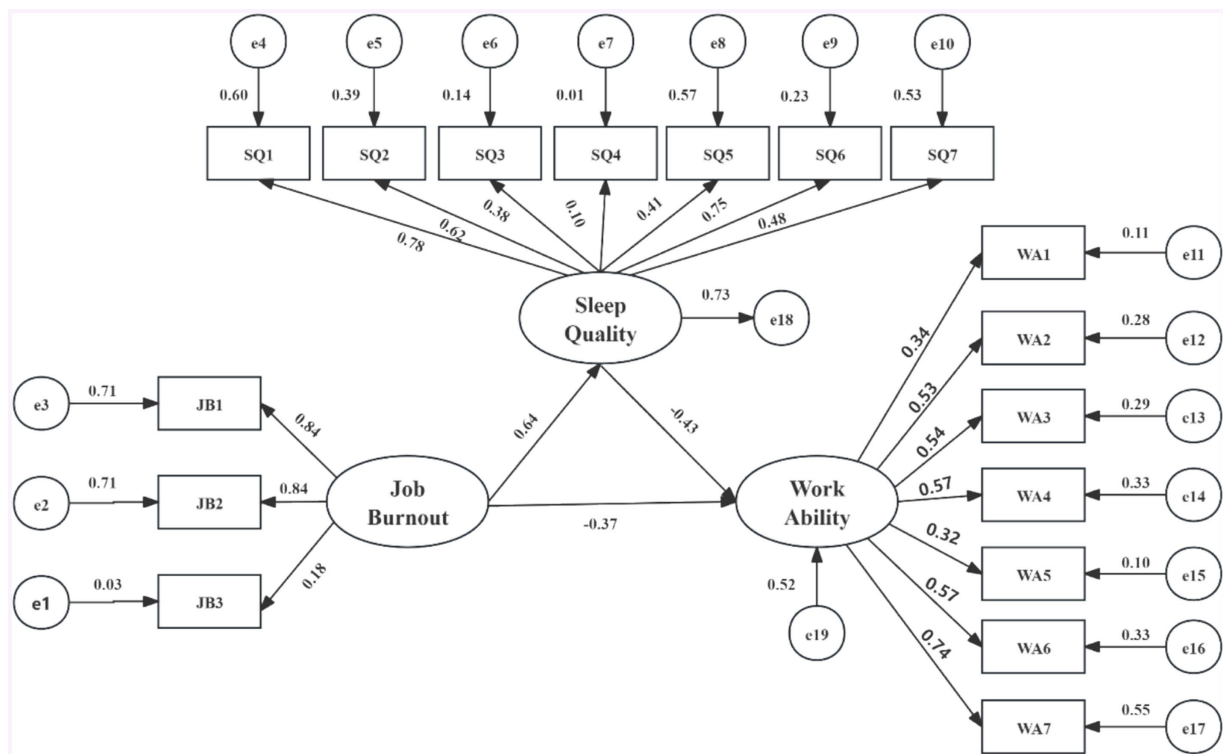


FIGURE 1 Structural equation model of career burnout, sleep quality, and work ability. Structural equation modeling results for the relationship between burnout, sleep quality, and work ability. All coefficients in the figure are standardized and significant at the 0.05 level. JB1, emotional exhaustion; JB2, depersonalization; JB3, reduced personal accomplishment; SQ1, the subjective sleep quality; SQ2, sleep latency; SQ3, sleep continuity; SQ4, habitual sleep efficiency; SQ5, sleep disorders; SQ6, hypnotic drugs; SQ7, daytime function seven factors; WA1, the lifetime best; WA2, work ability related to professional needs; WA3, the number of current diseases diagnosed by doctors; WA4, estimated work disabilities caused by diseases; WA5, the sick leave in the past year; WA6, the prediction of working ability in 2 years from now; WA7, and mental resources.

through sleep quality. As occupational burnout increases and sleep quality declines, the standardized path coefficient (β) is 0.64, leading to an indirect effect of occupational burnout on work ability of -0.28 (0.64×-0.43). For further details, please refer to Figure 1 and Table 7.

Discussion

Elevated rates of occupational burnout and sleep disorders among BSL employees

In 2019, the World Health Organization (WHO) released the 11th edition of the International Classification of Diseases, which included burnout as a medical condition, defining it as a syndrome resulting from chronic workplace stress that has not been successfully managed, characterized by feelings of exhaustion, cynicism, and reduced professional efficacy (45). Research indicates that prolonged job stress and persistent emotional and mental fatigue not only lead to mental health issues such as anxiety, depression, and emotional instability, but are also associated with physical health problems including sleep disorders, digestive system diseases, and cardiovascular diseases (46–48). Furthermore, long-term burnout can have negative impacts on organizations and society, such as increased employee turnover intentions, leading to higher recruitment and training costs (49). At the societal level, prolonged burnout may result in escalated healthcare costs and social welfare expenditures, ultimately affecting economic

TABLE 6 Fit indices of structural equation model.

Model fit indices	ML	Bollen-Stine P-value	Criteria
χ^2/df	19.073	1.23	<3.0
RMSEA	0.10	0.01	<0.08
GFI	0.88	0.99	>0.90
AGFI	0.84	0.98	>0.90
NFI	0.78	0.99	>0.90
TLI	0.76	1.00	>0.90
IFI	0.79	1.00	>0.90
CFI	0.79	1.00	>0.90

ML, maximum likelihood estimation.

development and social stability. As professionals handling highly infectious biological materials and pathogens in laboratory settings, Biosafety Level (BSL) personnel play a crucial role in preventing disease transmission and protecting human and environmental health and safety. Therefore, their physical and mental well-being deserves utmost attention.

This study shows that employees from several biosafety laboratories (BSL) in Xinjiang reported significant levels of occupational burnout and sleep quality issues. These laboratories primarily engage in research and testing related to pathogenic microorganisms. Despite having implemented biosafety measures,

TABLE 7 Structural equation model path regression coefficients.

Path	Unstandardized regression coefficients	SE	CR	P-value	Standardized regression coefficients
Job burnout → Sleep quality	1.547	0.225	6.87	<0.01	0.637
Sleep quality → Work ability	−0.461	0.049	−9.447	<0.01	−0.426
Job burnout → Work ability	0.969	0.165	−5.86	<0.01	−0.368

some employees still feel at risk of pathogen exposure. Some participants in this study come from county-level health departments, where there are issues such as aging or damaged key facilities, including biosafety cabinets and waste disposal equipment, which may increase the risk of pathogen leakage. Additionally, some laboratory personnel in health departments have not strictly adhered to standards for personal protection, such as masks, gloves, goggles, and isolation gowns that do not meet usage standards. These factors contribute to the risk of pathogen exposure. Our study investigated burnout among 1930 BSL personnel in Xinjiang and found a burnout detection rate of 67.4%, which is significantly higher than the results of other relevant studies; for example, in a systematic review encompassing 161 studies, only 47% of 341,014 healthcare workers worldwide reported experiencing burnout. This significant difference highlights the unique pressures and challenges faced by personnel in the Xinjiang Biosafety Laboratory (50). This phenomenon may be attributed to the stress caused by the risk of COVID-19 infection. Related studies have shown that the incidence of burnout among healthcare workers during the COVID-19 pandemic was higher than in the past, which is associated with the increased psychological burden on medical system workers due to high virus exposure risk and intense workload (51). The subjects of this study include workers who come into contact with biological samples, such as virology laboratory personnel, nucleic acid testing personnel, and hospital laboratory personnel. They face high virus exposure due to their occupational characteristics, increasing the risk of mental health issues.

Sleep profoundly influences various aspects of the body, playing a crucial role in physical and mental health. Almost every country reports complaints about sleep disorders (or poor sleep quality) (52). Untreated sleep disorders can pose life-threatening risks; they are not only the result of medical conditions but also significant drivers of other diseases (53). Poor sleep quality significantly affects daytime performance, including social and work functions (54), increases the risks of occupational and traffic accidents (55), and diminishes quality of life and overall health (56). Numerous studies suggest links between sleep disorders and attention deficit, depression, anxiety, impaired cognitive function, and neurocognitive dysfunction (57, 58). Therefore, evaluating sleep quality is vital in epidemiological and clinical research. This survey found an overall sleep disorder detection rate of 38.9% among employees at BSL in Xinjiang. According to the “China Sleep Index,” the sleep quality scores of medical workers have continued to rank second from the bottom for several years, with a sleep disorder incidence rate as high as 39.9%, which is consistent with the findings of this study. Sleep issues such as insufficiency and poor sleep quality directly reduce the operational efficiency and work ability of BSL personnel, and in severe cases, even threaten their lives. Studies by Pappa S and Ntella V, among others, have shown that during the COVID-19 pandemic, frontline healthcare workers faced anxiety and high stress levels, which resulted in decreased sleep quality (59). As virus detection personnel, BSL employees undertake heavy workloads

and are concerned about highly infectious viral samples, leading to considerable psychological stress that may impair their sleep quality. The survey also found that 69.9% of BSL employees required shifts, which is a primary factor affecting their sleep quality. Night shifts disrupt the circadian rhythm, leading to confusion in the sleep–wake cycle. Moreover, exposure to bright environments, especially blue light, suppresses melatonin secretion, compromising sleep quality. Research indicates that individuals who work night shifts for extended periods have lower melatonin levels compared to those working fixed day shifts (60).

Factors reducing work ability among BSL employees: (female, older age, low education level, short work experience, low professional title, married, low income, hypertension, diabetes, coronary heart disease, low exercise frequency)

Based on the findings of this study, the work capability level of BSL employees in Xinjiang is relatively high, with a detection rate of 66.7%, slightly surpassing the results of a French survey involving 4,306 medical professionals (65.5%) (61). This suggests that the overall work capability of Xinjiang BSL personnel is satisfactory. This positive outcome may be attributed to the generally high educational attainment of the study participants, who predominantly hold college and bachelor's degrees, and the fact that they are primarily young individuals under the age of 40. These characteristics likely contribute to their enhanced stress resistance and adaptability compared to the general population. Additionally, the survey participants, being BSL personnel during the COVID-19 pandemic, play a critical role in the control and progression of the outbreak. Consequently, due to the significant responsibilities they bear, their work capability requirements are notably higher than in the past (62).

The study found that male employees generally exhibit better work capabilities than female employees, which may be attributed to advantages in psychological resilience and stress tolerance among men. This disparity is particularly evident during the COVID-19 pandemic when the extensive virus sample testing highlights men's physical endurance (63). Additionally, work capability tends to decline with age and years of service. This decline could be due to the gradual deterioration of physical functions such as strength, endurance, and reaction time with age. Furthermore, long-term engagement in the same job can lead to professional burnout, reducing enthusiasm and motivation, which subsequently affects work performance. Topa et al. (64) indicated that although employees may attempt to enhance their job satisfaction and engagement by adjusting their work tasks and methods, these adjustments may, over time, actually lead to a decrease in their sense of engagement. This can result in older employees, compared to their younger counterparts, being less attracted to

developmental goals and high levels of effort, making them more vulnerable to feelings of burnout.

Among BSL employees, those with higher professional titles generally have lower work capability indices. Employees with junior titles exhibit better work capabilities compared to those with intermediate or senior titles. This could be due to the fact that promotions often involve additional management and leadership responsibilities, requiring more time and effort on administrative tasks and reducing opportunities for hands-on scientific research, thereby leading to a relative decline in work capability. The study also found that unmarried individuals have better work capabilities. Research by Giacomo Garzaro (65) indicates that single workers exhibit significantly higher work capabilities than their married counterparts. This could be because single employees are typically younger, have lower BMI, and engage in more leisure exercise weekly. In contrast, married individuals face higher financial and psychological pressures, which may negatively impact their work capability. Moreover, multiple regression analysis results indicate that educational level has a protective effect on BSL employees' work capability. Higher educational attainment is associated with stronger work capability. This is because individuals with higher education typically undergo more systematic and in-depth learning, possess broader and deeper knowledge, and are better equipped to understand and apply work-related theories, techniques, and methods, thereby enhancing work efficiency and quality.

Multifactorial analysis results indicate that the frequency of weekly exercise positively influences the work capacity of BSL employees. Moderate exercise can relieve physical and mental tension and promote the release of neurotransmitters such as dopamine, endorphins, and serotonin, which contribute to improved mood (66). Furthermore, moderate physical activity is associated with enhanced sleep quality, thereby increasing daily work efficiency. This study found that BSL personnel with chronic illnesses exhibit lower work efficiency. This can be explained by biopsychosocial theories, which suggest that chronic illnesses lead to physical instability, subsequently affecting cognitive abilities and work performance. Additionally, chronic conditions may impair the functioning of the brain and nervous system, further impacting individuals' ability to cope with work tasks (67). A cohort study involving 38,470 participants with chronic diseases revealed a strong negative correlation between cardiovascular diseases and type 2 diabetes (DM2) and work efficiency in mid- to late-career stages (68). The study also demonstrated that occupational burnout significantly negatively affects the work capabilities of BSL personnel. A survey of 3,030 nurses found that 64.3% reported experiencing burnout, with 36.5% planning to leave their hospital within a year. A significant correlation exists between high levels of burnout and the intention to leave (69). Moreover, the results indicate that sleep disorders are a crucial factor impacting the work efficiency of BSL personnel. According to perspectives from sleep medicine, sleep disorders can affect individuals' alertness and attention, subsequently influencing work efficiency and the safety of laboratory operations.

Job burnout and sleep disorders reduce the work ability of BSL personnel

This study investigated the additive interactions of influencing factors using a logistic regression model. The results revealed that

the risk of reduced work capacity is 21.430 times higher in individuals experiencing both occupational burnout and sleep disorders compared to the reference group (those without burnout and with good sleep quality). This finding indicates a significant additive interaction between these factors. According to the two-factor theory, job satisfaction or dissatisfaction consists of two independent but interacting factors: job content and job environment (70). These factors interact to shape employees' work experiences. In BSL, occupational burnout and sleep quality can be seen as the "satisfaction" and "dissatisfaction" factors in this theory. Occupational burnout pertains to job content, such as work stress, workload, and mental strain, while sleep quality relates to job environment factors, such as work schedules and environmental impacts. Burnout affects employees' cognitive and decision-making abilities, thereby impacting work quality and efficiency. Poor sleep quality, on the other hand, affects mood, physical condition, and concentration, leading to decreased work efficiency and quality, and even increasing the risk of accidents. A structural equation model was established to further explore the pathways between occupational burnout, sleep quality, and work capacity. The results showed that sleep quality mediates the relationship between occupational burnout and work capacity. Studies have indicated that high levels of occupational burnout not only lead to sleep problems but also that poor sleep can exacerbate or trigger burnout (71). Brubaker et al. (72) suggested that health promotion should prioritize sleep quality as an early risk indicator, with interventions focusing on improving sleep to reduce the incidence of burnout. These findings highlight the close relationship between occupational burnout and sleep quality, and how both issues can severely impact the health and work capacity of professionals, significantly increasing the risk of workplace accidents.

Based on the findings of this study, occupational burnout and sleep disorders significantly affect the work capacity of biosafety laboratory (BSL) employees. The participants in this study come from multi-center laboratories across 106 counties in 4 prefecture-level cities, 5 regions, and 5 autonomous prefectures in Xinjiang, including relevant disease control and prevention centers, hospital laboratory departments, and other institutions. These laboratories primarily focus on the detection of pathogens causing infectious diseases and vaccine development. Among them, there are BSL-1, BSL-2, and BSL-3/4 laboratories. BSL-1 laboratories are mainly used for academic research on non-pathogenic microorganisms or other tissue cultures under basic experimental conditions; BSL-2 laboratories are primarily used for handling moderately hazardous pathogens, including those that cause local infections and inhalation infections; BSL-3/4 laboratories are mainly used for operating highly hazardous pathogens, such as Ebola virus and variola major virus. However, during the study, we found that some laboratories have inadequacies in protective measures against pathogen exposure, which may influence employees' mental health and work capacity. The results from the structural equation modeling analysis suggest that reducing occupational burnout and improving sleep quality can enhance the work capacity of BSL employees in Xinjiang. To address these issues, relevant organizations should offer training on sleep health and management and promote healthy sleep practices, such as regular sleep schedules and manageable work intensity. Furthermore, while participants are required to undergo biosafety training upon employment to ensure they understand laboratory protocols and safety procedures, there is a need to enhance the specificity of these

training programs to better equip employees in managing work-related challenges. Attention should also be given to employees' mental health, with timely interventions for negative psychological conditions, as these are crucial for improving work capacity. Implementing these measures is essential for enhancing overall job performance and reducing occupational burnout.

Limitations

This study has several limitations that warrant consideration. First, the use of a cross-sectional design limits the ability to establish causal relationships between occupational burnout, sleep quality, and work ability. Therefore, future longitudinal studies would be more beneficial in elucidating the dynamic relationships among these variables over time. Second, the reliance on self-reported measurement tools, such as the Maslach Burnout Inventory and the Pittsburgh Sleep Quality Index, may introduce response bias, as participants might overestimate or underestimate their levels of burnout and sleep quality. Additionally, this study is focused exclusively on biosafety laboratory staff in the Xinjiang region, which may restrict the generalizability of the findings to other regions or different types of laboratory environments. Consequently, future research should aim to include a broader population across various locations and laboratory settings to enhance the external validity of the results. Lastly, while this study identified significant interactions and mediating effects, other potential confounding factors, such as workload, health status, and individual coping strategies, were not thoroughly examined. Considering these factors in subsequent research may provide a more comprehensive understanding of the multidimensional variables influencing the work ability of biosafety laboratory personnel.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Urumqi Center for Disease Control and Prevention, Xinjiang. The studies were conducted in accordance with the local legislation and institutional

requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KJ: Investigation, Methodology, Writing – original draft, Writing – review & editing. RW: Writing – review & editing. LY: Data curation, Investigation, Methodology, Project administration, Resources, Software, Writing – review & editing. JL: Writing – review & editing, Methodology, Conceptualization, Validation, Project administration, Resources. JY: Writing – review & editing, Formal analysis, Investigation. LD: Writing – review & editing, Conceptualization, Project administration, Investigation. MX: Writing – review & editing, Formal analysis, Project administration, Validation, Investigation.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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EDITED BY

Salvatore Zaffina,
Bambino Gesù Children's Hospital (IRCCS),
Italy

REVIEWED BY

Luis Felipe Dias Lopes,
Federal University of Santa Maria, Brazil
Jennifer Creese,
University of Leicester, United Kingdom

*CORRESPONDENCE

Mansoor Malik
✉ mmalik4@jhmi.edu

PRESENT ADDRESS

Tanvi Bafna,
University of Miami Miller School of Medicine,
Miami, FL, United States

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Systematic review of well-being interventions for minority healthcare workers

Tanvi Bafna^{1†}, Mansoor Malik^{2*}, Mohua C. Choudhury¹,
William Hu¹, Christine M. Weston¹, Kristina R. Weeks^{3,4},
Cheryl Connors⁵, M. Haroon Burhanullah², George Everly²,
Henry J. Michtalik^{4,5} and Albert W. Wu^{1,4,5}

¹Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, United States, ²Department of Psychiatry, Johns Hopkins University School of Medicine, Baltimore, MD, United States, ³Department of Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, Baltimore, MD, United States, ⁴Johns Hopkins School of Medicine, The Armstrong Institute for Patient Safety and Quality, Baltimore, MD, United States, ⁵Department of Medicine, Johns Hopkins School of Medicine, Baltimore, MD, United States

Introduction: Healthcare workers' well-being is of utmost importance given persistent high rates of burnout, which also affects quality of care. Minority healthcare workers (MHCW) face unique challenges including structural racism and discrimination. There is limited data on interventions addressing the psychological well-being of MHCW. Thus, this systematic review aims to identify interventions specifically designed to support MHCW well-being, and to compare measures of well-being between minority and non-minority healthcare workers.

Methods: We searched multiple electronic databases. Two independent reviewers conducted literature screening and extraction. The Mixed Methods Assessment Tool (MMAT) or Joanna Briggs Institute (JBI) criteria were utilized to assess the methodological quality of studies, based on the study design. Total scores as percentages of criteria met were used to determine overall quality as low (<40%), moderate (40–80%), or high (>80%). For conflicts, consensus was reached through discussion. Meta-analysis was not possible due to heterogeneity of study designs.

Results: A total of 3,816 records were screened and 43 were included in the review. The majority of included studies (76.7%) were of moderate quality. There were no randomized control trials and only one study included a well-being intervention designed specifically for MHCW. Most (67.4%) were quantitative-descriptive studies that compared well-being measures between minority and non-minority identifying healthcare workers. Common themes identified were burnout, job retention, job satisfaction, discrimination, and diversity. There were conflicting results regarding burnout rates in MHCW vs non-minority workers with some studies citing protective resilience and lower burnout while others reported greater burnout due to compounding systemic factors.

Discussion: Our findings illuminate a lack of MHCW-specific well-being programs. The conflicting findings of MHCW well-being do not eliminate the need for supports among this population. Given the distinct experiences of MHCW, the development of policies surrounding diversity and inclusion, mental health services, and cultural competency should be considered. Understanding the barriers faced by MHCW can improve both well-being among the healthcare workforce and patient care.

KEYWORDS

well-being, minority healthcare workers, burnout, supportive interventions, peer support

Introduction

Healthcare worker (HCW) well-being is of great public health importance as high rates of burnout are present throughout the medical field and are linked to poor patient care outcomes (1). Burnout can be defined as unsuccessfully managed chronic workplace stress that results in emotional exhaustion, job dissatisfaction, and reduced professional efficacy (2). Systemic factors such as workload, organizational structure, and access to support systems contribute to stress and burnout rates. Since the COVID-19 pandemic, well-being has taken center stage due to concerning levels of psychosocial strain throughout the healthcare workforce. A study by the United States Centers for Disease Control and Prevention (CDC) reported significantly higher burnout rates among health workers in 2022 (46%) compared to 2018 (32%) (3). In the global context, a report by the Qatar Foundation, World Innovation Summit for Health (WISH), in collaboration with the World Health Organization (WHO) found similar findings of healthcare worker burnout ranging from 41 to 52% (4). Other measures such as the number of poor mental health days, intent to change jobs, and harassment showed similar trends before and after the pandemic (3).

The negative impact on quality and costs of care associated with poor HCW well-being is also of significant concern (1). HCWs suffering from burnout may struggle to concentrate and be less detail-oriented, and more likely to make mistakes that can affect patient care and increase medical expenditures (5). Multiple studies have demonstrated a relationship between the onset of physician burnout and declining patient safety (6, 7). A systematic review by Hall et al. found that “poor [well-being] and moderate to high levels of burnout [were] associated, in the majority of studies reviewed, with poor patient safety outcomes.” (6) Increases in the frequency of hospital-acquired infections (8), mortality risk, and length of hospital stay have all been found to be associated with nurse burnout (9). A cost-benefit analysis of an institution-wide support program for nursing staff projected an estimated \$1.81 million in annual hospital cost savings after implementation of the well-being intervention (10). Given these concerning findings, it is imperative to address well-being among HCWs.

Minority healthcare workers (MHCW), such as those self-identifying with racial/ethnic, sexual and gender, or migrant minority groups, face unique challenges that may affect their workplace associated well-being. In addition to traditional workplace pressures, MHCW may need to navigate systemic barriers such as structural racism, discrimination, and stereotyping. Further, they are more likely to work in underserved communities with limited resources (11). These circumstances may compound one another and contribute to differences in well-being compared to their non-minority counterparts. Although it is crucial to acknowledge the unique circumstances of this population, there is inconclusive evidence that MHCW experience worse well-being. Previous studies present conflicting evidence on burnout rates between minority and non-minority HCWs with some even suggesting that a minority background can be a protective factor (12).

There is limited data on interventions targeting the well-being of MHCW. Most well-being interventions are designed as one-size-fits-all solutions intended to apply to all workers. It may be important to implement targeted interventions that address the distinct needs of MHCW. By doing so, all HCWs, regardless of their sociodemographic

backgrounds or identities, could feel supported and continue to provide high-quality care for their patients. The aim of this study was to identify and examine interventions specifically designed to support the well-being of MHCW. Additionally, the study analyzed existing literature on well-being outcomes and experiences comparing minority and non-minority HCWs.

Methods

This systematic review was conducted between November 2023 and April 2024 in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, 2021) (13) guidelines. The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO, ID# CRD42023478339) prior to commencement of data collection.

Search strategy

A comprehensive literature search was performed using the following databases: PubMed, Medline, Scopus, Embase, PsycINFO, Web of Science, CINAHL, ProQuest Dissertations and Theses Global, American Doctoral Dissertations, and Open Access Theses and Dissertations. Additional sources such as databases of gray literature, volumes of journals, reference lists of books, book chapters, systematic reviews were also searched. No time or study design restrictions were applied. The search was limited to availability in English. Multiple key terms and Boolean operators such as minority, underrepresented, healthcare worker, well-being, mental health, intervention, and program were used to target relevant papers. Results were limited to publications that included the search terms within their title or abstract text. The reference lists of eligible articles were also hand-searched to identify any additional publications. The detailed search strategy by database is included in Supplementary 1.

Eligibility criteria

Published papers reporting original or secondary results of quantitative, qualitative, or mixed-methods research on the well-being of MHCW and targeted program interventions for MHCW were included. All study designs were considered inclusive of other systematic or scoping reviews in an effort to synthesize high-level evidence and reduce duplication of effort. We defined HCWs to be inclusive of physicians, pharmacists, physician assistants, nurses, hospital faculty, and their corresponding students or trainees. We chose to include early-career groups such as students as literature suggests early onset of burnout (14). Similarly, a broad characterization of minority was utilized to include racial/ethnic, gender, sexual, and migrant minority groups. These were defined within the geographic and cultural contexts in which the studies were conducted. The wide-ranging definitions were used capture more relevant data since published literature on this topic are relatively scarce. For inclusion in this review, articles must have included MHCW well-being outcomes or an intervention targeting the well-being of MHCW. Table 1 provides the detailed inclusion and exclusion criteria utilized to determine study eligibility.

Study selection and data extraction

An online systematic review management system, Covidence (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia),¹ was utilized for literature screening and data extraction. There were four reviewers, MM, TB, MC, and WH. Two independent reviewers conducted each title/abstract screening and full-text review. In cases of disagreement, consensus was acquired through discussion. At least one reviewer completed data extraction for selected articles. Extracted data included study title, author(s), date of publication, country, study design, type of HCW, type of MHCW, number of participants, attrition and response rate, well-being measures or interventions, well-being related primary and secondary outcomes (if applicable), and lessons learned.

Data synthesis

Extracted information was exported from Covidence to Microsoft Excel (version 16.81). A spreadsheet was used for organization of the extracted data with a focus on relevant variables. Meta-analysis was not possible due to heterogeneity in the methodological features of the studies. Therefore, descriptive analysis of the included papers was conducted.

Quality assessment

Included studies were categorized as quantitative (randomized, non-randomized, or descriptive), qualitative, mixed-methods, or systematic/scoping review. Due to the variety of study designs included in this review, two comprehensive critical appraisal tools, the Mixed Methods Appraisal Tool (MMAT, version 2018) (15, 16) and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Systematic Reviews and Research Syntheses (2015) (17), were utilized. Two reviewers independently assessed all studies and disagreements were addressed through discussion to achieve consensus.

The MMAT is designed for the assessment of five study types: qualitative, quantitative randomized control, quantitative non-randomized, quantitative descriptive, and mixed-methods studies. There are two screening questions: (1) “Are there clear research questions?” and (2) “Do the collected data allow to address the research questions?” (15). The screening questions are followed by 25 appraisal items addressing quality criteria split into five sections corresponding to the specific study design, with each section having five questions. A total of five appraisal items are answered for all qualitative and quantitative study designs. A total of 15 questions are assigned for mixed-method studies as the specific two study designs included plus the mixed-methods-specific questions must be answered; however, the lowest score of the three categories is considered the overall quality. Response options to the series of questions include ‘yes’, ‘no’, or ‘cannot tell’. The full set of assessment questions can be found elsewhere (15). Quality was categorized as low (MMAT score, 0–2), moderate (MMAT score, 3–4), or high (MMAT score, 5).

TABLE 1 Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
- Study population includes MHCW - Reports on MHCW well-being outcomes or targeted, supportive interventions, directly or indirectly - Full-text available, if applicable - English language	- Does not stratify findings by minority status - Does not include outcomes related to well-being - Interventions not aimed at well-being (e.g., educational) - No abstract or full-text available for review - Articles that are not evidence-based (e.g., opinion pieces, editorials, or commentaries) - Duplicate paper included in a systematic or scoping review

The JBI tool was utilized for the quality appraisal of systematic reviews and scoping reviews. This tool has a total of 11 items with response options of ‘yes’, ‘no’, ‘unclear’, or ‘not applicable’. Overall quality was reported based on percentage of criteria as low (<40%), moderate (40–80%), or high (>80%).

Results

Study selection

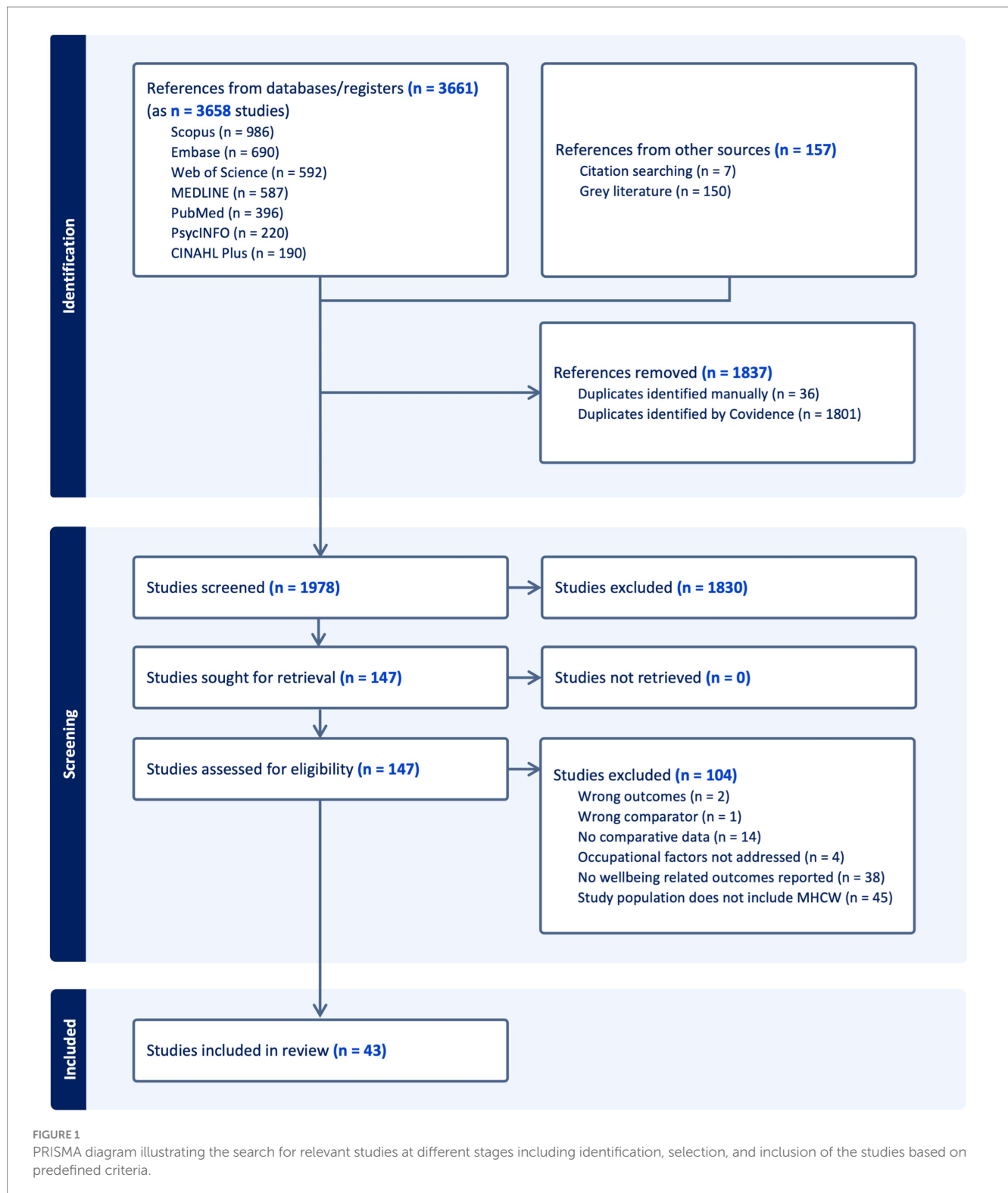
The initial search produced 3,815 records, of which 1,837 duplicates were removed (Figure 1). After screening of the available abstracts and titles by two independent reviewers, 147 studies were eligible for full-text review. Of these, 104 were excluded for various reasons (detailed in Figure 1) resulting in 43 included studies.

Study characteristics

All 43 included studies were written in English and published between 2006 and 2023. Most of the studies (67.4%) utilized quantitative descriptive methods, 7 (16.3%) qualitative, 3 (7.0%) systematic or scoping reviews, 2 (4.7%) quantitative non-randomized, and 2 (4.7%) were mixed-methods studies. No studies utilized a randomized design. Geographic location was mostly the United States (81.4%) followed by Canada (7.0%) and the United Kingdom (4.7%). Other countries included Germany, Israel, and Malaysia. There was wide variability in the types of healthcare professionals included: physicians, medical trainees (fellows, residents, and students), nurses, health department employees, physician scientists, and other clinical-based students. A majority of studies defined minority status by race/ethnicity. Table 2 summarizes the key characteristics of the included studies.

Studies measured several well-being domains such as burnout, emotional exhaustion, depersonalization, job satisfaction, intent to leave, depression, anxiety, and discrimination. Many authors created their own questionnaires or adapted already existing ones. Burnout was the most commonly assessed well-being outcome. Multiple validated and non-validated tools were utilized in assessing burnout; 10 studies utilized the Maslach Burnout Inventory (MBI) (18) and 5

¹ www.covidence.org



used the Copenhagen Burnout Inventory (CBI) (19). All authors used paper-and-pencil or web-based/electronic self-report questionnaires and nine studies used semi-structured interviews to identify qualitative themes. A majority of studies used convenience sampling to identify participants, however we included data from 4 large national systematic surveys that compare well-being measures for racial/ethnic minority and non-minority HCWs.

Study quality

The MMAT was used to evaluate 40 studies (Table 3). All of these had a response of 'yes' to the two screening questions, which were not included in Table 3. MMAT questions 2.1 to 2.5 were also not included as no studies met the design criteria. All primary studies met more than half of the quality criteria of MMAT and used an appropriate

TABLE 2 Characteristics of included studies.

Characteristic	N (Total <i>n</i> = 43)	%
Study design		
Quantitative descriptive	29	67.4
Qualitative	7	16.3
Quantitative non-randomized	2	4.7
Mixed-methods	2	4.7
Systematic/scoping review	3	7.0
Country		
United States	35	81.4
Canada	3	7.0
United Kingdom	2	4.7
Germany	1	2.3
Israel	1	2.3
Malaysia	1	2.3
Type of Healthcare Worker		
Physicians	13	30.2
Medical trainee (fellow/resident/student)	11	25.6
Nurses	5	11.6
Doctoral students	1	2.3
Health department employees	1	2.3
PhD/physician scientists	1	2.3
Physician associate students	1	2.3
Residency program directors	1	2.3
Student registered nurse anesthetists	1	2.3
Multiple	7	16.3
Multiple (students only)	1	2.3

sample frame to address the target population. However, the adequacy of the sample size and the use of valid methods was unclear for several studies. Two systematic reviews and 1 scoping review used the JBI appraisal tool. Table 4 shows appraisal results of JBI-evaluated studies. Overall, 76.7% of the included studies were of moderate methodological quality and 23.3% were of high quality. No studies were rated as low quality.

Study outcomes

Well-being in minority versus non-minority HCWs

Most qualitative studies (85.7%) did not have non-minority comparison groups, however all identified negative experiences for MHCW (20–25). The qualitative themes identified included exposure to microaggressions, institutional ostracizing, tense working environment, racial isolation, lack of culturally diverse mentors, stereotypical or offensive attitude from patients, unprofessional encounters from peers, pressure to prove themselves as a result of negative experiences, and fear of being othered. Experiences of microaggression and discrimination were reported by both racial/ethnic and gender/sexual MHCW.

A majority of studies (*n* = 29, 67.4%) compared the well-being of minority and non-minority HCWs either qualitatively or quantitatively. Of these, the vast majority (82.8%) noted some worse outcomes in the MHCW population (26–49). One study found no significant overall difference in burnout by gender or ethnicity (50). Three studies reported better well-being among MHCW in comparison to their non-minority counterparts (12, 51, 52). Garcia et al. (12) reported lower adjusted odds of burnout among minority racial/ethnic groups in comparison to non-Hispanic white participants (Hispanic/Latinx physicians, odds ratio [OR] = 0.63, 95% confidence interval [CI] [0.47, 0.86]; non-Hispanic Black physicians, OR = 0.49, 95% CI [0.30, 0.79]). This study was a secondary analysis of survey data from 4,424 physicians, using MBI to assess burnout. Authors noted several limitations including a much lower response rate for minority physicians and the utilization of the American Medical Association's Physician Masterfile dataset to identify minority physicians, which lacked comprehensive racial/ethnic information. Additionally, Abraham and Holman (53) conducted a scoping review of literature on the well-being of racial and ethnic minority nurses during the COVID-19 pandemic. Two studies in their review documented greater anxiety among white nurses, but contained relatively small, predominantly white, unrepresentative samples. The authors concluded that “findings for the nurses of color may not be reliable because the samples included few racial and ethnic minority nurses.” (53).

In regards to overall burnout scores, two studies found no significant difference between minority and non-minority medical students (28, 32). However, one of these studies (28) (*n* = 162) showed significantly higher rates of personal burnout among racial/ethnic minority medical students (*p* = 0.001). The second study (32) surveyed medical students (*n* = 545) and although there were similarly no overall differences in burnout, emotional exhaustion, or depersonalization, minority medical students had a significantly lower sense of personal accomplishment (42% vs. 28%; *p* = 0.02). Also of note, minority students were less likely to respond to the survey (37% vs. 50%; *p* < 0.001).

A systematic review by Lawrence et al. (54) that focused on the racial/ethnic differences in burnout rates had inconclusive findings, and recommended increased evaluation and focus on systemic factors that may be at play. Three of the 16 studies in this review did not include HCWs. Additionally, Lawrence et al. noted that their findings were nuanced and several of the included studies had methodological issues.

The majority of studies used convenience sampling to identify participants, but our sample also included data from four large national systematic surveys that compared well-being measures for racial minority and non-minority HCWs. The largest of these (31) (*n* = 27,953) was from the National Sample Survey of Registered Nurses. It found that Asians had lower odds (*p* < 0.001) of job dissatisfaction and having changed jobs (*p* < 0.001) compared to white counterparts, while Black and Hispanic participants showed no significant association. The authors concluded that race/ethnicity was a predictor of job satisfaction and turnover and Asian nurses showed more positive outcomes than white nurses, while Black and Hispanic individuals showed significantly worse outcomes. Another large national survey (30) (*n* = 14,778) reporting on the data from RN4CAST-U.S found that Black nurses reported greater job dissatisfaction (*p* < 0.001) and intent to leave within a year (*p* < 0.001).

TABLE 3 Appraisal of quantitative, qualitative, and mixed-method studies using MMAT.

Study design; Author (year)	Assessment criteria					
1. Qualitative	1.1	1.2	1.3	1.4	1.5	Quality
Boateng et al. (2019) (26)	Y	Y	Y	Y	Y	High
Cedeño et al. (2023) (20)	Y	Y	Y	N	Y	Moderate
Chilakala et al. (2022) (21)	Y	Y	Y	Y	Y	High
Keshet and Popper-Giveon (2016) (22)	Y	Y	0	Y	Y	Moderate
Klingler and Marckmann (2016) (23)	Y	Y	0	Y	Y	Moderate
Nfonoyim et al. (2021) (24)	Y	Y	Y	Y	Y	High
Rivera (2018) (25)	N	Y	Y	Y	Y	Moderate
3. Quantitative non-randomized	3.1	3.2	3.3	3.4	3.5	Quality
Daley et al. (2006) (56)	Y	Y	N	N	Y	Moderate
Jaishankar et al. (2021) (27)	N	Y	Y	Y	Y	Moderate
4. Quantitative descriptive	4.1	4.2	4.3	4.4	4.5	Quality
Armstrong and Reynolds (2020) (28)	N	Y	Y	N	Y	Moderate
Bazargan-Hejazi et al. (2023) (65)	Y	Y	Y	N	Y	Moderate
Burns et al. (2021) (29)	Y	Y	Y	0	Y	Moderate
Carthon et al. (2021) (30)	Y	Y	Y	0	Y	Moderate
Chin et al. (2016) (50)	Y	N	Y	Y	Y	Moderate
Doede (2017) (31)	Y	Y	Y	0	Y	Moderate
Douglas et al. (2021) (51)	Y	Y	Y	N	Y	Moderate
Dyrbye et al. (2007) (52)	Y	Y	Y	Y	Y	High
Dyrbye et al. (2006) (32)	Y	N	Y	Y	Y	Moderate
Evans et al. (2021) (33)	Y	Y	Y	N	Y	Moderate
Ey et al. (2013) (57)	Y	Y	Y	N	Y	Moderate
Frias and Yuen (2021) (34)	Y	Y	Y	N	Y	Moderate
Garcia et al. (2020) (12)	Y	Y	Y	Y	Y	High
Glymour et al. (2004) (35)	Y	Y	Y	Y	N	Moderate
Graham-Brown et al. (2021) (36)	Y	Y	Y	Y	Y	High
Greenberg et al. (2022) (37)	Y	Y	Y	N	Y	Moderate
Khan et al. (2021) (38)	Y	Y	Y	Y	Y	High
Mitchell et al. (2022) (39)	Y	Y	Y	N	N	Moderate
Nunez-Smith et al. (2009) (66)	Y	N	Y	N	Y	Moderate
Obichi et al. (2023) (67)	Y	Y	Y	N	Y	Moderate
Odei and Chino (2021) (40)	Y	Y	Y	N	N	Moderate
Padela et al. (2016) (41)	Y	Y	Y	N	Y	Moderate
Perina et al. (2018) (68)	Y	Y	Y	N	Y	Moderate
Pillado et al. (2023) (42)	Y	Y	Y	Y	Y	High
Primack et al. (2010) (43)	Y	N	Y	N	Y	Moderate
Psenka et al. (2020) (44)	Y	Y	Y	N	Y	Moderate
Rhead et al. (2020) (45)	Y	Y	N	Y	N	Moderate
Serrano et al. (2023) (46)	Y	Y	Y	N	Y	Moderate
Yoon et al. (2010) (47)	Y	Y	Y	Y	N	Moderate
5. Mixed-methods	5.1	5.2	5.3	5.4	5.5	Quality
Doyle et al. (2021) (48)	Y	0	0	Y	Y	Moderate
Eliason et al. (2018) (49)	Y	Y	Y	N	N	Moderate

MMAT scores of 0–2 represent low quality, 3–4 moderate quality, and 5 is high quality. 0 = cannot tell; N = no; Y = yes.

TABLE 4 Appraisal of systematic and scoping reviews using JBI critical appraisal checklist for systematic reviews and research syntheses.

Assessment criteria	Study author (year)		
	Abraham and Holman (2023) (53)	Alvandi and Davis (2023) (55)	Lawrence et al. (2022) (54)
1. Is the review question clearly and explicitly stated?	Y	Y	Y
2. Were the inclusion criteria appropriate for the review question?	Y	Y	Y
3. Was the search strategy appropriate?	Y	Y	Y
4. Were the sources and resources used to search for studies adequate?	Y	Y	Y
5. Were the criteria for appraising studies appropriate?	N	Y	Y
6. Was critical appraisal conducted by two or more reviewers independently?	N	Y	Y
7. Were there methods to minimize errors in data extraction?	N	Y	Y
8. Were the methods used to combine studies appropriate?	Y	Y	Y
9. Was the likelihood of publication bias assessed?	N	Y	Y
10. Were recommendations for policy and/or practice supported by the reported data?	Y	Y	Y
11. Were the specific directives for new research appropriate?	Y	Y	Y
Overall Appraisal	Include	Include	Include
Quality	Moderate	High	High

N = no; Y = yes.

in comparison to white nurses. A national training survey from the UK General Medical Council of 627 renal medicine physicians similarly suggested that racial/ethnic minority medical trainees reported higher burnout rates than white trainees (36).

However, data from a national physician survey ($n = 3,096$) from the American Board of Family Medicine (ABFM) Family Medicine Continuing Certification Examination Registration questionnaire showed that minority physicians were significantly less likely to report depersonalization, both as a binary variable ($p = 0.03$) and continuous variable ($p < 0.001$), less likely to report emotional exhaustion as a continuous variable ($p = 0.04$), but equally likely to report emotional exhaustion ($p = 0.09$) (51). Minority physicians were more likely to work in counties with higher diversity index and authors concluded that working in racially and ethnically diverse environments could be a mediating factor resulting in a lower frequency of emotional exhaustion and feelings of depersonalization (51).

Among studies that compared outcomes between men and women ($n = 16$), 68.8% found worse well-being among women HCWs. Yoon et al. (47) explored conflict as a correlate of burnout among HCWs. No association was found between conflict over treatment decisions and race/ethnicity, but there was a significant positive association among women physicians. Reasons for this association are not well understood, but Yoon et al. (47) suggest that female patients are more likely to choose female physicians and more willing to voice disagreements with physicians of the same gender. Five studies specifically investigated gender differences in burnout. Two of these studies did not find any difference in burnout among male and female HCWs (38, 50). One study found that male renal trainees reported higher burnout rates than women colleagues (36). However, a systematic review of 11 studies by Alvandi and Davis (55) showed that female HCWs reported greater burnout.

Sexual minority HCWs were examined in four studies. Key findings include discomfort in 'coming-out' in the workplace (49),

being socially excluded (25), and greater odds of depressive or anxiety symptoms than heterosexual counterparts (33).

Well-being interventions

Only one study, by Daley et al. (56) included a specific MHCW-focused well-being intervention. They examined the change in retention rate among health center faculty after the implementation of the Junior Faculty Development Program for minority-identifying faculty which provided development workshops, counseling, and mentoring. There was a non-significant increase in retention rate of 15% among minority-identifying faculty in academic medicine. One other study by Ey et al. (57) included an intervention that was not tailored to the MHCW population. They evaluated a Resident Wellness Program that provided free, on-site counseling for all medical trainees regardless of minority status. Findings indicated that MHCW were significantly less likely to utilize the program.

Details of study population, measures, outcomes, and lessons learned of all included studies are summarized in Supplementary 2.

Discussion

Contrary to our expectations, there were few publications on supportive interventions that specifically target MHCW. We found only one published MHCW-specific intervention, a development and mentorship program which showed no significant association with retention rate (56). Instead, findings from this review suggest that creating a safe work environment and empowering MHCW to participate in well-being interventions may be important. One study (57) showed that MHCW were less likely than their non-minority counterparts to utilize their well-being program. Several studies found discomfort among HCWs in receiving support, and that time away from work may be a potential barrier to utilizing well-being programs

(57, 58). These barriers may be greater for MHCW experiencing discrimination and other systemic challenges, who may want to avoid any additional discomfort in the workplace.

To our knowledge, this is the first systematic review to comprehensively explore the well-being of MHCW. We aimed to cover a broad topic area as we felt that any narrowing of the well-being definition may result in selection bias. The search included a broad range of search terms with minimal limitations. All study designs were included and no studies were excluded based on quality. Uniformity in the critical appraisal process was prioritized by usage of the MMAT which encompassed most study designs. This important review provided context and awareness to how intersectional factors (e.g., race, gender, sexual orientation) affects the well-being of the minority-identifying healthcare workforce, highlighting the importance of inclusivity and equity in the workplace and providing evidence-based syntheses for policymakers to improve the well-being of MHCW.

Consistent with previous literature, we found inconsistencies in well-being outcomes among MHCW. There are potential reasons for these discrepant findings. It is important to consider that minority populations may express stress differently which could affect scores on well-being measures. The validity of previously established stress models has been questioned for minority populations. Ivey and Gauch (59) demonstrated that “minority communities have different distributions of emotions than the general population” and that existing models may not be representative as they are not trained with minority-specific data. Singh et al. (60) found that chronic stress among individuals who experience continuous discrimination leads to emotional dysregulation and emotional suppression. They argued that the “impact of any instance of social isolation, discrimination, and bias is directly responsible for suppression of emotional expression” (60) whether that be negative or positive responses. This potential reporting bias should be considered in interpreting our findings.

Notably, larger, well-represented national surveys tended to find higher rates of burnout among MHCW. It also appeared that burnout among MHCW can be modulated by a variety of professional and environmental factors. For example, working in racially and ethnically diverse environments was found to be a mediating factor reducing burnout among minority family physicians (51). MHCW may feel less minoritized in settings that promote diversity. Similarly, in a survey of 519 oncologists, 48 minority radiation oncologists reported greater burnout rates than non-minority, but minority medical oncologists reported lower burnout rates than non-minority respondents. This suggests a potential influence of differences in work environment on burnout (40).

Psychological distress can be cumulative over the life course and can also be compounded by the presence of multiple stressors. For example, identifying with more than one type of minority or identifying with an ‘invisible’ minority group may be associated with worse outcomes. Those identifying as sexual minorities, in particular, are sometimes able to make a ‘choice’ about coming-out to colleagues and patients, as opposed to those with racial/ethnic minority status which may be more visibly apparent. This could worsen well-being among the LGBTQ+ community as they internalize negative feelings. Future studies should control for or evaluate the differences associated with a particular minority group, however this is understandably challenging given the concept of intersectionality in identity. There is a complex interplay of various facets of identity, such as ethnicity, gender,

sexuality, professional seniority, etc., that do not exist in isolation but rather intersect in various ways to shape an individual’s context (61).

There are multiple benefits to an inclusive and supportive work environment in promoting well-being among MHCW. Wolfe (62) theorizes that LGBTQ+ healthcare professionals, similar to other minority-identifying populations, encounter incongruence between their personal and professional identities, and thus have differential experiences with mental distress and burnout. They also call for “intersectional actions that recognize and mitigate spaces of inequality that constrain the benefit marginalized professionals receive from improvement efforts” (62) such as interventions tailored to specific minority group needs. Brown et al. (63) emphasize that medical education diversity goals are only attainable “when inclusion and equity are on the table as well” since a supportive work environment must address systemic inequalities in order to promote well-being among the workforce. Prioritizing diversity and inclusion policies requires a systemic approach of stakeholder collaboration, strategy evaluation, and community engagement (64). This will also have a direct impact on the retention of MHCW. Additionally, a healthcare workplace that closely represents the community it serves will improve the quality of care (64).

Limitations

This study has some limitations. There was methodological heterogeneity in the types of well-being outcomes and the measurement tools included in studies. However, there was less heterogeneity in the study populations. Studies also utilized different definitions of “minority” with most focusing on racial/ethnic minorities, while others included immigration status and religious affiliation. This prevented aggregation or quantitative comparisons of results. Furthermore, findings from different countries were included in this review without consideration of the cultural, political, and economic contexts surrounding healthcare. Therefore, the results should be interpreted in context.

Conclusion

There is paucity of published evidence on supportive interventions to address MHCW well-being. The results of our review do not fully support the need for well-being programs tailored solely to MHCW. However, we could only find one study specifically supporting MHCW’s. It is possible that systematic barriers such as discrimination are preventing MHCW’s participation in support programs. Given the complex and intersectional nature of identity, it is understandable that there is no one “size” approach even among a particular population of MHCW. Rather, a broad public health approach should be considered to mitigate the negative health outcomes and improve utilization of support programs, including the development and implementation of policies surrounding diversity and inclusion, mental health services, and cultural competency. By increasing focus on the barriers to well-being faced by MHCW, the well-being of the entire healthcare workforce could be improved and subsequently translate into better patient care. We recommend future research on MHCW utilizing validated

well-being measures and incorporating a wider geographical variation beyond North America and Europe, especially from underrepresented countries.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

TB: Formal analysis, Writing – original draft, Investigation, Methodology. MM: Formal analysis, Writing – original draft, Conceptualization, Writing – review & editing. MC: Formal analysis, Investigation, Writing – review & editing. WH: Data curation, Software, Writing – review & editing. CW: Methodology, Writing – review & editing. KW: Investigation, Methodology, Writing – review & editing. CC: Writing – review & editing. MB: Writing – review & editing. GE: Writing – review & editing. HM: Funding acquisition, Writing – review & editing. AW: Funding acquisition, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

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EDITED BY

Kim Walker,
University of Aberdeen, United Kingdom

REVIEWED BY

Kata Ivanišević,
University of Rijeka, Croatia
Sandra Nicholson,
University of Worcester, United Kingdom

*CORRESPONDENCE

Cindy E. Frias
✉ cfrias@clinic.cat

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Strategies to support the mental health and well-being of health and care workforce: a rapid review of reviews

Cindy E. Frias^{1*}, Nimesh Samarasinghe², Cecilia Cuzco³, Jaseem Koorankot², Andrés de Juan¹, Husameldin Mohamed Ali Rudwan², Hanan F. Abdul Rahim⁴, Adela Zabalegui⁵, Iain Tulley², Sanaa T. Al-Harashsheh⁵, Mona Shaheen S. T. Al-Homaiddi², Meredith Fendt-Newlin⁶ and Jim Campbell⁶

¹Hospital Clinic of Barcelona, Barcelona, Spain, ²Hamad Medical Corporation, Doha, Qatar,

³Fundamentals and Clinical Nursing Department, University of Barcelona, Barcelona, Spain, ⁴College of Health Sciences, Qatar University, Doha, Qatar, ⁵Qatar Foundation, Doha, Qatar, ⁶World Health Organization, Geneva, Switzerland

Background: Countries globally face challenges in educating, employing and retaining their health and care workforce, largely due to underinvestment in health systems. Health and care workforce report significantly greater levels of job-related burnout and mental health problems, which in turn are associated with poorer patient outcomes, increased medical errors, diminished quality and safety, decreased patient satisfaction, and reduced healthcare efficiency.

Objective: We conducted a rapid review of systematic reviews to evaluate the mental health and well-being of health and care workers since the onset of the COVID-19 pandemic and to identify interventions available at organizational and individual levels.

Methods: PubMed and Epistemonikos were searched for systematic reviews published between May 2022 and February 2024. The inclusion criteria were systematic reviews written in English with quantitative design, with or without meta-analysis.

Results: Fifty articles met the criteria for inclusion in the analysis. Overall, there has not been a significant change in the prevalence of depression and anxiety among health and care workforce since 2022, suggesting the impact of the COVID-19 pandemic on workers' mental health and well-being was not specific to their experience working during the pandemic. Sixteen studies reported two types of mental health and well-being interventions: individual-level interventions and organizational-level interventions with specific impact on mental health and work environment variables. No specific policy interventions were found. However, some studies suggested policy interventions to improve the mental health and well-being of the health and care workforce.

Discussion: Our analysis highlighted the need for systemic changes to protect the mental health and well-being of the health and care workforce in the post-COVID-19 era. Despite the wealth of evidence on mental health problems and on effective interventions, there remains a notable gap in systemic implementation and organizational accountability. The call to action for a paradigm shift must be embraced and we must strive to build resilient healthcare systems and invest

in active support and sustain them, incorporating structural, non-structural and functional aspects of organizational resilience.

KEYWORDS

public health workforce, rapid review, healthcare workers, mental health, burnout, depression, anxiety, health systems resilience

1 Introduction

Countries worldwide face significant challenges in educating, employing, and retaining their health and care workforce, largely due to underinvestment in health systems. These challenges are particularly pronounced in low-income countries and among the 55 countries listed on the WHO Support and Safeguards List 2023 (1). Where shortages, low pay, unsafe working conditions, and high-stress levels persist (2). These systemic issues have led to a growing mental health burden among health and care workers (HCWs), exacerbating burnout, absenteeism, and reduced job satisfaction (2, 3). The resulting impacts extend beyond individual workers, contributing to poorer patient outcomes, decreased healthcare efficiency, and widening gaps in healthcare delivery (3, 4).

The World Health Organization (WHO) defines HCWs as individuals engaged in work actions intended to improve health, including doctors, nurses, midwives, public health professionals, community health workers, and traditional medicine practitioners (4). Mental health, defined by the WHO as a state of well-being that enables individuals to cope with life stresses and contribute to their communities, is a critical component of overall health and a fundamental human right (5, 6). Similarly, well-being, encompassing quality of life and societal resilience, is influenced by social, economic, and environmental conditions (7). These definitions highlight the urgent need to address mental health and well-being as central components of workforce sustainability (7, 8).

The COVID-19 pandemic exposed and intensified preexisting vulnerabilities within healthcare systems, placing HCWs under immense pressure. During this period, HCWs experienced increased workloads, emotionally charged situations, and stigma surrounding mental health care, resulting in heightened levels of anxiety, depression, and burnout (9, 10). These challenges highlighted the inadequacy of organizational support structures and the need for systemic changes to safeguard HCWs' mental health and well-being (10–14). Building on the recommendations “Our Duty of Care: A global call to action to protect the mental health of health and care workers,” (15) this rapid review evaluates the mental health and well-being of HCWs since the onset of the COVID-19 pandemic. It is further informed by World Health Assembly (WHA) Resolution 74.14 (16) which called for the development of the Global Compact for Health and Care Workers to alleviate mental health disorders and improve HCW well-being. The review also draws on other WHO guidelines on mental health at work to identify supportive interventions and programs. Specifically, it examines individual and organizational level interventions aimed at addressing these challenges. Despite the wealth of evidence and guidance, the systemic implementation of such measures remains limited. By synthesizing recent findings, this review seeks to address this gap and propose strategies to safeguard HCWs' mental health and build resilience within healthcare systems (11, 17).

Therefore, this rapid review aims to evaluate the mental health and well-being of health and care workers since the onset of the COVID-19 pandemic and to identify interventions available at organizational and individual levels.

2 Materials and methods

We conducted this Rapid Review using Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guidelines (18). Two authors independently conducted the literature search, study selection, and data extraction. Any disagreements were resolved by discussion with a third author when necessary.

2.1 Study search

The literature search utilized two electronic databases PubMed and Epistemonikos. Both were also used in the 2022 Our Duty of Care report (15). The latter database focuses on systematic reviews and regularly updates from several databases including the Cochrane Database of Systematic Reviews (CDSR), EMBASE, and PsycINFO. The search strategy used for both databases was partially based on the previous Our Duty of Care report. For PubMed database, the following search strategy was implemented: (“Mental Health”[Mesh] OR “Anxiety”[Mesh] OR “Depression”[Mesh] OR Burnout OR Distress OR Stress) AND (“Nurses”[Mesh]) OR “Physicians”[Mesh] OR Doctors OR Health Care Workers OR Health Workers)] NOT (Pati* OR Qualitative OR Scoping OR Synthesis). For Epistemonikos database, the following search strategy was used with some minor changes respecting the other: Mental Health OR Anxiety OR Depression OR Burnout OR Distress OR Stress AND Nurses OR Physicians OR Doctors OR Health Care Workers OR Health Workers NOT Pati* NOT Qualitative NOT Scoping NOT Synthesis. The search was limited from the period of May 2022 (which was the final period carried out for the Our Duty of Care Report, 2022) to February 2024. The terms chosen for both databases can be seen in [Supplementary material S1](#).

2.2 Inclusion criteria

The inclusion criteria chosen were nearly identical to those used in the previous review 2 years ago to ensure consistency in addressing the same area. However, for this review, the articles did not need to measure the impact of COVID-19 specifically, as many recent studies no longer consider it a primary focus. Inclusion criteria were English-language, quantitative systematic reviews with or without meta-analysis, available in full text and published between May 2022 and February 2024. Additionally, articles were required to include a mental health outcome, including burnout or stress, anxiety, depression,

suicidal ideation, trauma, insomnia, and/or sleep disturbances. Moreover, the selected articles focused on or included the health and care workforce, such as physicians, nurses, community health workers, physical therapists, pharmacists, and other related professions. All these criteria were followed based on the duty of care report protocol.

2.3 Exclusion criteria

The exclusion criteria were as follows: studies including healthcare students or the general population with no separate analysis of the health and care workforce, publications other than systematic reviews or with qualitative or mixed methods designs, studies written in languages other than English and studies that did not measure or did not track any mental health related outcome such as those specified in the inclusion criteria.

2.4 Study selection

In the first screening process, two independent researchers (AD and CC) screened the titles and abstracts of the searched documents from both databases to identify potentially related articles meeting the eligibility criteria. To remove duplicates, the Zotero® and Rayyan® platforms were used. The titles and abstracts were initially read, according to the pre-established criteria, by two independent reviewers; besides, the same researchers independently reviewed the selected full texts. The final inclusion of studies was decided through the two-step screening process. In the screening process, discrepancies between the researchers were resolved through discussion with a third researcher (CF). The study selection process is presented following a PRISMA flow diagram in [Figure 1](#).

2.5 Risk of bias assessment

The current review did not conduct a formal risk of bias or quality assessment, which is often omitted in rapid reviews. Due to the limited time available for data analysis and considering that all included articles were systematic reviews—most of which had already assessed the methodological quality of the studies within them—no additional specific risk of bias assessment was conducted. However, we ensured that all included studies had undergone a prior risk of bias evaluation, thereby enhancing the reliability and robustness of the evidence.

2.6 Data extraction

Data extraction was conducted independently by two reviewers (AD and CC) to ensure accuracy and consistency. Any conflicts were resolved by a third reviewer (CF). To ensure the integrity of the assessment, we piloted the data extraction form on three studies. The extracted data included publication date, author(s), the title of the study, study design, country or geographic area covered, total population size, types of health and care workforce included in the study, an assessment tool to measure mental health burden and well-being, and the aim of studies related to mental health variables and well-being.

2.6.1 Data analysis

To conduct a detailed and comprehensive analysis of the results of each included study, a description table was designed to extract all relevant data related to the main outcomes related to mental health burden, well-being, and work environment. In addition, for each included article, we analyzed whether the interventions aimed at improving health and care workers' mental health or well-being had been designed for implementation at an organizational or individual level and the benefits obtained on mental health, well-being, and the work environment. Finally, each included study was also analyzed to see if recommendations at the government level based on actions at the policy level were presented.

3 Results

3.1 Study search

The flowchart of the study selection process is shown in [Figure 1](#). The initial search found 455 references. After removing duplicates, 425 records were screened by title and abstract. Then, 128 full-text articles were retrieved for detailed evaluation. After review, 71 articles were removed for the following reasons: wrong study design (i.e., qualitative design only or qualitative design combined with other design) ($N = 22$), wrong population ($N = 46$), and other reasons ($N = 3$). "Wrong population" refers to studies on students or the general population instead of health and care workers. "Other reasons" include studies not being in English, wrong publication type, or not being found. Fifty seven studies were assessed for eligibility, leading to the exclusion of 7 studies. Fifty studies were finally included. Therefore, the intervention of the third reviewer was not necessary.

3.2 Characteristics of the articles included

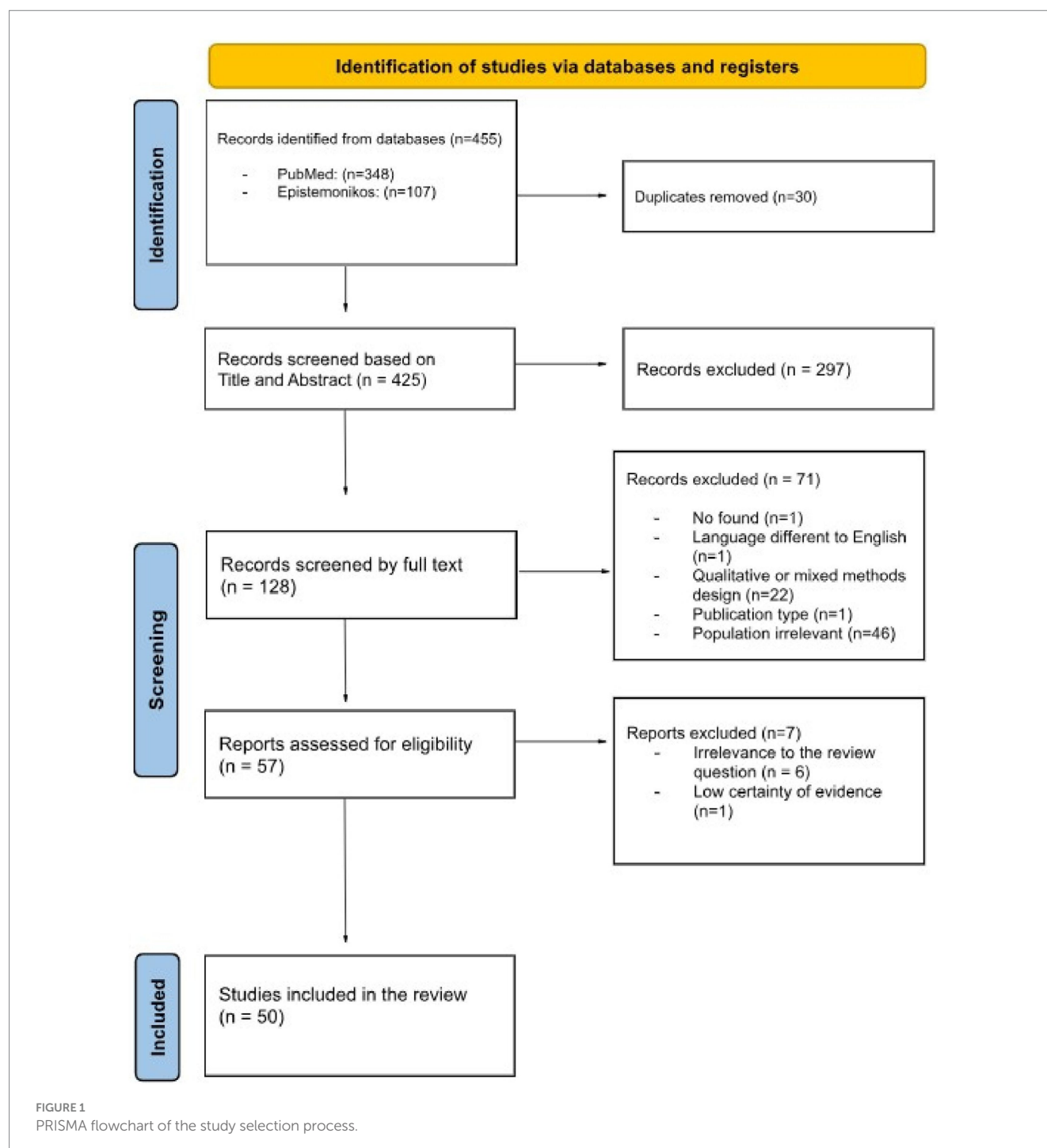
An overview of the 50 studies selected for data extraction and analysis is presented in [Supplementary Table 1](#). Fifty studies were included, of which 34 included a meta-analysis, and 16 were systematic reviews without meta-analyses. The studies were conducted in China ($n = 19$), France ($n = 5$), England ($n = 4$), Korea ($n = 4$), and Brazil ($n = 3$). One study was conducted in each of the following countries: Canada, Greece, South Africa, India, Lebanon, Saudi Arabia, Singapore, Finland, USA, Romania, Spain, Hungary, Indonesia, and Australia.

3.3 Participants

In the studies, the sample sizes ranged from 29 HCWs (19) to more than 341,014 (20) HCWs. Samples were predominantly female (at least more than 50% in 14 of the included studies). Most of the participants were nurses and doctors. Some studies also included the participation of midwives (21), occupational therapists, speech therapists (22), social workers (23), dentists (24, 25), technicians and administrative staff (26), paramedics, laboratory and X-ray technicians (19, 20, 23, 27–29).

3.4 Aim of the articles included

The studies measured mental health outcomes, including anxiety, depression, burden, and Post Traumatic Stress Disorder (PTSD), and



well-being outcomes, such as job stress and satisfaction, sleep disorders, quality of life (QoL), general health and job stalking (job stalking is described as unwanted harassing behavior towards health and care workforce from patients or even from patients' relatives). It is undesirable and repeated behavior, including following or monitoring someone, writing letters, calling by phone, communicating on the Internet, giving unsolicited gifts, and making annoying requests (30) and presenteeism. Likewise, some results associated with the work environment, such as workplace bullying, were evaluated.

3.5 Main results

3.5.1 The mental health and well-being of HCWs since the COVID-19 pandemic

The updated prevalence estimates for anxiety were lower than for the general population, especially for men and women (28) until study estimates ranged from 6 to 90% (20). The level of depression symptoms was also lower than for the general population (28) rates varied until 91.30% (M = 27.23%, M = 23.28%) (23).

HCW reported that burnout and moral distress were conditions that had been present since before the pandemic, but that worsened due to the pressure of care at that time. This worsening was more evident in specific health and care groups, such as nurses and doctors. However, no significant differences have been observed compared to the previous report's data, even if it has been noted that Intensive Care Unit (ICU) doctors and nurses exhibit higher levels of burnout, with 42 and 45%, respectively. An analysis of 20,723 ICU professionals revealed that the prevalence of high burnout levels did not differ significantly ($p = 0.63$) between ICU physicians (0.41 [95% CI, 0.33; 0.5]) and ICU nurses (0.44 [95% CI, 0.34; 0.55]). However, the proportion of ICU professionals with a high level of emotional exhaustion was higher in ICU nurses than in ICU physicians (0.42 [95% CI, 0.37; 0.48] and 0.28 [0.2; 0.39], respectively, $p = 0.022$) (31). We found burnout prevalence rates until 95% (32). A meta-regression analysis showed that the association between workplace bullying, and job burnout was stronger in studies with a higher percentage of females (coefficient beta = 0.01, 95% CI = 0.006 to 0.019, $p = 0.001$) (33). Several studies have examined the relationship between sociodemographic variables and burnout. Findings indicate that gender is not a significant predictor of burnout. However, educational attainment demonstrates a significant association, with nurses holding bachelor's degrees exhibiting the highest levels of burnout among all academic groups (34).

The overall prevalence of PTSD ranged between 14% and 16% during the pandemic, 19% between 1 and 6 months after the end of the pandemic, then decreased to 8% over a year later. According to the results of our rapid review the prevalence of PTSD was lower after the pandemic ended and tended to be lower after the following year (22). However, it is noted that alterations in the sleep–wake cycle pattern are still present in HCWs. Some authors also found a high level of sleep disturbance with a prevalence of insomnia (46.9, 95% CI: 31.8, 62.5%; $I^2 = 97.7\%$, $p < 0.001$) (35).

A revision showed the prevalence of PTSD was 65.9% (IC 95%: 62.6%, 69%; $I^2 = 0\%$, $p < 0.001$) (35). Other mental health problems were found: 18.8% of men and 10.7% of women used alcohol to cope. 22.8% reported a lifetime suicidal ideation, with 10.4% reporting serious suicidal ideation and 3.1% reporting having previously attempted suicide. No gender difference was found, but there was a higher prevalence of women who 'wished they were dead' (28). One study found the rate of suicidal thoughts to be 1.5 to 3 times higher than the national average, but only 26% of those with suicidal thoughts had sought help, and 60% of those with suicidal ideation were hesitant to seek help due to concerns about their career (36). A review revealed that the rates of fear occurrence were (52.1, 95% CI: 30.1, 73.3%; $I^2 = 98.1\%$, $p < 0.001$) (35) (Supplementary Table 2). Supplementary Table 3 describes the prevalence of mental health disorders by region and occupation.

3.5.2 Evidence of interventions

This rapid review also considered studies that provided interventions that addressed outcomes related to the mental health and well-being of HCWs, in any clinical care setting where health and care workforce provide care.

Of the 50 studies included, 16 studies reported the outcomes of interventions on health and care workforce's mental health and well-being. After analyzing each one of them, they were classified into two types of interventions: interventions at the individual level

and at the organizational level. These types of interventions or categories are based on the WHO guidelines on mental health at work. In these guidelines, the WHO provides evidence-based global public health guidance on organizational and individual interventions for the promotion of positive mental health and the prevention of mental health conditions, as well as recommendations on returning to work after absence associated with mental health conditions and obtaining employment for people living with mental health conditions (37).

3.5.2.1 Individual-level interventions

In the included reviews, various interventions were carried out at the individual level, such as single interventions with one or several sessions, multi-component interventions, and interventions focused on alleviating mental health symptoms to also improve emotional well-being.

- a. Interventions with one or more sessions: *Well-being Centers*: These centers were equipped with staff ('well-being buddies') trained to offer psychological first aid to personnel of an acute hospital trust (listening, comforting and directing towards services, as needed) (38). *Training Programs*: Simulation-based teamwork training to develop leadership and communication skills, crucial during crises (38). *Resilience Training Program* ("R2 for Leaders"): Comprising virtual sessions to equip healthcare leaders with skills for organizational leadership and staff support (38). *Psychoeducation programs* showed a significant impact on stress reduction and how nurses cope with challenges using positive coping mechanisms (39).
- b. Multi-component interventions: *Specific Multi-Component Programs*: Workplace recognition; infection protection measures, reasonable work shift arrangements, logistical support, reorganization of wards and increased nurse-to-patient ratios; training on PPE use and its availability; establishment of a psychological help desk, promotion of autonomy among nurses, limiting work hours, adjusting staffing levels, providing information updates, offering immune-boosting supplements, and mental health support services. The multi-component prevention programs demonstrate potential protective effects, such as reducing anxiety and depression, and enhancing the quality of the psychosocial work environment, including job control, managerial and peer support, and workplace relationships. However, the confidence in these findings is low due to reliance on observational study designs and significant risks of selection and confounding bias (38).
- c. Interventions focused on alleviating specific symptoms: *Mindfulness-based interventions (MBI)*: focused on stress reduction using relaxation, yoga, breathing, and physical exercise. The evidence suggests that MBI training moderately reduces stress, but it shows no significant effect on anxiety (40). However, some authors concluded that MBI appears to alleviate stress and depression and has beneficial effects on the well-being of nurses (21, 41–43). Yang et al., also confirmed that MBI may be effective in reducing the symptoms of anxiety, depression, and stress. In addition, the training effectively reduces burnout (29, 40).

Evidence claimed by Lee and Chiyong (44) supported reducing emotional exhaustion and depersonalization but did not support low personal accomplishment. Furthermore, MBI also effectively reduced the oncology nurses' Compassion Fatigue. However, its effectiveness requires further research confirmation (45, 46). *Art Therapy*: One of the included reviews revealed significant reductions in anxiety, depression, and perceived stress levels among clinical nurses (47). *Music-based interventions*: Another review suggested that music interventions may decrease stress parameters even under critical stressful pressure (19). *Interventions based on cognitive behavioral therapy (CBT)* for PTSD, anxiety, and depression were found to lead to reliable changes in PTSD and anxiety symptoms (48). Some interventions were also found based on resilience programs, mobile applications, and nurse-led interventions that showed some effects on secondary traumatic stress, burnout, and compassion satisfaction (45). Figures 2–5 describe individual interventions by region.

3.5.2.2 Organizational-level interventions

The review identified a glaring lack of organizational-level intervention in coping with emotional distress and improving work-related outcomes. However, only one of the reviews concluded that increasing salaries, nurse remuneration or benefits, improving professional skills, empowerment, strengthening mutual support among peers, and engaging in team-building activities can help reduce work alienation, considering these factors as a protective factor (49).

3.5.3 Policy-level interventions

No specific policy interventions were found, but some authors pointed out some recommendations based on their findings. Recommendations included highlighting the need for gender-sensitive policies and programs when addressing the diverse effects of the pandemic on different employment outcomes, such as recent precedents on healthcare pressure and the impact on the mental health and well-being of health and care workforce, they also show that further studies are required to establish successful methods to promote gender equality in the labour market and to point out the underlying causes of the gender differences detected through the analysis (50).

COGNITIVE BEHAVIORAL THERAPY

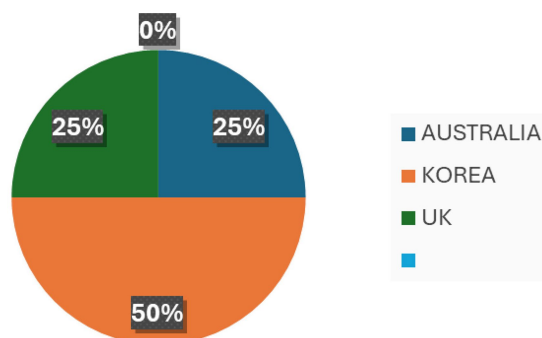


FIGURE 3
Percentage of cognitive behavioral therapy at individual level by region.

ART THERAPY OR MUSIC FRIEND INTERVENTIONS

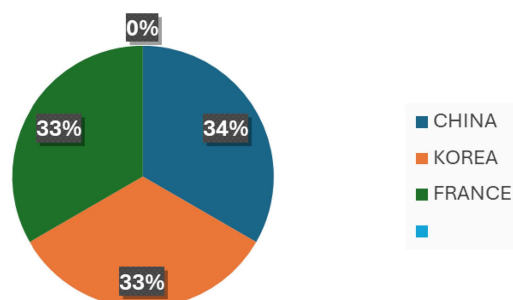


FIGURE 4
Percentage of art therapy/music intervention at individual level by region.

MINDFULNESS

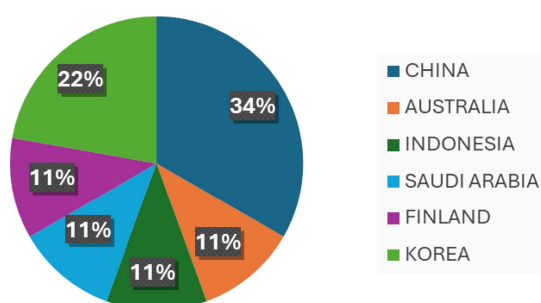


FIGURE 2
Percentage of individual mindfulness interventions by region.

RESILIENCE/SUPPORT PROGRAMS

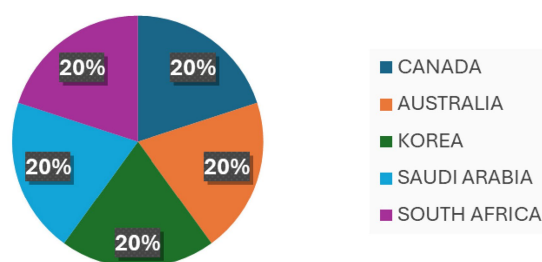


FIGURE 5
Percentage of resilience/support programs at individual level by region.

4 Discussion

The Our Duty of Care report highlights the significant mental health challenges confronting the health and care workforce, exacerbated by the COVID-19 pandemic (15, 51). Contributing factors include excessive workloads, inadequate pay, high patient-to-nurse ratios, early burnout, and increasing intention to leave the profession. Additionally, societal shifts such as ageing populations and the rise of chronic illnesses have amplified the demand for nurses, particularly in community and long-term care settings (52–54).

Our review highlighted the need for systemic changes to safeguard HCWs' mental health and well-being in the post-COVID-19 era. Despite extensive evidence of the mental health burden and effective interventions, there is a notable lack of systemic implementation and organizational accountability. A significant shift is necessary to address ongoing issues like anxiety, depression, burnout, stress, and PTSD among HCWs (22, 36, 50, 55–58). However, depression prevalence data must be cautiously interpreted due to inconsistencies in definitions and measurement methods (23).

Galanis et al. (33) recently found that high levels of compassion satisfaction among nurses reduced workplace bullying's negative effects, lowering the risk of compassion fatigue, burnout, stress, and depression. This finding should inform future organizational and individual interventions aimed at improving HCWs' mental health and well-being.

4.1 Shifting the burden: from individual resilience to organizational resilient culture

The COVID-19 pandemic exposed the limitations of focusing solely on individual resilience, highlighting the need to integrate resilience into organizational culture. The Our Duty of Care report (15) highlighted the failure to adequately support HCWs, emphasizing the importance of sustainable interventions. Placing the burden of resilience solely on individuals can harm their mental health, especially when systemic factors are ignored. Evidence suggests that healthcare organizations must provide supportive environments during crises, which enhances both healthcare systems and patient care (33, 39, 59). Therefore, a fundamental shift in organizational culture is needed to foster a resilient healthcare system.

Resilience operates across multiple levels: individual, organizational, and systemic. In times of crisis, resilience should be initiated at the organizational level, as healthcare organizations play a pivotal role in supporting health and care workforce (60, 61). By integrating structural, non-structural, and functional elements of resilience, organizations can effectively support HCWs during disruptions, alleviating individual stress and enhancing crisis management at the system-wide level.

The focus on resilience has evolved beyond individuals to exploring how organizations can foster resilience within their systems. Recent efforts aim to understand the human elements of resilient systems, including how resilience affects health and care workers, patients, and families. This shift emphasizes informal networks, communication, and the importance of engaging people in maintaining system safety. Additionally, there is a need for further research on everyday clinical work and developing robust research

methods, such as simulations, to study resilience in healthcare systems (62).

A resilient healthcare system is characterized by robust leadership, adequate resources, and effective organization. Resilience requires a motivated workforce, strong partnerships, and reliable information systems, alongside financial reserves. Effective leadership is essential to mobilize resources, adapt service delivery, and manage crises. Policymakers must regularly assess their healthcare systems to identify vulnerabilities and prepare for potential risks. Targeting weak areas enhances both resilience and overall system performance (63).

Lessons learned from recent shocks offer valuable insights into building resilient healthcare systems. While effective crisis responses are essential, a comprehensive understanding of resilience necessitates an examination of its broader dimensions, particularly the integration of healthcare systems with external frameworks, such as ecological and socio-political structures. Well-integrated systems demonstrate greater resilience in withstanding shocks. Furthermore, crises often exacerbate existing inequalities, intensifying disparities in health outcomes and access to care. Addressing these inequities is a critical component of resilience-building policies (64).

The transition from merely conceptualizing resilience to actively operationalizing it within healthcare systems is imperative. Strengthening resilience requires the creation of enabling environments through the development of policies, operational frameworks, and evaluation mechanisms. Additionally, integrating health and care workers into governance structures and enhancing their capacities are vital steps in constructing a more resilient healthcare system (65).

4.2 Organizational interventions: a critical need

After analyzing the 50 included articles, no organizational-level interventions aimed at addressing emotional distress and improving work-related outcomes were observed. Review findings also highlighted the lack of training for managers in specific mental health conditions of HCWs. The findings emphasize a considerable need for equipping leaders with skills to help create a supportive environment for the health and care workforce and address the mental health crisis in the workplace. Findings also indicate that organizations with supportive environments facilitate more effective crisis management, enhance work satisfaction, and highlight the significance of fostering resilience in organizations (39, 59). This further emphasizes the importance of providing leaders with the necessary resources to establish such a setting and proactively tackle mental health issues.

Although Cognitive Behavioral Therapy (CBT) and mindfulness interventions have been shown to be effective at the individual level, their integration into organizational-level interventions remains limited (29, 41–43, 48, 66). There is a need for healthcare systems to adopt evidence-based organizational interventions that promote psychological well-being and job satisfaction on a broader scale (38, 39, 59, 67, 68).

Therefore, considering all possible scenarios and stakeholders designing complex interventions attempts to go beyond asking whether an intervention works in terms of achieving the intended outcome, and address a broader range of questions (e.g., identifying the impact on HCW, patient outcomes, economic impact on the organization and the

healthcare system). Furthermore, designing complex interventions for system change could use the evidence generated to support real-world decision-making. A complex intervention is one that is designed taking into account other components than the intervention itself, allowing its implementation to vary in different contexts, while maintaining the integrity of the core components of the intervention taking into account the context, key uncertainties, stakeholders, economic considerations and continuous improvement of the intervention based on the aforementioned components, with the aim of refining and adapting it to the context and need (69).

4.3 Assessment tools: a gap in systemic evaluation

Although the mental health burden among HCW has been acknowledged (20, 57, 58), there is a noticeable lack of comprehensive assessment tools designed to evaluate and improve organizational interventions. Existing tools primarily assess individual mental health factors without offering a comprehensive framework for identifying and addressing issues at an early stage. Findings signify the need for developing comprehensive guidelines for assessing organizational and individual interventions (38, 68, 70–74), both universal and specific, to evaluate the implementation and effectiveness of interventions in healthcare organizations to enhance HCWs' mental health and well-being.

4.4 Strengths and limitations of this rapid review

Although we performed a rigorous rapid review following PRISMA guidelines, our study had some limitations. First, we opted to use English as the language of inclusion to limit the number of articles we could gather, excluding other languages such as Spanish. Second, time constraints necessitated conducting the data analysis within a period of less than 2 months. Although most systematic reviews employed tools to assess the quality of the articles, we did not assess the thoroughness of these evaluations. All included articles were systematic reviews, with the majority having already evaluated the methodological quality of the studies within each review. No additional specific risk of bias assessment was performed on the included studies; however, we ensured that all studies had previously undergone a risk of bias evaluation.

Third, most of the reviewed studies focused on the mental health of nurses and physicians. This emphasis should be considered when applying the findings to other healthcare and care workers. Although this rapid review included studies on other healthcare professionals, such as dentists, psychologists, and physiotherapists, these groups were underrepresented or, in some cases, not studied at all. Fourth, this rapid review excluded qualitative studies, as quantitative research typically involves larger sample sizes and employs standardized measures, making its findings more generalizable. Nonetheless, qualitative research remains essential for capturing the complexities of mental health and well-being, offering valuable insights into the personal, emotional, and cultural factors that may not be adequately addressed through quantitative methods. While quantitative approaches are often prioritized when seeking large-scale, standardized evidence, both methodologies are

complementary and contribute to a more comprehensive understanding of the topic. Future reviews would benefit from a mixed-methods approach, incorporating both qualitative and quantitative studies to provide a more comprehensive understanding of the topic.

5 Conclusion

5.1 Towards health system resilience

The findings of this review indicate that, although there has been no significant change in the prevalence of depression and anxiety among health and care workers since 2022, these workers continue to exhibit levels of anxiety and depression. These levels are clearly representative in specific groups of workers and units. This suggests that these mental health issues and burnout are not exclusive to pandemic situations but may be associated with work-related factors, as well as personal and family factors of each worker. Therefore, the findings of this review underscore the significant mental health challenges faced by health and care workers, which are exacerbated by systemic issues such as inadequate working conditions, staff shortages, and evolving societal demands.

Based on the analysis of the interventions offered to health and care workers (HCWs), it was observed that individual interventions are the most commonly provided. These interventions have shown some effectiveness in reducing stress, improving well-being, and developing coping strategies. Among the most notable individual interventions are mindfulness and cognitive-behavioral therapy. However, it is crucial to address the underlying causes of burnout, stress, and anxiety, as this requires broader structural changes within healthcare organizations.

It is evident that relying solely on individual resilience is insufficient and unsustainable. Instead, resilience must be embedded within healthcare systems, with organizations assuming a central role in fostering supportive environments. This necessitates the integration of structural, non-structural, and functional elements of resilience into organizational frameworks. By adopting these strategies, healthcare organizations can not only enhance support for their health and care workforce but also improve overall patient care and system performance, particularly in times of crisis.

The broader implications of these findings highlight the significant, far-reaching consequences of poor mental health among HCWs. Beyond the direct impact on individuals, these challenges affect patient outcomes, healthcare quality, and the efficiency of healthcare systems. To mitigate these issues effectively, a shift towards evidence-based, systemic interventions is required, moving beyond the limited scope of individual-level solutions.

Finally, the findings highlighted the lack of specific policies, with some authors recommending the establishment of policies and programs that consider all stakeholders. Therefore, it is imperative to develop comprehensive guidelines for healthcare organizations to safeguard the mental health and well-being of health and care workers. These guidelines should be aligned with international standards, such as those set by the WHO, and should emphasize systemic accountability, organizational interventions, and continuous evaluation of their effectiveness. Implementing these guidelines is essential to foster a supportive and healthy work environment, more resilient healthcare systems, enhanced workforce retention, and

improved patient care outcomes. Safeguarding the mental health of health and care workers is not only an ethical responsibility but also a critical foundation for building resilient and sustainable healthcare systems.

6 Recommendations

Evidence indicates the necessity of proposing and incorporating policies to integrate mental health support into workplace practices. Consequently, organizational strategies that foster resilience, such as adjusting workloads and enhancing peer support, are emphasized.

Incorporation of mental health support in workplace policies

- Develop employee-sensitive mental health policies specific to the needs of health and care workers (HCWs).
- Institutionalise accessible psychological support services at all organisational levels, such as well-being centres and counselling programs.
- Implement Employee Assistance Programs (EAPs) to promote early identification and intervention for mental health concerns among HCWs.
- Implement programs that build awareness and develop psychological safety among health and care workers through ruptured programs.

Resilience-based organisational practices

- Modify workload demands and task distributions to sustainable levels to prevent burnout.
- Strengthen peer support systems by creating opportunities for HCWs to share experiences and coping strategies.
- Adopt multi-component interventions, such as training on personal protective equipment use, emotional first aid desks, and structured resilience-building programs.

Leadership and managerial support

- Train leaders and managers to identify and respond to mental health challenges among their staff effectively.
- Integrate mental health into organisational crisis management frameworks with an emphasis on the role of leaders in supporting HCWs during disruptions.
- Allocate resources for mental health support and resilience enhancement within healthcare settings.
- Establish frameworks for periodic evaluations of healthcare facilities to detect vulnerability areas and engage in preventive practices.

To policymakers

- Design policies that introduce mental health support in organisational settings. This aims to bring about systemic/organisational responsibility.
- Invest in comprehensive interventions targeting HCW mental health, including resilience-building initiatives and welfare programs.

For healthcare organizations

- Invest in managerial training to create supportive work environments that enable early identification of signs of mental distress among staff.
- Focus organisational interventions on reducing burnout through workload adjustments and improvement in peer support systems.
- Regularly review the effectiveness of implemented interventions with validated assessment tools and make improvements accordingly.

For researchers

- Conduct longitudinal studies to determine the sustained effects of organisational and individual-level interventions on HCW mental health.
- Develop and validate assessment tools tailored to organisational resilience and mental health interventions.
- Examine the interaction between sociodemographic factors and intervention outcomes to inform context-specific strategies.
- These recommendations are intended to fill systemic gaps pointed out in the manuscript to create a resilient and supportive healthcare environment that prioritises the well-being of its workforce.

Author contributions

CF: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. NS: Investigation, Methodology, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis. CC: Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. JK: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. AJ: Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. HA: Supervision, Writing – original draft. HR: Conceptualization, Supervision, Validation, Visualization, Writing – review & editing. AZ: Supervision, Validation, Visualization, Writing – review & editing. IT: Supervision, Visualization, Writing – review & editing, Writing – original draft. SA-H: Supervision, Funding acquisition, Validation, Visualization, Writing – review & editing. MS: Supervision, Writing – original draft. MF-N: Conceptualization, Funding acquisition, Project administration, Supervision, Validation, Writing – review & editing, Formal analysis, Methodology. JC: Supervision, Visualization, Writing – review & editing, Conceptualization, Funding acquisition, Project administration, Resources, Validation.

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Conflict of interest

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Supplementary material

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EDITED BY

Carla Viegas,
Instituto Politécnico de Lisboa, Portugal

REVIEWED BY

Mohammad Ali Zakeri,
Rafsanjan University of Medical Sciences, Iran
Benedict Francis,
University of Malaya, Malaysia

*CORRESPONDENCE

Marzieh Momennasab
✉ momennasab@sums.ac.ir

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Relationship between religious coping and post-traumatic stress disorder and professional quality of life of nurses working at COVID-19 wards: a descriptive correlational study

Zohreh Sanavi Shiri, Poursan Tavakoli and
Marzieh Momennasab*

School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran

Purpose: Considering effects of COVID-19 pandemic on the physical and mental health and professional quality of life (PQoL) of nurses working at COVID-19 wards, it seems necessary to investigate the factors affecting adaptation and reducing adverse effects of this pandemic on nurses. The present study aims to investigate the relationship between religious coping with post-traumatic stress disorder (PTSD) and professional quality of life (PQoL) among nurses.

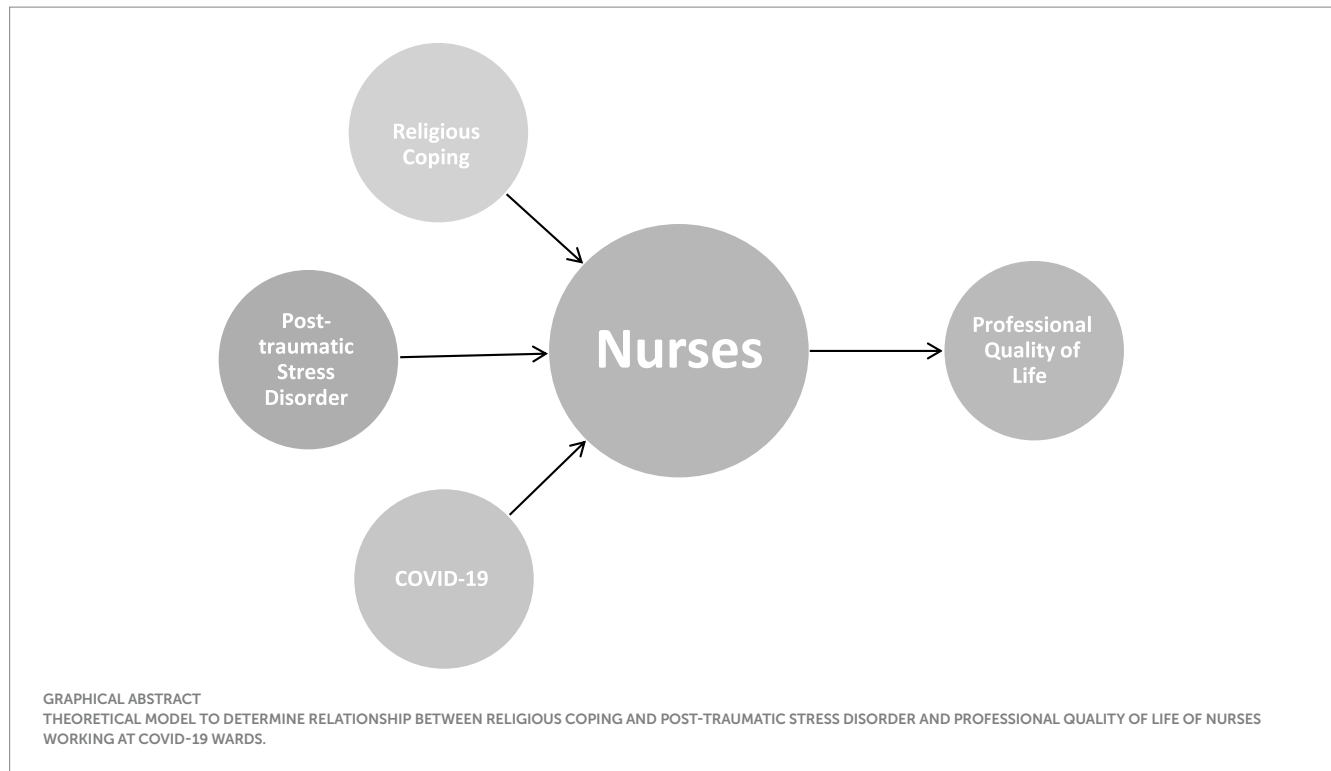
Materials and methods: This descriptive correlational study was conducted on 368 nurses working at hospitals affiliated to Shiraz University of Medical Sciences. In this research, Mississippi scale for post-traumatic stress disorder (M-PTSD), Pargament's brief religious coping measure (B-RCOPE) and Stamm's professional quality of life (proQoL) were used for data collection. Statistical significance was considered at $p < 0.05$.

Results: The mean score of positive religious coping was 13.01 ± 5.22 (moderate) and the mean score of negative religious coping was 5.27 ± 4.57 (low). The mean PTSD score of nurses was 96.92 ± 18.17 and most of them were at the moderate level (92.9%). The scores of compassion fatigue, secondary traumatic stress, and compassion satisfaction were in the moderate range. The Spearman's correlation test results showed a significant and negative correlation between positive religious coping and PTSD, and a significant and positive correlation between negative religious coping and PTSD ($p = 0.000$). Moreover, a significant and positive correlation was observed between compassion satisfaction and positive religious coping ($p = 0.005$), and a negative and significant correlation was found between compassion fatigue and secondary stress and positive religious coping ($p < 0.05$). The statistical test of multiple regression revealed a significant correlation between nurses' positive religious coping and compassion satisfaction, as well as between nurses' negative religious coping and secondary stress and PTSD ($p < 0.05$).

Conclusion: Positive religious coping was correlated with reduced PTSD and improved PQoL among nurses.

KEYWORDS

religious and spiritual coping, post-traumatic stress disorder, quality of life, nurse, COVID-19



Introduction

COVID-19 was first reported in Wuhan, China (December, 2019) and rapidly spread in whole China and, subsequently, worldwide (1, 2). The outbreak of this pandemic exposed the healthcare workers, as the frontline group, to the risk of physical and mental disorders (3). Although healthcare providers were also exposed to stress, compassion fatigue, depression, drug addiction and suicide before COVID-19 pandemic (4), initial world reports have revealed the incidence of depression, anxiety, Post-traumatic stress disorder (PTSD), suicide, compassion fatigue and sleep disorders increased among them after this pandemic (5–7). PTSD is among the psychological disorders among nurses that has been addressed by various studies during the pandemic period (8–12).

PTSD is considered a mental disorder that develops when an unfortunate and traumatic event threatens one's life (13). Currently, PTSD is a growing concern in the nursing profession. Nurses are exposed to this disorder due to being either directly or indirectly in traumatic conditions and being responsible for taking care of patients (14).

Studies have demonstrated professional quality of life (PQoL) of healthcare providers decreased during COVID-19 pandemic (15, 16). PQoL is a multidimensional concept, consisting of two components of compassion satisfaction and compassion fatigue. The second component itself includes two components of compassion fatigue and secondary traumatic stress (17). Among all health-related professions, nurses are more prone to burnout,

compassion fatigue and reduced job satisfaction due to the mental and physical stress caused by taking caring of critically ill patients (18). This issue is of particular importance because nurses' PQoL is associated with the quality of nursing care, work productivity, burnout, job satisfaction, inappropriate performance, inappropriate violence, organizational effectiveness and organizational commitment (19–21). Currently, there is strong evidence on the inverse correlation between occupational stress and PTSD among nursing staff as well as between their perceived job satisfaction and PQoL (22–24).

Secondary traumatic stress is considered a negative aspect in PQoL, which plays a vital role in nurses' physical and mental health (25). During stressful events, coping strategies are stabilizing methods used to help individuals maintain psychological adaptation (26). Coping strategies could be defined as cognitive and behavioral measures used to manage stressful conditions (27). Coping strategies affect one's feelings or thoughts to create a good quality of life and make a positive action (28). Adopting an appropriate coping strategy plays a major role in relieving PTSD symptoms (29). However, coping strategies could cause severe psychological stress, if not appropriately used (28).

Spirituality has received great attention as an important coping strategy for promoting psychological well-being among patients and healthcare workers (30). Religion is often considered an important and well-known aspect of spirituality (31). Religious coping is defined as using religious beliefs and behaviors to solve problems and prevent or relieve negative psychological consequences when faced with difficult problems and conditions (32).

Religious coping includes two positive and negative dimensions. Positive religious coping (PRC) involves ways of facing negative life events, in which one accepts the events using positive appraisals and interpretations related to God's will.

Abbreviations: PQoL, professional quality of life; PTSD, post-traumatic stress disorder; M-PTSD, post-traumatic stress disorder; B-RCOPE, brief religious coping measure; PRC, Positive religious coping; NRC, negative religious coping.

However, in other form of coping, called negative religious coping (NRC), a person establishes an avoidant and insecure relationship with God. PRC involves benefiting from a favorable connection with God or higher power during the crisis. In NRC, one blames God for their difficulties. Positive and negative religious coping is associated with higher and lower levels of psychological health, respectively (33). Studies have reported positive religious coping during infectious disease outbreaks could help individuals reduce the risk of depression (34, 35). However, some studies have not found a significant correlation between positive religious coping and lower levels of anxiety, depression and concern (36–39). The conflicting results show the necessity of conducting further studies in this field.

Considering the effect of COVID-19 pandemic on the physical and mental health and PQoL of nurses working at COVID-19 wards, it seems necessary to investigate the factors affecting adaptation and reducing adverse effects of this pandemic on nurses as their adaptation could be improved by identifying and strengthening these factors. Although the relationship between religious coping and some variables has been previously investigated separately, these variables have been less addressed during COVID-19 pandemic, which imposed a severe and chronic stress on nurses. The aim of the present study was to investigate the correlations between religious coping with PTSD and PQoL of nurses working at COVID-19 wards.

Some studies have been conducted separately on nurses' post-traumatic stress disorder, quality of professional life, and religious adjustment and coping strategies during the COVID-19 pandemic (40–47). Studies on the relationship between religious coping and post-traumatic stress disorder have been limited and show contradictory results (38, 48, 49). However we could not find any study which investigated the multivariate relationship between all three mentioned variables. This gap in studies indicates the necessity of conducting the present study which aimed to investigate the correlations between religious coping with PTSD and PQoL of nurses working at COVID-19 wards.

Materials and methods

Study type and setting

In this descriptive correlational study, the nurses working at COVID-19 wards of five hospitals affiliated to Shiraz University of Medical Sciences, southern Iran, during the last 6 months.

Sampling and sample size

Participants were selected using convenience sampling method. The sample size was determined 304 individuals based on the results of a similar study (50) using G*Power software considering the power of 80% and $\alpha = 0.05$, which increased to 365, taking into account the withdrawal rate of 20%.

The inclusion criteria were having at least a bachelor's degree in nursing, having at least 2 months of work experience at COVID-19 wards at the time of completing the questionnaire, not suffering from

known mental illnesses such as anxiety and severe depression, not facing physical or mental traumatic events within 6 months before the study, lack of severe work or communication problems in the workplace (The last three items were based on the participants' self-report) and being willing to participate in the study. The exclusion criterion was failure to complete the questionnaires.

Measurements

In this study, demographic questionnaire (including age, gender, level of education, marital status, total work experience, length of time working in the COVID-19 wards, living with high-risk people, and how religious they are from their point of view), Mississippi scale for post-traumatic stress disorder (M-PTSD), Pargament's brief religious coping measure (B-RCOPE) and Stamm's professional quality of life (proQol) were used to collect data.

The self-report 39-item M-PTSD was developed and introduced by Norris and Raid (99). The items with a star are scored based on a 5-point Likert scale, ranging from (5) very often true to (1) never true, and items without a star are reverse-scored, and the total score ranges between 0 and 195. Scores less than 65, 65–130 and above 130 are considered mild, moderate and severe, respectively (51). The Cronbach's alpha coefficient of this scale was reported as 0.86–0.94 (52). In the present study, the Persian version of this scale, which has been previously used in various studies in Iran and its validity and reliability have been confirmed, was employed (51–54). This scale was validated by Goodarzi (51) in Iran. The scale reliability was obtained as 0.92, 0.92, 0.91, and 0.82 based on the internal consistency, split-half method, test-retest method and peer test (PTSD inventory) (53). In the present study, Cronbach's alpha for the M-PTSD questionnaire was determined to be 0.88.

The 14-item brief religious coping measure (B-RCOPE) was developed by Pargament (100). In this questionnaire, each of the positive and negative scales includes 7 items. Items 1–7 indicate positive religious coping and items 8–14 indicate negative religious coping. The items are scored based on a 4-point Likert scale, ranging from "never" to "always" (0–3). The minimum and maximum scores of each subscale of positive and negative religious coping are 0 and 21, respectively. The religious orientation scale (ROS) was used as a reference to assess the reliability and validity of the Persian version of this scale in a preliminary study conducted in 2001. Concurrent validity was assessed using religious coping scale. The correlation between the scores obtained from the simultaneous use of the two scales was obtained as 0.6 (101, 102). Cronbach's alpha coefficient was calculated to evaluate the scale validity. This coefficient was obtained as 0.86 and 0.65 in the subscales of positive and negative religious coping, respectively (55). In this study, the values of Cronbach's alpha coefficient were obtained as 0.90 and 0.83 for positive and negative religious coping, respectively. The self-report 30-item professional quality of life (proQol) was designed and developed by Stamm. This scale includes three dimensions of compassion satisfaction (items 3, 6, 12, 16, 18, 20, 22, 24, 27, 30), compassion fatigue (items 1, 4, 8, 15, 10, 17, 19, 21, 26, 29) and secondary traumatic stress (items 2, 5, 7, 9, 11, 13, 14, 23, 25, 28). Each dimension consists of 10 items scored based on a 5-point

Likert scale (1 = never to 5 = very often). The score of each subscale is obtained from the sum of all its items, so that the score of each subscale varies between 10 and 50. Each subscale consists of 10 items. In all the three subscales, the score of 22 or less indicates low level of compassion satisfaction, compassion fatigue and secondary traumatic stress, the score of 23–41 indicates moderate level of compassion satisfaction, compassion fatigue and secondary traumatic stress, and the score of 42 and higher indicates high level of compassion satisfaction, compassion fatigue and secondary traumatic stress (56). In the present study, the Persian version of this scale, which has been previously used in various studies in Iran and its validity and reliability have been confirmed, was employed. The validity and reliability of the whole scale was confirmed in the study by Yadollahi et al. and its Cronbach's alpha was reported as 0.70 (57). In other studies, the alpha coefficient was reported as 0.73 and 0.75 (58, 59). In the present study, the Cronbach coefficient was estimated as 0.88, 0.74, 0.84, and 0.65 for compassion satisfaction, compassion fatigue, secondary traumatic stress, and proQol total use score, respectively.

Data collection

The samples were first selected using the convenience sampling method considering the inclusion criteria. After explaining the research objectives and methodology, the participants signed the informed consent form. The questionnaires were given and collected by researcher (first author) and her assistant and collected after completing. Due to the multiplicity of questionnaires and the large number of questions and in order to maintain the cooperation of the samples, the questionnaires were collected 2 days after distribution. In total, 375 questionnaires were completed, 7 of which were excluded due to high missing values, and the data of 368 nurses were analyzed.

Statistical analysis

The data were analyzed using SPSS 26.0. Given that the data were not normally distributed, non-parametric Mann-Whitney and Kruskal-Wallis tests were used. Pearson's correlation coefficient and its non-parametric equivalent, i.e., Spearman's correlation, as well as multiple regression were employed to investigate the correlation between the quantitative variables. p -value < 0.05 was considered statistically significant.

Ethical considerations

This study was approved by Research Ethics Committee of Shiraz University of Medical Sciences (No: IR.SUMS.NUMING.REC.1401.30). All the participants signed the informed consent form after receiving information about research objectives and methodology. The participants were assured that their information would be kept confidential and anonymous. It was emphasized that it would not have any impact on their professional status if they do not participate or withdrawal from the study.

Results

The mean age of the nurses participating in the study was 31.43 ± 6.45 years old, ranging from 22 to 55 years old. The mean work experience of nurses was 8.21 ± 6.44 , ranging from 6 months to 28 years, and the mean work experience at the COVID-19 ward was 16.11 ± 10.91 , ranging from 2 to 36 months. Most of the nurses were female (77.40%) and married (54%) and had a bachelor's degree (90%). The majority of the nurses were working at non-intensive units (61%) and did not live with older adult people (61.5%) or those with chronic diseases (85.50%). Most of them considered themselves to be moderately religious (54%) (Table 1).

The mean score of positive religious coping was 13.01 ± 5.22 , which was at the moderate level. Also, the mean score of negative religious coping was 4.57 ± 5.27 , which was at the low level. A significant correlation was observed between religious coping and educational level ($p = 0.03$) and self-report religiosity ($p = 0.000$).

Figure 1 presents the mean and standard deviation of PQoL and PTSD scores.

The Spearman's correlation test results showed a significant, negative correlation between positive religious coping and PTSD and a significant positive correlation between negative religious coping and PTSD ($p < 0.05$). PTSD had a stronger correlation with negative religious coping ($r = 0.485$) (Table 2). The Spearman's correlation test results showed a positive significant correlation between compassion satisfaction and positive religious coping ($p = 0.005$) and a significant, negative correlation between compassion fatigue and secondary stress and positive religious coping ($p < 0.05$). There was a significant and adverse correlation between negative religious coping and compassion satisfaction, and a positive and significant correlation between compassion fatigue and secondary stress ($p < 0.05$) (Table 2).

The statistical test of multiple regression revealed a significant correlation between positive religious coping and compassion satisfaction among nurses ($p < 0.05$). If considering PTSD constant and adding one point to the positive religious coping score, 0.375 point will be added to the compassion satisfaction score. No significant correlation was found between positive religious coping and PTSD ($p = 0.289$). Also, no significant correlation was observed between compassion fatigue, secondary stress, PTSD and positive religious coping ($p > 0.05$) (Table 3).

The statistical test of multiple regression revealed a significant correlation between negative religious coping and secondary stress and PTSD among nurses ($p = 0.000$). If considering PTSD constant and adding one point to the negative religious coping score, 0.294 point will be added to the secondary stress score. If considering secondary stress constant and adding one point to the negative religious coping score, 0.247 point will be added to the PTSD score. However, no significant correlation was found between compassion fatigue, compassion satisfaction and negative religious coping ($p > 0.05$) (Table 4).

Discussion and conclusion

Results of the present study showed the mean scores of positive and negative religious coping were at the moderate and low levels, respectively, and positive religious coping had a higher mean score than negative religious coping. In studies by Ken Chow et al. and Francis et al.

TABLE 1 Mean score of religious coping considering demographic characteristics of nurses working at COVID-19 ward.

	Classification	Frequency (%)	Mean	Test statistic	p-value
Gender	Female	285 (77.44%)	177.81	-1.73	0.083*
	Male	83 (22.55%)	200.63		
Educational level	Bachelor's degree	318 (89.83%)	183.37	2.00	0.001*
	Master's degree or Ph.D.	36 (10.16%)	206.41		
Marital status	Single	169 (46.42%)	165.95	-0.64	0.518*
	Married	195 (53.57%)	179.19		
Living with parents or older adult people	Yes	139 (38.61%)	188.42	-1.14	0.251*
	No	221 (61.38%)	175.52		
Living with high-risk people or those with special diseases	Yes	52 (4.68%)	171.33	-0.47	0.637*
	No	302 (85.31%)	178.56		
Ward type	Intensive care unit	131 (38.87%)	158.04	-1.64	0.099*
	Non-intensive care unit	206 (61.12%)	175.97		
Self-report religiosity	High	27 (7.50%)	256.13	2.00	0.000**
	Moderate	246 (68.33%)	193.83		
	Low	87 (24.16%)	119.33		
Having a history of chronic diseases	Yes	35 (9.91%)	185.13	-0.49	0.619*
	No	318 (90.08%)	176.11		

*Mann-Whitney test, **Kruskal-Wallis.

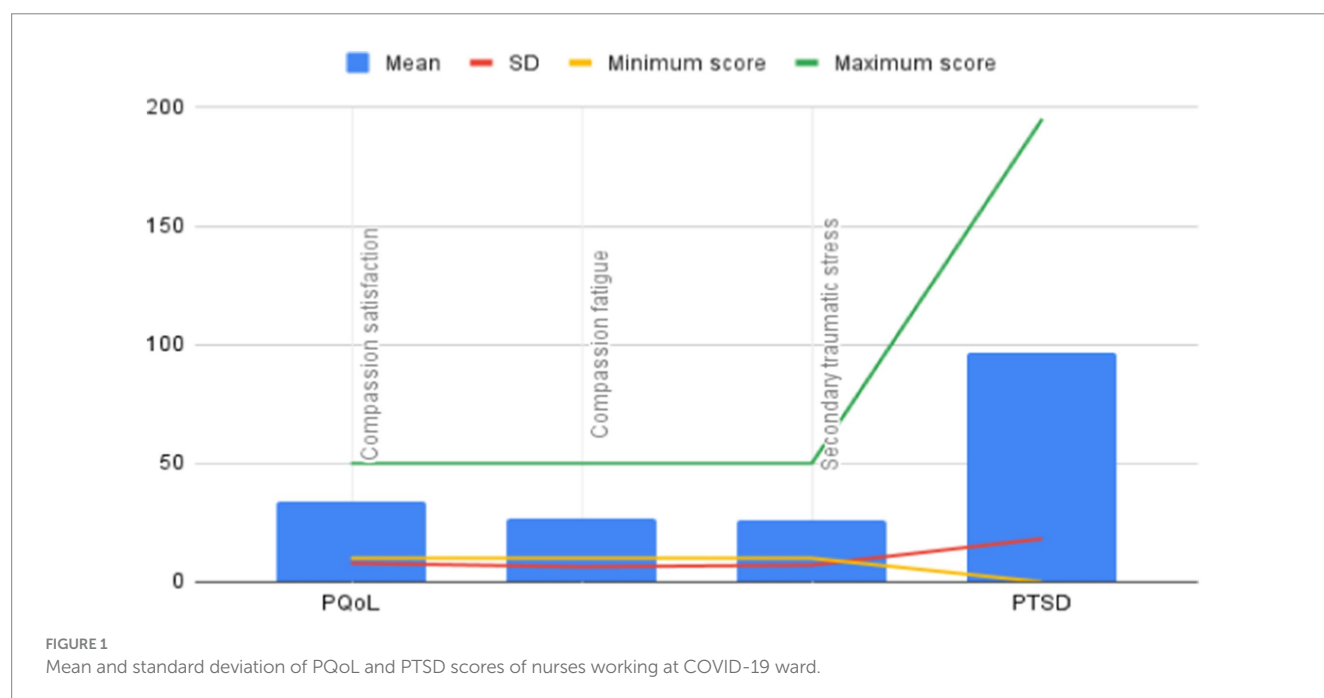


TABLE 2 Correlation between mean scores of nurses' religious coping and PTSD.

	Total score	Intrusive memories	Difficulty in interpersonal communication	Inability to control emotions	Depression
Positive religious coping	$p = 0.000$	$p = 0.000$	$p = -0.017$	$p = 0.000$	$p = 0.000$
	$r = -0.225$	$r = -0.185$	$r = -0.125$	$r = -0.191$	$r = -0.208$
Negative religious coping	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$
	$r = 0.485$	$r = 0.466$	$r = 0.256$	$r = 0.312$	$r = 0.433$

TABLE 3 Correlation between mean scores of nurses' religious coping and PQoL dimensions.

	Total score	Compassion satisfaction	Compassion fatigue	Secondary stress
Positive religious coping	$p = 0.770$	$p = 0.000$	$p = 0.000$	$p = 0.034$
	$r = 0.015$	$r = 0.395$	$r = -0.277$	$r = -0.111$
Negative religious coping	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$
	$r = 0.350$	$r = -0.290$	$r = 0.420$	$r = 0.462$

TABLE 4 Multivariate correlation between compassion satisfaction, compassion fatigue, secondary stress and PTSD with positive and negative religious coping.

Religious coping	PTSD	Non-standard coefficient B	Standard coefficient B	R-squared	R	Sig.
Positive religious coping	Compassion satisfaction	0.245	0.375	0.165	0.406	$p = 0.000$
	Compassion fatigue	-0.012	-0.015			$p = 0.871$
	Secondary stress	0.047	0.065			$p = 0.350$
	PTSD	-0.021	-0.075			$p = 0.289$
Negative religious coping	Compassion satisfaction	-0.019	-0.320	0.305	0.552	$p = 0.646$
	Compassion fatigue	0.047	0.066			$p = 0.438$
	Secondary stress	0.190	0.294			$p = 0.000$
	PTSD	0.062	0.247			$p = 0.000$

on healthcare workers working in a hospital during COVID-19 pandemic in Malaysia, the mean score of positive and negative religious coping was greater than the study present. However, the mean positive religious coping score was higher than the negative religious coping score, which was in line with the present study (41, 60). In some other studies conducted in Asian countries, positive religious coping was used more than negative religious coping (61, 62). It seems that healthcare workers tend to rely more on God or supreme existence under critical conditions (63). Not surprisingly, participants with greater self-report religiosity were significantly more likely to use religious coping. Religious coping was, in turn, associated with greater mental health, in line with previous research (64–67). The results showed significant correlation between religious coping and educational level. Although in one study there was no correlation between education level and religious coping (68), in some other studies educational level was directly correlated with spiritual experiences and religious coping (69, 70). These difference may stem from participants characteristics and cultural background.

In the present study, more than 90% of the nurses working at COVID-19 wards had moderate PTSD. Various studies have confirmed the increased incidence of PTSD at moderate and severe levels among healthcare providers and nurses working at COVID-19 wards (71–73).

In studies by Almeida and Mirab Zadeh Ardekani, the mean PTSD score has been at the severe level among about half of the participants, and the risk of suffering from PTSD in Almeida's study was higher than that of the present study. It seems that these investigations were carried out during the COVID-19 pandemic in the absence of sufficient protective facilities when there was difficulty in controlling the disease, which brought more stress (8, 74).

The scores of all the three dimensions of PQoL scale, including compassion satisfaction, compassion fatigue and secondary stress, were at the moderate level, and compassion satisfaction had a higher mean score. Various studies conducted during the COVID-19 pandemic in the

United States, as well as studies by Carla Serrão and Cuartero-Castañer in Portugal and Ecuador have shown the moderate level of compassion fatigue and secondary traumatic stress and moderate to high levels of compassion satisfaction (75–77). However, another research indicated most of the healthcare professionals had high levels of compassion fatigue and moderate to high levels of burnout and compassion satisfaction (78). Trumello et al. found that those working in areas with higher likelihood of disease transmission reported a higher level of compassion fatigue and a lower level of compassion satisfaction (79).

The conflicting results could be due to the point that these studies were mainly conducted in the initial peaks of COVID-19, while more adaptation was achieved over time using coping strategies. On the other hand, the present study was conducted after vaccination against COVID-19, which could affect the stress level and, as a result, nurses' PQoL (80).

This study showed PTSD was significantly and inversely correlated with positive religious coping, and there was a relatively strong positive correlation between PTSD and negative religious coping. Moreover, there was a negative and significant correlation between intrusive memories, difficulty in interpersonal communication, inability to control emotions and positive religious coping. Also, a significant and positive correlation was observed between intrusive memories, difficulty in interpersonal communication, inability to control emotions, loss and depression and negative religious coping. In general, PTSD had a stronger correlation with negative religious coping, and the total religious coping score had the maximum correlation with intrusive memories and minimum correlation with inability to control emotions.

Studies by Reiner Fuentes-Ferrada and Tatum Feiler demonstrated negative religious coping was among the risk factors for PTSD among students, which was in line with results of our study (35, 81). Investigations have revealed respondents who used positive religious coping showed less PTSD symptoms than those who used negative religious coping (82–84).

There was a significant, positive correlation between compassion satisfaction and positive religious coping and a negative and significant correlation between compassion fatigue and secondary stress and positive religious coping. A significant and negative correlation was found between negative religious coping and compassion satisfaction. However, a significant and positive correlation was observed between negative religious coping and compassion fatigue and secondary stress.

Moreover, there is a significant correlation between nurses' PQoL and religious coping. Nurses' PQoL could be improved by promoting the quality of religious coping because religious people with high spirituality experience higher compassion satisfaction and lower compassion fatigue and burnout (85–87). It seems that people see themselves connected to a source of energy by taking advantage of religious beliefs and deal with burnout and fatigue with more tolerance using better coping strategies (56). This issue is more tangible in Iran, which has a religious background (88).

In this study, all PTSD dimensions were significantly and negatively correlated with compassion satisfaction, and all PTSD dimensions were significantly and positively correlated with compassion fatigue. Also, all PTSD dimensions were significantly and positively correlated with secondary stress. The strongest correlation was observed between intrusive memories and compassion fatigue. Some other studies have confirmed these findings (89–91).

Results of this study indicated positive religious coping had a greater impact on the compassion satisfaction than PTSD. Also, negative religious coping affected the secondary stress and PTSD, and negative religious coping had a greater effect on the secondary stress. Studies have revealed improving the quality of positive religious coping could increase nurses' QOL (85) and positive religious coping strategies have been associated with promoting well-being and personal growth (92). Religiosity and spirituality are resources that provide a coping strategy for mental disorders, especially under stressful conditions (93). Various studies have shown negative religious coping is associated with increased psychological complications and disorders, secondary stress and post-traumatic stress (60, 82, 83, 94). Also some recent works on religious coping and mental health wellbeing among healthcare workers, found that healthcare workers employed more positive than negative coping strategies when dealing with their struggles (60, 61, 95). It seems that the positive religious coping is associated with better physical and mental health outcomes (96). Research has shown benefits of positive religious coping on mental health and opposite results of negative religious coping in different populations (97, 98).

Conclusion

The results showed religious coping could affect nurses' PQoL and PTSD working at COVID-19 wards. Positive religious coping was correlated negatively with PTSD and positively with PQoL. PTSD had a stronger correlation with negative religious coping.

The effect of COVID-19 pandemic on nurses' physical and mental health and PQOL working at COVID-19 wards, which may continue for years, demonstrates the necessity of reducing the negative effects of this pandemic on nurses. Training and using different strategies to strengthen effective coping, especially religious coping, could be considered to better adapt nurses to the effects of the pandemic crisis. Holding educational workshops and in-service classes could affect nurses' performance and viewpoints in this regard. Moreover,

specialized psychological and religious counseling is recommended for nurses with high stress levels and negative religious coping users.

Although multicenter designing is the strength of this study which enhances the generalizability of the results, conducting it in a specific cultural background may limit the generalizability of the findings to other regions or healthcare settings. Another limitation of this study was that high workload and fatigue of nurses working in the hospital may have affected their responses, which could not be controlled. Furthermore, the data collection through self-report measures, may have affected accuracy of the data.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Author contributions

ZS: Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Data curation, Project administration, Funding acquisition, Writing – original draft. PT: Conceptualization, Methodology, Formal analysis, Investigation, Writing – review & editing. MM: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Visualization, Funding acquisition, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Jacqueline G. Bloomfield,
The University of Sydney, Australia

REVIEWED BY

Christopher Cunningham,
University of Bath, United Kingdom
Joseph Mellors,
University of Westminster, United Kingdom

*CORRESPONDENCE

Kathrine Gibson Smith
✉ kathrine.gibson.smith@abdn.ac.uk

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"I'd keep going until somebody said no and nobody ever said no": exploring identity-strengths amongst medical students from widening participation backgrounds

Kathrine Gibson Smith^{1*}, Jennifer A. Cleland², Kim Walker¹,
Colin Lumsden¹ and Anita Laidlaw¹

¹School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Aberdeen, United Kingdom, ²Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore

Background: Widening participation is an important consideration in medicine, which has been historically elitist. Despite the evolving evidence base on WP in medicine and advancing of discourse around conceptualizing WP, the identity of students from WP backgrounds remains problematized. Currently, there are few studies exploring how WP medical students have found strength in their experiences of adversity and developed skills which will be an asset to their career. To address this gap, the aim of this study is to understand, using a strengths-based approach, the strengths and resources that WP students draw on to enact success in medicine.

Methods: This is a qualitative study using individual interviews for data collection. We selected the identity-specific strength lens to understand how WP students in medicine draw on their strengths and resources to enact success in pursuing careers in medicine. We recruited eligible students who had completed, or were undertaking, a 'gateway' programme and had directly entered the undergraduate medical degree and who had fulfilled university WP criteria prior to entry. Interviews were recorded electronically and transcribed verbatim. Data were coded inductively and in accordance with thematic analysis.

Results: Five main themes were constructed from the analysis. Participants drew on the following strengths and resources to enact success in medicine: (i) Not taking no for an answer: determination and perseverance; (ii) Learning from the past: using their lived experience; (iii) Making things work: resourcefulness; (iv) Drawing on their sense of self: Self-awareness, reflection and independence; and, (v) Growing a support network: Having strong relationships with others.

Conclusion: There is still much to be done in creating inclusive environments in medical education which promote belonging and development of diverse values

and beliefs. However, using strengths-based approaches can reframe study of widening participation in medicine and shift thinking and discourses from deficit to anti-deficit ways of thinking and discourses.

KEYWORDS

widening participation, widening access, strengths based approach, anti-deficit, medicine

Background

Governments across the globe have developed and adopted policy to widen participation to higher education. The ultimate aim being to promote participation in higher education amongst groups who are typically underrepresented (1, 2). Enactment of widening participation (WP) policies varies according to the context and history of marginalization [e.g., in the United Kingdom (UK) the focus tends to center on social mobility, whereas in Australia, the prevailing discourse is in relation to social accountability (2, 3)]. There is also considerable variation in terms of the demographic groups which WP seeks to target. For example, even within the UK, there are significant differences across academic institutions in terms of who qualifies as WP (1).

Widening participation is an important consideration in medicine, which has been historically elitist (3). Recent evidence suggests that, still, the largest number of learners in medicine have been educated at more privileged schools (4, 5). Despite evidence of persistent privilege in medicine, there is increasing diversity in learners within medical education partly due to the proliferation of Initiatives which have been embedded across medical schools globally to increase representation of individuals traditionally underrepresented within the medical profession (6, 7). With this, there is a growing evidence base which has enhanced understanding and knowledge in relation to WP in medicine, and which has illustrated the continued structural and systemic inequalities that WP learners experience across the continuum of medical education (6, 8, 9). Despite the evolving evidence base on WP in medicine and advancing of discourse around conceptualizing WP, the identity of students from WP backgrounds remains problematized. What we mean by this is that an individual's identity and background are framed as potential barriers to success (7, 10). For example, attributing the prevalence of certain personality traits as individual deficiencies (11). Such understanding is termed as a 'deficit' way of conceiving WP e.g., WP as a problem to be solved (11, 12).

Burke et al. (13) argue that the adoption of this deficit model inflicts further harm to students from underrepresented backgrounds since it fails to recognize, and further develop, the values that diverse student learners bring to educational institutions. Accordingly, adoption of a deficit-based lens to detangle the experiences of those who have been historically underrepresented in medicine obfuscates the depth of experience that individuals have outside the realm of systemic inequality (e.g., persistent privilege), and which can positively impact on their, and others, learning (14). Anti-deficit, or strengths-based, approaches pose an alternative lens to position WP learners and offer a

means to explore how institutional cultures and traditions are not configured in a way which promote belonging amongst diverse groups (12). Accordingly, integration of anti-deficit approaches within research in HPE would step away from problematizing WP (e.g., framing of aspects of an individual's background and identity as barriers to success) and seek to embed perspectives of flourishing, or thriving, into ways of thinking (11, 15).

Yet this is not straightforward. Research and interpretations using strength frameworks need to avoid the trap of focusing on the need for the learner his or herself to enact change (16), rather than focusing change efforts at structural and systemic barriers. Similarly, there needs to be due consideration given to avoid replacing negative stereotypes with positive counters, as these also perpetuating troubling discourses and limit opportunity for the dismantling of systemic inequality, in relation to privilege, for underrepresented groups (17). For example, the term grit, often considered as a facet of resilience, can be positioned within a deficit approach (e.g., placing the onus on the learner to develop grit), or, more positively, within an anti-deficit lens (e.g., how grit may be developed amongst learners as they transcend systemic inequalities) (11).

Currently, there are few studies exploring how WP medical students have found strength in their experiences of adversity and developed skills which will be an asset to their career (8). There is limited understanding of how such students may have transformed their experiences to enact success [e.g., an individual's ability to not just "get in" but "get on" (7, 10)] in an environment where they continue to face structural and systemic inequalities. To address this gap, the aim of this study is to understand, using a strengths-based approach, the strengths and resources that WP students draw on to enact success in medicine. By doing so, we hope to move away from problematizing WP in medicine and toward developing an understanding of how WP students thrive in an unequal system.

Materials and methods

Conceptual framework

Of the various strengths-based approaches outlined within the literature [e.g. (18)], we selected the identity-specific strengths lens owed to its relevance, and previous use in higher education (14), to inform our way of thinking and conceiving how WP students in medicine draw on their strengths and resources to enact success in pursuing careers in medicine. The identity-specific strengths approach, also termed background-strengths (14), postulates that

individuals who have experienced marginalization often acquire important skills, knowledge and perspectives as a consequence of their backgrounds and associated experiences (18). In the context of education, the identity-strengths, such as an ability to persist in the face of challenges, of WP students can be valuable resources beneficial to the individual's education and to society more generally (18). Hence, the framework fits neatly with both notions of social justice, including social mobility, in WP to medicine and WP as a means to potentially enhance patient care via the proposition of 'like treat like' (6).

Design

The work is concerned with individuals' experiences and interpretations of their own realities within a social context and is therein positioned in relation to an interpretivist worldview within a social constructivist paradigm (19). This is a qualitative study using individual interviews for data collection.

Context

The research was conducted in Scotland, UK. There is a significant policy focus in Scotland which has been driven by the Scottish Government in collaboration with the wider higher education sector on widening access to higher education (20, 21). There are several policies and programmes which have been implemented in an effort to reduce the gap in educational attainment which has been evident across socioeconomic groups. These have included free tuition for Scottish-domiciled students, contextual admissions, ring-fenced university places, scholarships and outreach programmes (20). In this context, WP initiatives are focused on supporting those from less traditional/privileged backgrounds to pursue a career in medicine e.g., potential students who have resided in one of Scotland's 20% most deprived areas (22), are care experienced, attended a school with lower progression rates to higher education (for example, in a remote and rural area), etc. This study was conducted at a Scottish University where there are two entry routes into medicine for students from WP backgrounds: via a 'gateway' programme; and, via standard entry into medicine.

The 'gateway' programme was established by the University in 2017 in response to a Scottish Government call (21) to further support entry for students from target areas into medicine. Students on the 'gateway' programme are required to fulfill predetermined academic performance criteria in their 'gateway' year and undertake an admissions test (23) and a Multiple Mini Interview (24) to confer entry to first year of medicine within the institution.

Students from WP backgrounds also enter medicine via the standard entry route (e.g., directly to Year 1 of the medical programme). Contextualized (holistic) admissions (25) may be applied via standard entry routes and consider aspects of an applicant's background [including home postcode, whether they are care-experienced, are a young carer or registered for the Reach National Schools Programme (26)] when making offers to get into medicine (e.g., reducing the required grades for entry).

Participants and recruitment

Eligible students were those who had completed, or were undertaking, the 'gateway' programme and those who had directly entered the undergraduate medical degree and who had fulfilled university WP criteria prior to entry (as outlined above). Class email lists of students who were currently enrolled in the 'gateway' programme were passed to the lead researcher (KGS). Students enrolled in the undergraduate medical degree programme were also recruited via class email lists which were sent out by year administrators. A recruitment email, containing an information sheet, was sent by KGS or a year administrator. Two reminder emails were sent. Participants were asked to express their interest via email and a consent form was sent. Students were recruited from all years across the 'gateway' programme and undergraduate medical degree.

Data collection

Data collection was undertaken by KGS, who has experience conducting qualitative interviews, over a 3-year period (2021–2024) either in-person in a small teaching room on university premises or virtually via Microsoft Teams. Students were captured at various points over the course of their studies – from 'gateway' to year five of medicine – and one student was interviewed twice.

Interviews were informed by a semi-structured interview guide which had been developed by the research team with reference to the wider literature on WP to medicine. This guide was used flexibly in accordance with participants' responses. It covered aspects of participant's experiences of the 'gateway' programme, where relevant, and transitions into and across their medical degree programme. Questions took an anti-deficit approach and incorporated a style of questioning similar to those outlined in the anti-deficit achievement framework (15). The framework outlines 'instead of' ways of thinking to counter common deficit ways of thinking which means looking at how success is enacted in the face of challenges. We encouraged students to reflect on how they had succeeded in the face of adversity and were continuing to thrive, as well as exploring how they negotiated entry into medicine and made connections. All interviews were digitally recorded on an audio recorder and were uploaded to a secure university shared drive prior to transcription by an approved transcriber and anonymized. The interview audio was then deleted on the recording device.

We used the concept of information power to guide our sample size (27) in that we (i) required a medium-sized sample since our aim was relatively broad, (ii) were recruiting specific participant characteristics, (iii) intended to utilize theory to interpret findings, (iv) attained a strong dialogue with participants, and (v) used a cross-case approach to analysis. We continually and iteratively appraised the data collected, to check for data sufficiency. We stopped data collection after 25 interviews.

Participant demographic information is not presented to ensure anonymity although WP status was framed as having met at least one of the following criteria: SIMD20 postcode; young person who was care experienced (e.g., looked after

by the local authority in care or care leaver); first generation applicant to higher education; eligible for Educational Maintenance Award; evidence of severe financial hardship not reflected by SIMD categorization; not schooled in English prior to secondary school; completed a Gateway programme (for which there were additional entry criteria, including: SIMD40; estranged; eligible for free school meals; resident in remote and rural area as per Scottish Government Urban Remote Classification; eligible refugee or asylum seeker). However, we can say that all twenty-five participants fulfilled WP criteria, 17 students were from the Gateway programme and 8 were direct entry. Of those who elected to disclose, two-thirds of students had resided in an area with a SIMD20 postcode (22). The data captured experiences across the Gateway programme ($n = 6$) and all years of the medical degree (Yr1 = 3, Yr2 = 3, Yr3 = 4, Yr4 = 4, Yr5 = 5).

Data management and analysis

The data in the transcripts were coded inductively (e.g., codes were developed from the data), in accordance with a thematic analysis as per Braun and Clarke (28), and therein analysed formally both manually, using visual mapping techniques, and Microsoft Excel. During this process, KGS identified relevant codes in relation to the research aims and generated themes to form a preliminary analytical framework. Themes were generated from the initial codes and sub-themes, and driven out of the strengths and resources that students felt they had drawn upon to successfully navigate their journey through medicine. Codes were discussed and reviewed by KGS and AL prior to consulting the wider research team for feedback. A revised analytical framework was agreed and applied by KGS and AL, independently, to the transcripts. KGS and AL met to discuss the coding and confirm themes – disagreements were resolved via critical discussion. The coding process was subject to regular review both by KGS and AL, and within the wider research team to enhance trustworthiness (29).

Ethical approvals

The study received ethical approval from [university ethics committee name] [reference: CERB/2017/8/1501].

Results

The main findings are presented below in relation to the strengths and resources that the participants had drawn on to enact success in medicine. Five main themes were constructed.

i Not taking no for an answer: determination and perseverance

Participants documented their journeys into and through medicine. They had typically faced challenges navigating the application process with some experiencing a lack of support from their school and family to apply to medicine. They may have had to

reapply several times to succeed or consider alternative pathways in (e.g., graduate entry, pre-medicine programmes).

Evident across the students interviewed was their determination and perseverance in the face of these challenges. Although support to apply to medicine was perhaps not in abundance, students were not dissuaded, nor were they deterred from having to consider longer routes into medicine since they were absolutely convinced that medicine was the career for them, “*I’d keep going until somebody said no and nobody ever said no.*”

Participants often discussed how they felt determined to leave their local community as they felt constrained in their life and career choices in these communities. They perceived that schools did not promote progression to higher education, “*I got the distinct impression that provided you didn’t stab someone, get caught selling drugs or get someone pregnant, they didn’t really care what you did post school,*” let alone medicine, and instead encouraged students to go into local rural industries such as farming and fishing. Some described how they longed and aspired for something bigger and greater, and wanted more for themselves than the opportunities they were facing if they stayed within the rural community, “*A lot of people on the island just tend to leave school with little to nothing. . . that’s just how life’s seen and almost like that’s what you do.*”

Participants were determined to succeed – in their studies and in their career aspirations. They were realistic about setbacks, both actual (e.g., having to resit exams) and potential (e.g., in relation to their family circumstances), and were determined about overcoming these. Some felt that although they knew their personal circumstances could pose challenges, they were not simply a product of this. They had high levels of self-confidence and did not view these as integral to their identity, rather they perceived these as challenges that could be overcome, “*I’m not going to let my circumstances, or some exams determine and define who I am because I know I can achieve this and things.*”

Although the students interviewed had successfully got into medicine, they found that establishing a sense of belonging could be difficult, “*I do feel like a fish out of water in a lot of circumstances because I can’t relate to a lot of people.*” They highlighted the hidden curriculum, “*I was concerned about that because again going from the old photographs of medical professors and seeing university and medicine as an institution I was concerned about that. I was concerned about not having a place, not fitting in, being quite different.*” They discussed how traditional university, and professional, practices proved unfamiliar, and they considered, contributed to challenges in establishing a sense of belonging, “*I was with an anesthetist and he’s from [place] as well. He’s “Oh, what school did you go to?” I was like, “[place]” He was like, “Oh, I’m so sorry for you” and it was quite funny. . . it definitely made me feel a lot more out of place.*”. However, although participants spoke to these challenges, they described how they were aware that they brought something to the table that perhaps others could not. Indeed, some students used this as motivation to drive their success and whilst we must be cautious as this speaks to the systemic inequality experienced by students as they enter the higher education institution, it was evident that participants used this to empower themselves, “*I think there’s certainly a type of resilience to be able to face all that and still be like this is what I want to do. I probably use the word spite against people who would detract from me. I need to prove you wrong.*”.

ii) Learning from the past: using their lived experience

Participants were keen to express that whilst they had perhaps experienced hardship, or at least seen it within others in their community or family, they felt they could turn these experiences into strengths in terms of both their outlook on life and also, the life skills they had developed as a consequence. For example, some felt that their knowledge and experience of living in less privileged areas was an asset in terms of being aware of the challenges which patients may face, “...if you’ve been working and you’re a single parent for a long time, that it’s a lot easier to just bang something in the oven.”

This was perceived to be advantageous as they felt that other students, who were from more privileged backgrounds, may not be aware of these experiences. This awareness led to enhanced confidence in terms of speaking to patients since they felt they could offer relatability based on their background and also may have the gift of insight that others do not have in terms of what might matter to the patient, “...say, if I come across a patient who is also a person of color, they tend to feel more safe and more like they can rely on you and because you understand some of the difficulties that you face as the barriers being a person of color.”

They felt that their experiences and background meant that they were well suited to overcoming inequalities that were prevalent in healthcare, partly because they were easily able to empathize, “I think a lot of the problems we face these days can be traced to a sort of generation or two of just middle-class sort of haughty taught white men basically who think they know everything.”

We found evidence that participants were determined to pay forward their experiences to those from similar backgrounds and give back to their community in some way. They were often passionate about inspiring other students with backgrounds similar to theirs and were involved in activities which gave something back such as outreach, mentoring, tutoring or going back to their school to talk about their experiences. Much of this was driven by passion to give back and provide opportunities to others that they did not have, “Like I will happily help them because I wish I had somebody to help me.”

iii) Making things work: resourcefulness

Access to resources have been viewed as being a key factor in promoting student success (30). However, we found that whilst it is not simply the mere availability of resources that is important, the students in our study discussed how they took ownership over their access to resources and actively negotiated this – some of which were not readily accessible to them and which they needed to negotiate access to. Participants were acutely aware that they needed to effectively utilize and act upon resources to make strides in medicine – both in social and material terms.

They were aware of lacking social capital and confidence compared to their more privileged peers, “...a few of the others, again a bit, from a bit more middle class or upper-class perspective, they’re a lot more comfortable with just going out there and talking to whoever they want to, whatever specialist they want to.” However, whilst students described feeling on the back foot to their colleagues in terms of the creation of professional connections, they effectively utilized resources to their benefit and made active effort to grow their network in medicine – often using placement opportunities

to develop a network, seeking out assistance from academic staff tutors to leverage opportunity or via their peers who they perceived to be more privileged, “And just kind of started asking, well if other students are doing it, how are they getting research opportunities.”

Participants were also proactive in utilizing university support resources from those directed toward pastoral care and wellbeing to developing academic skills. Ultimately, they were confident in knowing themselves and what they needed. Some students felt they lacked the academic preparedness, owed to having been educated in a school with lower progression rates to university, that they perceived others had. However, often through a process of trial and error, and at times failure, they figured out ways of learning that worked for them. They sought help from peers and dedicated support staff to advance their knowledge and recognized when they were struggling, “... in first and second year, I wasn’t studying the right way, I was like studying the way I did at school and then in third and definitely in fourth year I got a different way of studying for I was working on my memory.”

The link between financial struggle and WP permeated most of the interviews within this study. Many participants were balancing part time work with their studies and described the priority paid work had to take since it funded their living costs. It meant they sometimes had to forgo opportunities such as engaging in research, extracurriculars, studying or attending university for lectures. Students however, described the lengths they went to, to make things work – to balance their time, to stretch their finances and take care of themselves. Some had learned from their previous experiences, parents had shown how they could manage finances and maintain their wellbeing, “I’m generally really good with money because my mum raised me on such a strict budget... the woman’s a mastermind with money.”

iv) Drawing on their sense of self: Self-awareness, reflection and independence

Participants talked about experiences of adversity (e.g., parental estrangement, caring for family members with addiction/mental health issues, having been care-experienced) and trauma (e.g., personal mental health struggles, experiences of homelessness). They were keen to take ownership of their own narratives and share their stories.

Some described post-traumatic growth [e.g., how positive change had occurred after exposure to trauma (31)] and positive adaptation as a consequence of the adversity they had experienced, “...this sounds really grim, and when I say, but I actually have to say I’m kind of, I’m happy that it’s been like that [experience of caring for family member with mental health problem] because it’s shown me how to bounce back and it’s shown me resilience.” Others described how they used negative experiences as a form of empowerment. For example, one student, who had experienced racial microaggressions felt that they could use these experiences to empower themselves in the future, “I think I’d say even facing racism and microaggressions... even though they’re negative things, they can just give you a kind of a, more of a confidence and it allows you to be able to stand up for yourself.”

Students often reflected on their personal growth and development of independence, particularly when considering

context, and took great pride in what they achieved, *“I’m proud to say that this is what I’m studying. . . even though I’ve had to come via a back passage into it, I’ve still made it there.”* They also expressed that they felt gratitude for they believed that their life could have taken an alternate direction and were keen to dispel any notion that they were a victim – rather they felt, they were a master of their own destiny and not a passive recipient of what they had, *“I feel like thinking like that or letting those things get to me makes me feel as if I’m thinking of myself as a victim.”*

Students found ways to manage their own health and wellbeing where there were challenges and also, that of those they cared for, *“My mum’s quite unwell which has always been a difficult thing to manage and cope with studies. . . I’m very good at compartmentalizing like uni and personal life.”* They were adaptable, knew how to self-care and were aware of their mental wellbeing knowing what they needed to do for themselves to maintain positive wellbeing whilst achieving their goals, *“I need to overwork myself to make sure I pass my exams, but I’m also trying to lay myself back. . . I want to come out and still love the career that I’ve wanted. I’m hoping to just keep the passion all the way through.”*

- v) Growing a support network: Having strong relationships with others

The positive role of developing positive relationships with others, including family, peers, academic or clinical staff, was highlighted in this study. Participants talked about being able to draw on trusted relationships to develop their confidence, promote positive wellbeing and develop their social, and professional networks further. Being socially connected was an asset. For example, one student discussed how social networks served multiple purposes and they recognized how they were beneficial to maintaining a positive outlook and promoting personal growth *“I think the social networks are, one it just helps you get out of your comfort shell and then, two, as well, just being able to bounce ideas off each other and if you’re low, speaking to each other and just being able to increase morale between one another.”*

Their relationships allowed them to grow and develop as a young adult and begin their professional identity development. Academic staff and clinical tutors were valuable in developing participants’ confidence, particularly so where individuals no longer had contact with their parents or family. Trusted relationships with members of staff provided a pastoral and confidence boosting role in their lives, *“... all I really needed, I think, was someone to believe that I could and also give me a bit of a kick up the arse and sort of go, “Right, come on, you can get As and you can do this.”*

Discussion

The aim of this study is to understand, using a strengths-based approach, the strengths and resources that WP students draw on to enact success in medicine, and by doing so move away from problematizing WP in medicine and toward developing an understanding of how WP students thrive in an unequal system where persistent privilege is still at play.

Our findings highlighted that participants navigate inequality throughout their journey of trying to gain a place in medical school and their time at medical school by drawing on identity strengths and resources (18). These identity-strengths included determination and perseverance; resourcefulness; using their lived experience; developing self-awareness, reflection and independence; and establishing strong social networks. Students were not only cognizant of the identity resources they needed to draw on to succeed but also knew, or developed an understanding, of how they could operationalize these to leverage their career aspirations. In line with the identity-strength based approach (18), background and lived experience appeared to be pivotal in empowering students and providing them with confidence.

Whilst they often discussed feeling different to others in medicine, owed to their background (e.g., rural or lower socioeconomic status), participants simultaneously felt that their life experiences allowed them to better relate to patients [see also (32, 33)]. They drew strength from this and challenged deficit views in relation to their identity (18). Participants also demonstrated a clear sense of self – they were self-aware, knew their strengths, were able to self-reflect on their journey at key points of their educational experience to better themselves, and they also demonstrated how they had developed independence and used this to build confidence.

As in previous research (1), participants were often balancing part time work with their studies – they noted this came at a significant cost to their ability to engage with the course both academically and in extracurricular activities. However, they discussed how having limited financial resource meant they felt better able to manage their finances. There was also clear evidence that for some rural students, they were determined to make something different of their lives having felt they were constrained by expectations that they would stay local. This echoes research on rural student negotiation of identity and place, where the intersection between rurality and socioeconomic privilege was highlighted. This speaks to the importance of considering, where appropriate and possible, the various intersections of WP (33).

Lastly, they knew the value of having strong social ties and developing a social network which they could use for both personal support but also which they could draw on to develop themselves professionally. These findings echo previous research (34) wherein students from WP backgrounds in medicine recognized and mobilized weak social ties to create linking capital although encountered difficulties, once in medicine, in creating social ties.

Our findings illustrate a story of positivity – students from WP backgrounds have many identity strengths to bring to the table. However, we need to be cautious in interpreting whether students from WP backgrounds have more or different identity strengths than their more privileged peers. Similarly, we must also reflect on whether the level or extent of identity resources needed to succeed in medicine for WP students is different from that of their peers. Our findings highlight that systemic privilege is still at play, despite large scale global investment in increasing diversity in the medical profession and reinforce the need to change the discourse about WP to medicine.

Accordingly, it is perhaps useful to consider how our findings in relation to individual identity strengths fall into place within the wider system of medical education, and how they may

be cultivated to counter persistent privilege. We can draw on Bronfenbrenner's (35) Ecological Systems Theory (EST) of human development to further understand how various subsystems could interact within the medical education context to enable WP students to thrive in medicine. EST posits five ecological systems and suggest that proximal processes (bidirectional interactions) exist between an individual and their environment (35). The five systems proposed by Bronfenbrenner include the: microsystem (e.g., immediate contexts in addition to the people in these contexts who interact with the individual); mesosystem [e.g., influences between actors of microsystems (for example, university and family relationships)]; exosystem [e.g., external influences unrelated or departed from the microsystem (for example, educational and government policy)]; macrosystem (e.g., cultural and social influences such as socioeconomic status); chronosystem (e.g., changes across systems such as life transitions) (36, 37). EST helps us to frame the outcome of success of WP as a product of interaction between the individual and the systems they find themselves within – critically, this removes the onus being on the learner and their inherent traits and highlights the role that the environment has on influencing individual success.

Although we recognize that the framing of WP students' personal qualities as strengths may not be entirely novel in approach, our findings illustrate how WP students have thrived and flourished despite the systemic and structural inequalities they have faced in higher education institutions and in medicine. These illustrations are representative of an effort to shift the discourse of WP in medicine from problematizing learners toward understanding the strengths that can be brought to medical careers from students from diverse backgrounds. If WP learners can thrive in environments where equity is lacking, how might they flourish if the educational and medical milieu truly embraced, and supported, diverse learners? What could students achieve if we were to eradicate the systemic inequalities inherent within these systems? Importantly, we further question, why is the academic bar for medicine set so high whilst significant other 'achievements' such as those identified in this study are unrecognized currently within admissions systems? Hence our findings are not only relevant to WP learners in healthcare professions education but the wider field of WP in higher education.

Given that retention of doctors in medical practice in the UK is a current issue threatening the sustainability of the workforce (38), it would perhaps be prudent to consider individual strengths and how they might feed into long term resilience of the workforce. This fits with Cleland et al.'s (39) guide to robust, defensible and fair selection into medical school wherein they outline how when considering admissions into medicine is critical to consider the goals of the selection process e.g., the type of doctors we need to graduate. Accordingly, perhaps as highlighted by our evidence, there should be greater emphasis at the point of selection on the individual strengths applicants bring to a career in medicine such as perseverance, resourcefulness and self-awareness – with consideration given to these in relation to other contextual factors e.g., socioeconomic status, care-experienced etc.

We made efforts to recruit a wide and representative group of participants. They came from diverse WP backgrounds - lower SES,

care leavers, etc., - and there was breadth in terms of what they had experienced. However, they also identified challenges that were specific to subpopulations within the WP category (for example, care-leavers). Whilst we recognize the importance of conducting analyses via an intersectional lens, we were constrained within this study due to the population size at the recruitment site and duty to protect participant confidentiality. There remains much work to be done in developing an understanding on intersectionality within WP students (8). The study was carried out in one place and so the findings may not be transferable to other contexts. However, the WP criteria locally reflect those in many other countries (2, 40, 41) and our use of identity-specific strengths (18) as a theoretical framework will aid conceptual generalizability. The study design did not allow us to assess how students develop and draw on identity-strengths throughout their educational journey. We suggest that these come into play early in life rather than developing at the point of considering medical school. This needs further investigation: longitudinal qualitative work (42) and/or narrative accounts of students' stories, for example using a life story interview (43), are needed.

In conclusion, there is still much to be done in creating inclusive environments in medical education which promote belonging and development of diverse values and beliefs. However, using strengths-based approaches can reframe study of widening participation in medicine and shift thinking and discourses from deficit to anti-deficit ways of thinking and discourses.

Data availability statement

The datasets presented in this article are not readily available because participants could be identified by data the information in the data.

Ethics statement

Studies involving human subjects: The studies involving humans were approved by The School of Medicine, Medical Sciences and Nutrition Ethics Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

KS: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review and editing. JC: Conceptualization, Formal Analysis, Methodology, Validation, Writing – review and editing. KW: Conceptualization, Investigation, Methodology, Validation, Writing – review and editing. CL: Methodology, Writing – review and editing. AL: Conceptualization, Formal Analysis, Investigation, Methodology, Validation, Writing – review and editing.

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Conflict of interest

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