

INTERVENTIONS ADDRESSING STRESS IN HEALTHCARE: TRADITIONAL AND TECHNOLOGICAL APPROACHES- EVALUATION USING THE MCDM TECHNIQUE

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ABSTRACT

Workplace stress in the healthcare sector is a multifaceted issue that significantly affects employee well-being and performance and was exacerbated by the COVID-19 pandemic. Key stressors include excessive workloads, long hours, high demands, emotional obligations, and inadequate support, all which lead to mental, physical, and emotional health issues, reduced productivity, and increased absenteeism. Effective stress management interventions include technology-enhanced mindfulness, cognitive-behavioral therapies, and physical and expressive arts interventions. Technology-enhanced interventions show promise but face challenges like gender inequality and data security concerns. Traditional interventions improve mindfulness and well-being but have inconclusive impacts on burnout and resilience. Expressive arts and physical interventions reduce occupational stress, though larger studies are needed. Managing stress requires a comprehensive approach, combining traditional and technological methods. The Analytic Hierarchy Process (AHP) was conducted with 20 medical officers in an Indian hospital and identified Workload and Time Constraints (WTC) and Organizational Constraints (OC) as primary stressors. A sensitivity analysis was conducted to determine how variations in the prioritized variables would impact various alternatives. This study was conducted with doctors working as medical officers in a private hospital with the assumption that a decision on traditional or technical interventions would help decrease stress. Furthermore, this study is aligned with the United Nation Sustainable Development Goal, SDG-3 (good health and well-being).

Keywords: workplace stress; healthcare sector; COVID-19 pandemic; stress management interventions; Analytic Hierarchy Process

1. Introduction

Stress is a major contributor to poor mental health. The problem of workplace stress is intricate and ever-changing, encompassing the interplay between organizational

dynamics and individual employee traits. The demands of a job and the associated pressure are completely out of the individual's control when they result in this type of stress (Bhui et al., 2016; Bhui et al., 2012). Employee well-being and work performance can be negatively impacted by stress. Even though some employees have a degree of control over their work environment and activities, workplace stress remains a serious problem (Tetrick & Winslow, 2015). Stress is the sensation of tension or anxiety, either physical or mental, brought on by unanticipated occurrences or thoughts that cause irritation or restlessness. Tension can also develop when reality does not meet expectations (Mittal et al., 2022). Stress and anxiety are influenced by long work hours, an excessive caseload, shift work, a lack of staff, physical workspace dangers, administrative burdens, and emotional obligations (Joseph & Joseph, 2016; Panari et al., 2019; Reith, 2018). Overworked employees experience stress, which can cost employers millions of dollars a year in absenteeism, workplace accidents, mental, physical, and emotional health problems, and family problems (Muriithi & Kariuki, 2020; Szabo et al., 2012). It is well documented that chronic stress impacts the immune, cardiovascular, gastrointestinal, and endocrine systems. It also affects cognitive functions such as memory and cognition (Eskildsen et al., 2017; Yaribeygi et al., 2017). According to Chueh et al. (2011), uniformed personnel like police officers who perceive higher work stress have reported more severe psychosomatic symptoms as compared to non-uniformed individuals or the general public. Furthermore, the association between reported work stress and psychosomatic symptom severity was modulated by perceived social support (Chueh et al., 2011). The prevalence of occupational stress is widely recognized in both developing and developed countries. This stress has substantial impacts on well-being and results in financial costs (Suleman et al., 2018). Occupational stress can be physically and mentally exhausting (West et al., 2014). Human resource demands have intensified due to recent developments in the healthcare sector's funding, market dynamics, technology, and regulations. Healthcare professionals must perform at a higher level and possess the necessary flexibility and agility to flourish in this dynamic setting (Barattucci et al., 2019). Engaging in healthcare involves navigating a high-stakes environment where decisions emotionally impact the professionals (Hossain & Clatty, 2021). Long hours, high demands, and limited resources contribute to burnout (Ferri et al., 2016; Mohammad, 2014). Complex relationships among healthcare workers require effective communication (Chichirez & Purcărea, 2018). Burnout negatively affects professionals, emphasizing the need for well-being support (De Hert, 2020).

This study aligns with the United Nation Sustainable Development Goal 3 (SDG-3, good health and well-being) as it focuses on traditional and technical approaches to stress management interventions. This work highlights stress management interventions and directly supports SDG 3 by reducing stress-related health issues like cardiovascular diseases, anxiety, and depression (United Nations Statistics Division, 2022).

Pandemics, like COVID-19, strain healthcare systems and underscore the importance of resilience (Bruyneel et al., 2021). Effective communication is crucial to mitigate stress among healthcare workers (Tiwary et al., 2019). Work overload is the primary cause of physician burnout, which is a preventable and reversible problem affecting patient care, healthcare systems, and clinician well-being (Patel et al., 2018). Due to increased patient loads, irregular hours, and early pandemic job losses, the COVID-19 pandemic has made mental health issues worse, including anxiety, depression, sleeplessness, and decreased self-efficacy (Ahmad et al., 2022; Dyrbye et al., 2022; Hoedl et al., 2021; Spoorthy, 2020).

During the pandemic, clinicians encountered psychological obstacles, leading to increased levels of stress and burnout. Protective strategies including mindfulness and resilience-building are suggested, but more study is needed to determine how effective they are (Heath et al., 2020). Further research is necessary to determine the effectiveness of online mindfulness programs, especially in the COVID-19 setting (Zhang et al., 2021). Mindfulness-based stress reduction and music therapy are some interventions that help reduce stress among healthcare professionals (de Witte et al., 2022; Kriakous et al., 2020). Trials that are still in progress focus on AI-driven modifications and investigating new modalities for enhanced virtual experiences (Arpaia et al., 2022). Workplace stress therapies need to be carefully evaluated determine their effectiveness (Semmer, 2006).

Despite extensive research, the specific factors contributing to workplace stress and the most effective interventions to mitigate it remain unclear. The complexities of occupational stress, particularly in the healthcare sector, necessitate methodical approaches to identify effective strategies for reducing stress and enhancing well-being. The research questions guiding this study are as follows:

1) *What are the primary factors and subfactors that influence stress levels in a healthcare environment?*

Several factors include insomnia (Amra et al., 2023), end-of-life issues, moral distress, mortality salience and death anxiety (Covington et al. 2023), COVID-19 (Pallavicini et al., 2022; Phillips & Becker, 2019), quality of life, sleep, emotional management and work-life balance (Pettus et al., 2023), isolation and unfamiliar working environment (Ranjbar et al., 2022), and work-related risk factors (individual level of work demand) (Tammaing et al., 2023).

2) *How do traditional and technical interventions vary in addressing the identified factors and subfactors that contribute to stress among medical officers?*

Several interventions include cognitive behavioral therapy as the intervention to reduce stress (Amra et al, 2023), mindfulness-based interventions to reduce stress (Covington et al, 2023), wearable device interventions to reduce stress (González Ramírez et al., 2023), virtual reality home-based training to reduce stress (Pallavicini et al., 2022), mantra-based AMI Meditation intervention to reduce stress and burnout (Pettus et al., 2023), 10-week mind-body skills group to reduce stress (Ranjbar et al., 2022), and virtual reality as an intervention to reduce stress (Riches et al., 2023).

3) *What insights can be gained from a sensitivity analysis regarding the effectiveness of interventions in mitigating stress?*

This study will provide a prioritized list of context-specific stress-reduction strategies for medical officers. Benefits include better staff well-being and job satisfaction, tailored treatments targeting important stressors, data-driven decision-making for resource allocation, higher productivity and efficiency, and improved recruitment and retention in healthcare organizations.

2. Literature review

In this article, we sought to identify the various factors contributing to stress, delving into both the primary criteria and their sub-criteria. This exploration allowed us to

develop a comprehensive decision model tailored to address these stressors. Furthermore, our main objective was to investigate effective stress management interventions specifically designed for healthcare professionals working in a private hospital setting. We aimed to discover strategies that can be used to significantly reduce stress levels and enhance overall well-being among these vital members of the healthcare community.

To examine the stress management interventions, we considered the following criteria and sub-criteria which are the main reasons for stress. To evaluate the effectiveness of our stress management interventions, we identified key criteria and sub-criteria that represent the primary sources of stress. This structured approach allows for a comprehensive understanding of how various factors contribute to stress levels:

2.1 Criteria

1. Workload and Time Constraints (WTC)

Due to time limits and excessive workloads, modern workplaces are often stressful, leading to burnout and decreased productivity. These problems, which also lead to absenteeism, and increased turnover rates are caused by several factors, including downsizing, technological improvements, inadequate management, and escalating job demands (Bakker & Demerouti, 2007; Maslach et al., 2001; Schaufeli & Bakker, 2004).

2. Organizational Constraints (OC)

Stress levels increase and job effectiveness is hampered by organizational constraints like insufficient resources and ineffective procedures. According to the research, these factors hurt employee well-being and organizational commitment by causing unproductive actions, emotional tiredness, decreased work satisfaction, and increased turnover intentions (Bowling, 2024; Pindek & Spector, 2016).

3. Health Concerns (HC)

According to Roth et al. (2020), psychological anguish is exacerbated by chronic health issues, whether they are personal or family. These worries worsen stress at work and impair coping skills. Numerous health problems, including diabetes, heart disease, and mental health disorders, are associated with prolonged stress (Mariotti, 2015).

4. Emotional and Psychological Stress (EPS)

Emotional and psychological stress can lead to physical and mental health problems, including an increased risk of burnout, depression, anxiety, and overall stress. This is particularly relevant in high-demand environments like healthcare where employees often face emotional and psychological challenges (Demerouti & Bakker, 2011; Maslach, 2014).

5. Lack of Support (LoS)

Stress is increased by a lack of social support, especially in high-demand occupations. Research shows that burnout, emotional tiredness, and work-family conflict are made worse by a lack of support from co-workers, managers, or family, underscoring the significance of support in lowering stress and boosting resilience (Cohen & Wills, 1985; Frisone et al., 2021).

6. Work-Life Imbalance (WLI)

Stress and burnout are further exacerbated by work-life imbalance, which is brought on by excessive expectations at work. Research demonstrates how it affects

organizational results, employee well-being, and mental and physical health. Reducing stress, avoiding burnout, and improving one's personal and professional well-being all depend on effective balance maintenance techniques (Basuni & Sopiah, 2023; Bhui et al., 2016; Prentice et al., 2024).

2.2 Sub-criteria

1. Workload and Time Constraints sub-criteria

- **Excessive Workload**

Burnout, stress, poor performance, work-life imbalance and turnover are all consequences of an excessive workload. Organizational culture, inadequate planning, technology, and a lack of control are all contributing causes. Realistic objectives, flexible work schedules, job redesign, and stress, time, and priority management training are some of the solutions (Greenhaus & Beutell, 1985; Quick et al., 2004).

- **Long Working Hours**

Long working hours, impact health (Kim et al., 2019), safety (Baek & Yoon, 2024), work-life balance, and productivity (Golden, 2012). The effects vary by industry, job type, and individual, disproportionately affecting vulnerable groups (Lin et al., 2021).

- **Time Constraints and Deadlines**

Time constraints affect decision-making (Zakay & Wooller, 1984), performance, and project success. They exacerbate work-life balance problems (Greenhaus & Beutell, 1985) and stress. Negative impacts can be lessened by supportive organizational cultures and time management training.

- **Challenging Duties and Responsibilities**

Challenging job duties can cause workplace stress. While “challenge stressors” like workload and responsibility promote growth, they may also lead to emotional exhaustion if not balanced with adequate resources. (Oketunbi & Olumide, 2019; Wu et al., 2020).

2. Organization Constraints sub-criteria

- **Understaffing**

Stress at work is greatly increased by understaffing in all industries. Research shows how it affects workload, stress, and emotional strain, especially in the medical field. Individual dedication may rise, but group performance as a whole suffers. Despite its significance, research on understaffing is still lacking (Bhui et al., 2016; Ganster & Dwyer, 1995; Hudson & Shen, 2015; Witkoski Stimpfel et al., 2022).

- **Lack of Resources**

Resource loss adds to stress in a variety of circumstances, according to empirical research employing the Conservation of Resources (COR) theory (Snyder et al., 2020). Loss of psychosocial resources is a predictor of mental health problems in conflict situations. Inadequate resources cause academic stress, while socioeconomic inequality exacerbates stress by causing financial hardship and lack of psychological support has an impact on wellbeing (Johnston et al., 2016; Nandamuri & Gowthami, 2011; Snyder et al., 2020).

- **Organizational Issues**

Employee stress is largely caused by organizational problems, which have an impact on both performance and personal well-being. Role ambiguity, bad organizational culture, lack of control, excessive workload, and inadequate assistance are major

stresses. Research indicates that these stresses are associated with burnout and decreased engagement, underscoring the necessity of organizational stress-reduction measures (Finney et al., 2013; Landrum et al., 2012; Singh et al., 2022; Sohail & Abdul Rehman Professor, 2015).

- **Restrictions on Evaluation and Training**

Research shows that restrictions on evaluation and training lead to increased stress. Studies highlight the importance of tailored stress management programs for various categories of individuals in different professions like college students (Alborzkouh, 2015) and air traffic control trainees (Torrence et al., 2020) to alleviate stress and improve well-being by means of various psychological health interventions.

- **Lack of Skills**

A lack of essential skills among employees increases stress, harming well-being and performance. Role ambiguity, skill underutilization, and job-competency mismatches heighten stress. Aligning organizational culture with employee skills and providing targeted training can reduce workplace stress and enhance productivity (Jalagat, 2017; Kim & Jung, 2022; PVS, 2018).

3. Health Concerns sub-criteria

- **Pandemic-related Challenges**

The COVID-19 pandemic caused significant stress due to health fears, social isolation, economic instability, and academic pressures. Uncertainty led to decision-making fatigue, increasing anxiety and depression. Studies highlight its profound mental health impact, necessitating comprehensive support strategies (Lu et al., 2024; Manchia et al., 2022; Yang et al., 2021).

- **Trauma Exposure**

Trauma exposure among healthcare workers leads to stress-related disorders like PTSD and compassion fatigue. Studies highlight risk factors, including years of service and prior violence exposure. Preventive interventions, such as coping strategies, are essential to support the mental well-being of those exposed to trauma (Andhavarapu et al., 2022; D'ettorre et al., 2020; Vance et al., 2021).

- **Concerns about Personal Health and Safety**

Healthcare workers face occupational hazards like infectious diseases, physical injuries, and workplace violence, leading to psychological distress, burnout, and increased suicide risk. High work-related stress can compromise patient safety and care quality. Mental health challenges, including depression and anxiety, also affect performance and well-being (Sani et al., 2024; Zabin et al., 2023).

4. Emotional and psychological stress sub-criteria

- **Burnout**

Long-term work-related stress can gradually cause burnout syndrome, which can eventually become chronic and result in health problems (Montero-Marín, 2016). It affects cognitive, emotional, and attitudinal functioning psychologically, which frequently leads to negative actions toward one's career, co-workers, clients, and self.

- **Anxiety**

Anxiety among employees is a significant concern that affects workplace productivity, employee well-being, and organizational success. Research indicates that anxiety disorders can lead to increased absenteeism, reduced job performance,

and higher turnover rates. For instance, individuals with anxiety disorders are more than 1.5 times likely to be absent for at least two weeks compared to those without such disorders, and they are more than twice as likely to experience poor work performance (de Oliveira et al., 2023; Schneiderman et al., 2005).

- **Depression**

Employee depression has a detrimental effect on productivity and well-being, which increases turnover, presenteeism, and absenteeism. Depression risk is increased by things like excessive workloads and job uncertainty. Employee well-being and organizational performance may be enhanced by addressing this through organizational initiatives, mental health services, and a supportive work environment (Frisone et al., 2021; Gilbody et al., 2012).

- **Psychometric Problem**

Cognitive load theory and test anxiety highlight how complex tasks or high-stakes assessments induce stress, leading to cognitive overload, frustration, and physical symptoms. Additionally, social expectations, and personality traits like neuroticism, and perfectionism can intensify stress in psychometric situations.

5. Lack of support sub-criteria

- **Insufficient Assistance**

Insufficient assistance can be a significant source of stress. Social support and access to help are essential for coping with life's challenges and maintaining both physical and mental well-being. When individuals feel unsupported or unable to access the assistance they need, they are more likely to experience stress, anxiety, and depression (Bhatia et al., 2023; Vila, 2021).

- **Problems with Social Support**

Particularly in high-demand settings like healthcare, social support—instrumental, emotional, and informational—can act as a stress reducer. However, stress is made worse by insufficient or unfavorable support, such as contradictory or critical actions. Stress, burnout, and emotional tiredness can be exacerbated by social isolation and a lack of team support, especially in the healthcare industry (Cohen & Wills, 1985; Lakey & Cohen, 2015; Sonnentag & Frese, 2012).

- **Disparities in Expectations and Abilities**

Stress arises in academic, professional, and health environments when expectations and abilities are not aligned. People feel overburdened by these mismatches, which has a detrimental impact on their well-being and performance. To manage stress and enhance results across domains, these gaps must be filled (Kao, 2024).

- **Lack of Patient Engagement**

Poor health outcomes, stress, worry, and burnout are all influenced by a lack of patient engagement. This affects healthcare professionals, who get frustrated and burned out, as well as patients, who feel cut off from their treatment. Participation may be increased, stress can be decreased, and general health outcomes can be improved by implementing automated engagement and personalized communication (Arnetz et al., 2016; Castellini et al., 2021).

6. Work-life imbalance sub-criteria

- **Financial Strain**

Financial strain significantly contributes to stress, impacting emotional well-being, physical health, and quality of life. It leads to anxiety, depression, and physical symptoms like loneliness and poor health (Adams et al., 2016; Frank et al., 2014).

• **Unbalanced Work-Life Schedule**

Insomnia, burnout, work-family conflict, cognitive impairments, and health problems are all consequences of an unbalanced work-life schedule. Improving well-being and minimizing detrimental effects on productivity and health require addressing this imbalance through tactics including establishing boundaries, placing a high priority on self-care, and enlisting the help of employers (Al-Adawi et al., 2022; Basuni & Sopiaiah, 2023; Liswandi & Muhammad, 2023).

• **Emotional Tiredness**

Burnout, sadness, and anxiety are the results of emotional weariness brought on by ongoing stress and emotional labor. This has a major effect on psychological health, causing stress, sleeplessness, and cognitive exhaustion. To avoid serious health problems, stress management via self-care, work-life balance, and expert assistance is essential (Jeung et al., 2018; Jin et al., 2020a).

• **Lack of Work-Life Balance**

Stress is greatly increased by a lack of work-life balance, which has an impact on both mental and physical health. Research indicates that poor work-life balance, role conflict, and job overburden all contribute to elevated stress levels. The Spillover-Crossover Model emphasizes the effects of work-related stress on personal life. Putting work-life balance techniques into practice may lower stress and enhance health (Bishnoi, 2023; Borowiec & Drygas, 2023; Jin et al., 2020b; Massoud et al., 2020).

2.3 Stress management interventions (decision alternatives))

According to Glazer and Liu (2017), the literature review on stress management interventions has identified a large number of programs that can be broadly categorized into (a) technology-enhanced interventions centered on mental health and stress reduction, which can be carried out via online or mobile platforms; (b) spirituality- and mindfulness-based interventions; (c) programs that incorporate cognitive behavioral elements; and (d) interventions that address the physical side effects of stress.

Stress management encompasses diverse strategies to mitigate stress, enhance coping mechanisms, and modify perceptions. Researchers focus on interventions that reduce stressors, shift perspectives, and foster effective coping strategies. Numerous initiatives are needed to support the well-being of healthcare workers in light of the demands they face.

Numerous challenges exist in implementing digital mental health treatments, according to recent studies. Key challenges in stress intervention are identified by Harty et al. (2023) as gender inequity, age-related disparities, and insufficient interoperability. The potential exists for digital therapy; where during pandemics like COVID-19, smartphone interventions significantly reduced the stress that emergency and medical workers experienced at work. Stressors associated with pandemics include heavy workloads, a lack of resources, and inadequate assistance for medical personnel (Fiol-DeRoque et al., 2021). According to Coifman et al. (2021), frontline workers require extra care beyond traditional therapy, especially if they have a history of mental illness. Stress is made worse by heavy workloads, deadline pressures,

burnout, emotional weariness, and a poor work-life balance (Hwang & Jo, 2019; Mistretta et al., 2018). Concerns about social support, self-efficacy, the order of interventions, and seeing patients suffer are additional stressors (Bratt et al., 2022; Smoktunowicz et al., 2021). Lack of evidence-based digital tools, worries about data security, and the realization that burnout, despair, and suicidality are significant obstacles are some of the factors that lead to stress in healthcare workers (Pospos et al., 2018). The high prevalence of common mental diseases among working people has global ramifications, including socioeconomic variables, job performance, and general well-being (Yorita et al., 2023).

Since healthcare personnel are facing a growing number of stressors due to the COVID-19 pandemic including financial strain, work-life imbalance, health concerns, and excessive workloads (Mediavilla et al., 2022; Pallavicini et al., 2022; Riches et al., 2023), there is a growing need for effective stress management strategies, such as wearables therapeutics (González Ramírez et al., 2023). In summary, managing these complex pressures necessitates an all-encompassing strategy to assist healthcare personnel's mental health and well-being.

Physicians and nurses experience high stress due to a variety of factors, including heavy workloads, long hours, patient care obligations, and organizational restraints (Melnyk et al., 2020). Stress is a result of disparities in expectations, abilities, and social support, which can lead to burnout, anxiety, and depression among healthcare workers (Tamminga et al., 2023). Burnout, psychosomatic problems, and a decline in the quality of treatment provided in healthcare settings might result from these difficulties.

Stress-inducing variables for fellows and residents may include the demanding nature of the healthcare sector, time constraints, problems related to the epidemic, and a heavy workload (Ranjbar et al., 2022). Burnout is a growing problem for healthcare workers, made worse by the COVID-19 pandemic. High workloads, trauma exposure, and demanding healthcare environments are examples of stressors that need the use of stress-reduction strategies like mantra-based meditation (Pettus et al., 2023).

1. Traditional interventions

Mindfulness and cognitive-behavioral therapy interventions prove efficacious in mitigating stress, anxiety, and depression. Brief strategies involving deep breathing and gratitude display potential benefits. Individual-level stress interventions among healthcare workers, whether directing focus towards or away from stress, exhibit potential stress reduction lasting up to a year post-intervention. Mindfulness-Based Stress Reduction (MBSR) demonstrates efficiency in alleviating anxiety, depression, and stress while fostering mindfulness and self-compassion. However, its impact on burnout and resilience remains inconclusive (Tamminga et al., 2023). Chanting the Maha-mantra showed a significant 75.33% reduction in cortisol levels among nurses, offering a cost-effective stress relief method. Similarly, American Meditation Institution (AMI) meditation improved caregiver well-being, reducing burnout and enhancing compassion, supporting the importance of these interventions in healthcare (Pettus et al., 2023; W.J. et al., 2021). A successful 10-week mind-body group in residency enhanced resiliency and reduced burnout (Ranjbar et al., 2022). According to Kriakous et al. (2020) and Lomas et al. (2019), MBSR proved effective in alleviating anxiety, depression, and stress in healthcare professionals, enhancing mindfulness and self-compassion. However, its impact on burnout and resilience was inconclusive, necessitating a need for more rigorous research, notably high-quality randomized control trials.

Supervised structured yoga appears promising for stress reduction, as evidenced by an eight-week intervention yielding significant improvements in self-compassion and mindfulness among nursing students. While other outcomes like resilience and life satisfaction showed non-significant changes, the yoga group demonstrated notable enhancements in self-care, mindfulness, emotional exhaustion, and depersonalization. Larger studies are warranted to validate these findings and establish the border efficiency of yoga interventions (Alexander et al., 2015; Mandal et al., 2021; Mathad et al., 2017; Miyoshi, 2019).

Many studies have evaluated the effectiveness of Cognitive Behavioral Therapy (CBT) and Mindfulness-Based Cognitive Therapy (MBCT-l) in reducing stress for healthcare staff. A single session of CBT for insomnia proved effective in several studies (Amra et al., 2023; Strauss et al., 2018). Non-specialist mental health workers in rural south Australia found online training easy and applicable (Muambi et al., 2022b). In Clemow et al. (2018), the intervention group showed significant systolic blood pressure (SBP) reduction. Reviews on diverse interventions for burnout have highlighted limited overlap and insufficient randomized control trials. A few mHealth (medical and public health practices that use mobile devices) studies in developing countries have shown promising potential, urging larger, quantitative research (Covington et al., 2023; O'Donovan et al., 2015; Phillips & Becker, 2019). Expressive arts interventions, notably music and art-based, positively impact the well-being of healthcare professionals, reducing burnout and stress (Phillips & Beker, 2019). A Tranquil Cinematic-Virtual Reality pilot study effectively reduced subjective stress in the short term, emphasizing the need for further research (Beverly et al., 2022). Mindfulness-based training showed significant improvements in anxiety reduction and job satisfaction. Ghawdra et al. (2020) showed that successful stress reduction requires a blend of individual and organizational support.

Swedish massage effectively reduced occupational stress in Emergency Medical Services (EMS) staff and ICU nurses, as evidenced by notable decreases in stress scores. Massage has been shown to also significantly reduce heart rate and blood pressure, promoting overall well-being (Montibeler et al., 2018; Nazari et al., 2015). Auriculotherapy led to significant stress reduction in nurses, but there was no statistical group difference (do Prado et al., 2018). In busy clinics, Animal Assisted Intervention (AAI) programs are viable, and medical professionals accept them for their significant psychological benefits, despite some dissatisfaction of this experimental design by the same healthcare professionals as they were forced to leave the workplace at certain specific times. Etingen et al. (2020) said that high participation (51% of clinic employees; n=39), improved mood (from M = 2.9 points to M = 4.5 points, measured in a 5-point Puppy Mood Scale), and reduced patient-related burnout (from M = 40.0 to M = 18.0, measured in a Copenhagen Burnout Inventory scale) were observed which resulted in positive qualitative feedback indicating effective program satisfaction, improved clinic atmosphere and improved stress reduction with a boost in mood (Etingen et al., 2020; Maran et al., 2022; Hasson et al., 2005).

Six diverse studies, encompassing clinical trials, observational research, systematic reviews, and a case report, suggested moderate efficiency of tai chi in mitigating work-related stress for healthcare professionals (Cocchiara et al., 2020).

2. Technology-enhanced interventions

According to Harty et al. (2023), Digital Cognitive Behavioral Therapy exhibits efficiency for depression/anxiety and encourages broader implementation in Irish and global public healthcare. Muyambi et al. (2022) discovered that thematic analysis underscores course simplicity, seamless clinical integration, and vital ongoing support. The meta-theme, “easy to train and easy to apply”, affirmed positive reception and relevance for non-specialist healthcare workers in rural South Australia. Four studies worked with digital components for the intervention and/or control group (Coifman et al., 2021; Fiol-DeRoque et al., 2021; Hwang & Jo, 2019; Mistretta et al., 2018). Two studies made use of a web-based platform in different ways. Havermans et al. (2018) embraced it to provide details on organizational implementation tactics for work stress avoidance initiatives. Through the web-based platform, Smoktunowicz et al. (2021) provided a self-guided intervention. A blended learning approach—a mix of in-person instruction and web-based online training—was used in Montero-Marín et al. (2018). Incorporating visual cues, pedometers, and health coaching via texting enhanced physical activity among healthcare workers (Melnyk et al., 2020).

Pospos et al. (2018) described seven resources, such as Breath2Relax and Headspace, that target wellness and mitigate burnout, depression, and suicide risks in healthcare workers. E-healthcare interventions, like the online emotional freedom technique, exhibit promise in alleviating nurse burnout, but rigorous trials are imperative for conclusive evidence, especially in the COVID-19 era (Park et al., 2022). A randomized controlled trial demonstrated that an internet-based compassion course markedly alleviated work-related stress and stress of conscience in healthcare professionals, showcasing its potential as a potent intervention (Bratt et al., 2022).

Various interventions positively impacted mental health, including an app called IARA training which is a mindfulness-based program that helps to reduce stress. Additionally, an app named MBSH (headspace) is designed for healthcare professionals (HCPs) in order to decrease stress (Taylor et al., 2022). They collectively contribute to reduce stress, enhance emotional well-being, and increase self-efficiency among participants, highlighting the potential for innovative approaches in promoting mental health and suggesting avenues for further research and improvements (Barattucci et al., 2019; Hwang & Jo, 2019; Taylor et al., 2022). A stress management framework, employing a chatbot and fuzzy inference model, adeptly identified users’ sense of coherence. Nonetheless, user adoption faced challenges, with only a few expressing sustained interest in integrating the system into their daily lives (Yorita et al., 2023).

Brief VR interventions, such as meditation or nature-based stimuli (such as forests, beaches and water), show promise in enhancing workplace well-being. While feasibility and acceptability are demonstrated, more controlled, longer-term trials are needed to assess overall effectiveness, especially for healthcare workers and other stress-prone populations (Pallavicini et al., 2022; Riches et al., 2023). In a study by González Ramírez et al. (2023), it was found that among 6,259 studies on users’ evaluations for their impact on health and usability of wearable-based strategies, 21 studies, while meeting 40 inclusion criteria focused on stress reduction in healthcare workers using commercial wearables (González Ramírez et al., 2023). According to Prudenzi et al. (2022), ACT intervention, which emphasizes mindfulness and values-based behavior, significantly helped decrease distress for 48% of the participants (healthcare-staff) who received the ACT intervention, supporting its effectiveness. According to Mediavilla et al. (2022), ongoing trials aim to assess a stepped-care

program's efficiency in addressing mental health challenges during the pandemic, guiding future strategies.

Table 1
Criteria and sub-criteria

Criteria	Sub-Criteria
Workload and Time Constraints (Amra et al., 2023; Melnyk et al., 2020; Pallavicini et al., 2022; Ranjbar et al., 2022; Tamminga et al., 2023; W.J et al., 2021)	Excessive Workload (Fiol-DeRoque et al., 2021; Harty et al., 2023; Melnyk et al., 2020; Pettus et al., 2023; Ranjbar et al., 2022) Long Working Hours (Mediavilla et al., 2022; Riches et al., 2023) Time Constraints and Deadlines (Covington et al., 2023) Challenging duties and responsibilities (Phillips & Becker, 2019)
Organizational Constraints	Understaffing (Bratt et al., 2022; Melnyk et al., 2020) Lack of Resource (Fiol-DeRoque et al., 2021; Harty et al., 2023) Organizational Issues (Ghawadra et al., 2020; Kriakous et al., 2020) Restrictions on Evaluation and Training (Muyambi et al., 2022) Lack of Skills (Kriakous et al., 2020; Smoktunowicz et al., 2021)
Health Concerns (Fiol-DeRoque et al., 2021; Mediavilla et al., 2022; Riches et al., 2023)	Pandemic-related Challenges (Fiol-DeRoque et al., 2021; Mediavilla et al., 2022; Pallavicini et al., 2022; Riches et al., 2023) (Coifman et al., 2021) Trauma Exposure (Pettus et al., 2023) Concerns about personal health and safety (Kriakous et al., 2020; Montibeler et al., 2018)
Emotional and Psychological Stress (Coifman et al., 2021; Fiol-DeRoque et al., 2021; Mediavilla et al., 2022; Melnyk et al., 2020; Ranjbar et al., 2022; Riches et al., 2023; Tamminga et al., 2023)	Burnout (Cocchiara et al., 2020; Covington et al., 2023; Ghawadra et al., 2020; Kriakous et al., 2020; Maran et al., 2022; Melnyk et al., 2020; Miyoshi, 2019; Montibeler et al., 2018; Pettus et al., 2023; Ranjbar et al., 2022; Tamminga et al., 2023) Anxiety (Fiol-DeRoque et al., 2021; Ghawadra et al., 2020; Harty et al., 2023; Kriakous et al., 2020; Mathad et al., 2017; Melnyk et al., 2020; Pettus et al., 2023; Prudenzi et al., 2022; Ranjbar et al., 2022; Riches et al., 2023) Depression (Fiol-DeRoque et al., 2021; Harty et al., 2023; Kriakous et al., 2020; Melnyk et al., 2020; Pettus et al., 2023; Prudenzi et al., 2022) Psychometric Problem (Pettus et al., 2023; Ranjbar et al., 2022; Tamminga et al., 2023)

Criteria	Sub-Criteria
Lack of Support	Insufficient Assistance (Glazer & Liu, 2017; Kriakous et al., 2020; Muyambi et al., 2022) Problems with Social Support (Smoktunowicz et al., 2021) Disparities in Expectations and Abilities (Tamminga et al., 2023) Lack of Patient (Muyambi et al., 2022)
Work-Life Imbalance (Hwang & Jo, 2019; Melnyk et al., 2020; Mistretta et al., 2018)	Financial Strain (Mediavilla et al., 2022; Riches et al., 2023) Unbalanced Work-life Schedule (Bratt et al., 2022) Emotional Tiredness (Hwang & Jo, 2019) Lack of Work-life Balance (Hwang & Jo, 2019)

2.4 Analytic Hierarchy Process

The Analytical Hierarchy Process (AHP) addresses complex decision-making by integrating psychology and mathematics. Decision-makers are assisted by the AHP, which uses a hierarchical structure to evaluate options and choose the best options by combining qualitative and quantitative data (Saaty & Hu, 1998).

Taslicali and Ercan (2006) showcase the distinct advantage of the AHP over other Multi-Criteria Decision Making (MCDM) methods. They highlighted how the AHP stands out due to its user-friendly approach and its ability to incorporate both quantitative and qualitative factors when evaluating problems. This inventiveness makes the method particularly accessible for decision-makers in comparison to other MCDM techniques. The AHP simplifies complex evaluations by organizing, contrasting, and synthesizing priorities to support multiple criteria decision-making.

According to Saaty (1990), the AHP is a method designed to assist with the multiple criteria decision-making (MCDM). It consists of three key components, which are: (1) organizing the issue into a hierarchy made up of goals and subordinate elements (decomposition), (2) conducting pairwise comparisons among elements at each level (evaluation), and (3) transferring level-specific, local priorities to overall global priorities (synthesis). The lower levels of a hierarchy may include objectives, events, scenarios, actions, outcomes, and alternatives (Saaty, 1990).

Saaty's AHP emphasizes prioritization through pairwise comparisons. In 1998, Saaty introduced the Eigenvector method (EV) for this purpose (Saaty & Hu, 1998). He demonstrated in 2003 that the principal eigenvector of comparison matrices reliably represents both consistent and inconsistent preferences, enhancing decision-making accuracy (Saaty, 2003).

The Eigenvalue (EV) and Logarithmic Least Squares (LLS) approaches have been extensively examined as a complement to the AHP. Saaty (1990) and Wechsler and Leopold (1996) contend that the EV is inferior, while Barzilai (1997) and Zahedi (1986) favor LLS. However, the aforementioned conclusion has often been opposed (Golany & Kress, 1993). A perceptive comparison evaluation of popular prioritization approaches was carried out by Golany and Kress (1993). They concluded that every method had benefits and drawbacks and that no technique was fundamentally

superior. Therefore, choosing a prioritizing strategy should be guided by the specific objectives of the investigation. This result supports the work we did to develop and assess the Eigen Vector (EV) approach for AHP prioritizing, as well as our research on stress management interventions.

3. Methodology

3.1 Evaluation of stress management interventions among healthcare professionals using the AHP

3.1.1 Weight calculation using the AHP

The AHP is a problem-solving technique that prioritizes stress management interventions by identifying critical elements using the Eigenvector method. It reduces the effect of outliers using the geometric mean (rather than the arithmetic mean) for various comparison data points in a comparison matrix, and standardizes the data to enhance reliability. It also breaks down complex issues into hierarchical structures and assures informed choices are made through priority analysis and consistency verification; this methodical technique helps decision-makers in a variety of scenarios.

Each cluster undergoes a pairwise comparison within the same tier. This comparison is informed by the decision makers' expertise and insight or by incorporating opinions from relevant experts. For instance, when evaluating two criteria within a particular level (such as criteria and alternatives), each pair is scrutinized in relation to the overarching goals or objectives. These comparisons are then translated into a comparison matrix wherein elements within one tier are assessed against elements at a higher tier (the goal). The preferences of decision-makers are quantified using Saaty's fundamental scale which provides a structured method for expressing preferences (Saaty, 2008).

Due to subjective evaluations, pairwise comparisons in the AHP are prone to inconsistencies. A consistency check establishes the consistency ratio (CR), which is essential for guaranteeing reliability when evaluating many criteria ($n > 2$). First, a consistency index (CI) is computed using the largest eigenvalue (λ_{\max}) and matrix size (n). Next, by dividing the consistency index (CI) by the random consistency index (RI), the CR is determined. Evaluations are considered satisfactory if the CR is \leq the given limitations; otherwise, changes are required. These comparisons are used by hierarchical structures to rank matrices, calculate weights, and incorporate judgments into decisions that are prioritized.

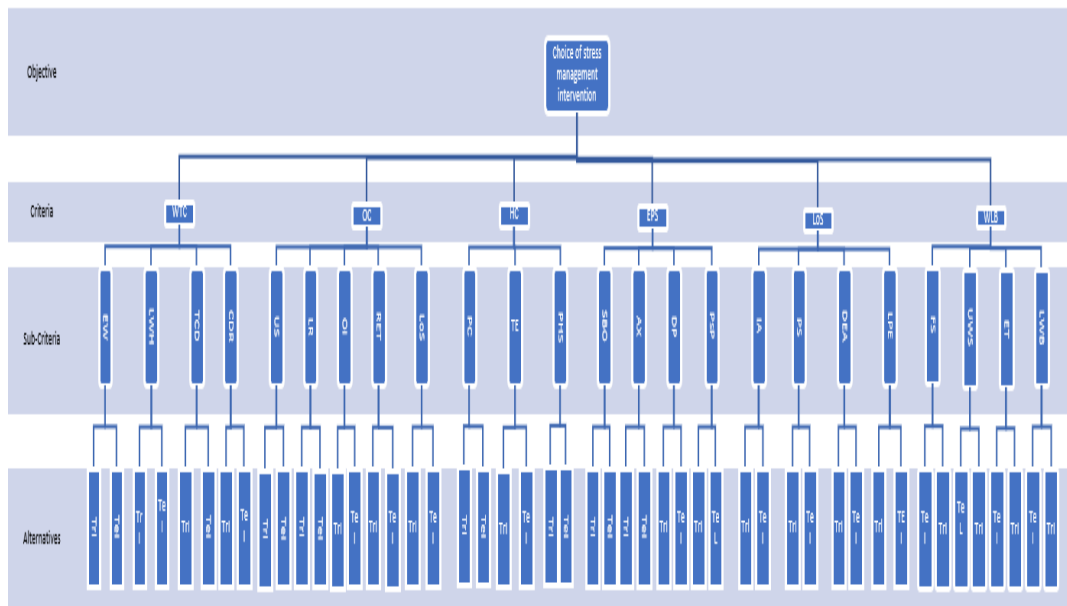


Figure 1 Hierarchy trees, outlining the overall goal, criteria, sub-criteria and the alternative

The elements $C_1, C_2 \dots C_n$ in the same hierarchy should be compared. The relative weight (or significance or priority) of C_i about C_j should be indicated by a_{ij} . This should be built into a square matrix $A = (a_{ij})$ of order n , taking into account the restrictions.

Saaty (2008) showed that for any k , $a_{ij} = 1/a_{ji}$ and $a_{ij} = a_{ji}$. This is called a reciprocal matrix. In the event where element C_i is chosen over C_j , then $a_{ij} > 1$. By this, for $p = 1, 2, 3, \dots, p$, the reciprocal property, and $a_{ij} = 1/a_{ji}$ is always true.

According to Saaty's basic scale of comparison, a_{ij} ranges from 1/9 to 9 (Saaty, 2008). For every level with n elements, ${}^nC_2 = (n(n-1))/2$ judgments are needed for each pair of comparisons. To accommodate all the comparisons, a positive reciprocal matrix of pairwise comparisons is formed, denoted as $A = [a_{ij}] \in \mathbb{R}^{n \times n}$. From this matrix, the priority vector $\omega = (\omega_1, \omega_2, \omega_3, \dots, \omega_n)$ can then be obtained.

When the decision-maker makes consistent decisions, all of the elements have perfect values. Thus, $a_{ij} = \omega_i / \omega_j$. If the weights are transitive, that is, $a_{ik} = a_{ij} * a_{jk}$ for all i, j , and $k = 1, 2, 3, \dots, n$, then there is consistency in the weights.

This kind of matrix is genuinely perfect and is only possible if the a_{ij} are determined using precisely measured data. Therefore, the pairwise comparison matrix A is consistent, and it has the form $A_c = [\omega_i / \omega_j]$. By dividing each element in every column of the comparison matrix A by the total of all the components in that column, and then averaging those elements, the consistent priorities are distinct and easily accessible.

Nevertheless, in actual situations, the decision-maker's assessments, a_{ij} , are not flawless. These are simply approximations of the precise ratios ω_i / ω_j . In real-world business circumstances, this kind of discrepancy in comparison and judgment is more prevalent. When that occurs, matrix A becomes inconsistent and can be seen as a

perturbation of matrix A_c , which is consistent. Furthermore, the inconsistent priorities can be determined using an error estimate technique because they are not unique.

3.1.2 Eigenvector Method (EV)

The Eigenvector (EV) principle is used by Saaty's (1977) AHP to rank items according to their relative value. Saaty (1977) states that small deviations from ideal ratios ω_i/ω_j in the pairwise comparison matrix A cause marginal alterations in the eigenvalues surrounding those of a consistent matrix A . The EV technique looks for a vector ω such that the largest eigenvalue, λ_{max} , equals $A\omega$. Inconsistent matrices, which are frequently found in human evaluations, depart from this ideal and impact λ_{max} about the matrix dimension n . Judgments are deemed consistent if $\lambda_{max} = n$; otherwise, deviations show different degrees of inconsistency in the judgments.

The Consistency Index (CI) is computed as $(\lambda_{max} - n)/(n - 1)$ to evaluate inconsistency in judgments inside the AHP. A standard is provided by Saaty's random consistency index (RI). Comparing CI with RI yields the CR; a value of $CR > 0.1$ denotes erroneous judgments, while a value of $CR = 0$ denotes perfect consistency.

The EV approach is based on Equation 1:

$$A\omega = \lambda_{max} * \omega \text{ and } \lambda_{max} \geq n \quad (1)$$

For minor deviations from the ideal evaluations, this method provides a fairly accurate estimate of the priorities vector. When the decision-maker's preferences are greatly inconsistent, the solutions are, nevertheless, not entirely satisfying.

$$\sum_{j=1}^n a_{ij} \omega_j = \lambda_{max} \omega_i \quad (2)$$

for $j = 1, 2, 3, \dots, n$

Taking the summation over

$$\sum_{i=1}^n \sum_{j=1}^n a_{ij} \omega_j = \lambda_{max} \sum_{i=1}^n \omega_i \quad (3)$$

for $i = 1, 2, 3, \dots, n$ and $j = 1, 2, 3, \dots, n$

This method is predicated on the idea that the element a_{ij} will occasionally deviate from the ideal ratios of ω_i / ω_j . These cause slight alterations in the comparison matrix's eigenvalues. Saaty's research demonstrated that the desired priority vector may be derived from the major eigenvector of A . Equation 4 must be solved to use the EV approach.

$$A\omega = \lambda_{max}\omega, \quad e^T\omega = 1 \quad (4)$$

The principal eigenvector λ_{max} of A is determined by solving the characteristic Equation 5,

$$|A - \lambda_{max}| = 0 \quad (5)$$

Then using the value of λ_{max} , the eigenvector $\omega = (\omega_1, \omega_2, \omega_3 \dots \omega_n)$ is determined from Equation 6:

$$(A - \lambda_{\max}) \omega = 0 \quad (6)$$

3.2 Research design

This research focuses on the healthcare sector in India, specifically targeting medical officers employed in private hospitals. To ensure consistency and eliminate hospital-specific biases, data were collected from a private hospital across different departments. Following Vinodh et al. (2011), consistency in decision-making was ensured, as the medical officers were from different medical departments within a single hospital. The medical officers often visit different hospitals, but the number of hospitals visited does not matter in ensuring consistency.

3.2.1 Data and variables

A total of 20 medical officers participated in the study, as subject experts, providing data in a structured questionnaire using the AHP's fundamental scale, and providing preferences for the comparison matrix. The data were analyzed using the EV method of the AHP using Microsoft Excel (Saaty & Hu, 1998; W.J. et al., 2021).

All the data gathered from the experts were aggregated into a single comparison matrix using the Geometric Mean (GM). GM is used to mitigate the effect of outliers (as compared to arithmetic mean). A pairwise comparison was conducted by comparing each variable with the other variables one at a time (Aczel & Saaty, 1983)

This data adheres to several fundamental assumptions:

- 1) Each participant in the study experiences similar factors affecting their work environment, including workload and time constraints, organizational constraints, health concerns, emotional and psychological stress, and lack of support, among others.
- 2) All participants hold the same job title, work similar hours, and face comparable workloads.
- 3) All participants are located in the same geographical area and are employed by the same organization.

4. Analysis and results

4.1 Problem resolution using the AHP-Eigenvector method

The AHP was utilized to ascertain the relative weights of the variables WTC, OC, HC, EPS, LoS, and WLB using Microsoft Excel. The pairwise comparison matrix and relative weights of WTC, OC, HC, EPS, LoS, and WLB by the adaption of the method from Saaty (2003) and Saaty and Hu (1998) are illustrated in Tables 2 and 3 respectively. The consistency ratio is 0.080814.

Table 2
Pairwise comparison matrix for main criteria

	WTC	OC	HC	EPS	Los	WLB
WTC	1	3.759722661	3.631653	3.653103	4.180197	7.644045
OC	0.265977	1	2.272035	3.077437	5.013812	4.989513
HC	0.275357	0.440134083	1	3.296267	5.64389	5.870191
EPS	0.27374	0.324945714	0.303373	1	2.400331	5.277512
LoS	0.239223	0.199449034	0.177183	0.416609	1	2.435107
WLB	0.130821	0.200420352	0.170352	0.189483	0.41066	1

Table 3
Relative weights of the WTC, OC, HC, EPS, LoS, and WLB

WTC	OC	HC	EPS	Los	WLB
0.416178	0.22315384	0.181671	0.095733	0.052569	0.030695

The relative weights are a result of the eigenvector method of the AHP, which deals with the pairwise comparative decision.

4.1.1 Sensitivity analysis in the AHP

Our analysis revealed that WTC and OC significantly contribute to stress and remain constant during normal periods but are manageable through traditional interventions. However, the sensitivity analysis showed that changes occur in WTC and OC during crisis periods like the COVID-19 pandemic. These variations impact the effectiveness of both traditional and technical interventions, indicating a need for tailored strategies during such periods. A sensitivity analysis was conducted to determine how variations in the prioritized variable would impact the different alternatives. This process helps identify which variables have the most influence on the outcomes and how changes in these variables can affect the overall decision-making process. By understanding these dynamics, we can better anticipate potential shifts and make more informed and robust choices.

The sensitivity analysis explains how there is a change in the optimal solution when model coefficients change. To assess the sensitivity of the AHP, a free online tool called Super Decisions can be utilized. To generate a meaningful sensitivity graph, it is crucial to establish an independent variable. In the sensitivity window, each alternative is represented by a separate line.

The optimum weights of w_1 , w_2 , w_3 , w_4 , w_5 , and w_6 are 0.416178, 0.22315384, 0.181671, 0.095733, 0.052569 and 0.030695 for WTC, OC, HC, EPS, LoS, and WLB, respectively. In this study WTC and OC hold the highest comparative weight among the criteria and are designated as the independent variables for generating the sensitivity graph. In Figure 2, the criteria WTC priority is arranged on the x-axis while the alternatives priority (all two interventions) is arranged on the y-axis.

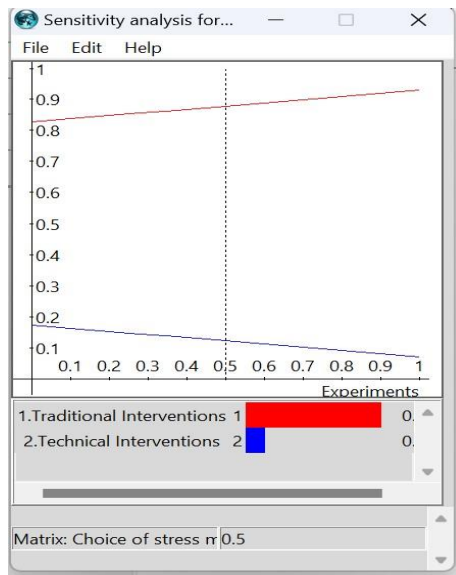


Figure 2 Sensitivity graph for the goal related to the WTC (Workload and time constraints) criterion for two alternatives

Table 3 shows the sensitivity analysis for the goal concerning WTC (Workload and time constraints) criterion for two alternatives at nine different data points.

Table 3
Sensitivity analysis for the goal concerning the WTC (Workload and time constraints) criterion for two alternatives at nine different data points

Input Value	Matrix: Choice of stress management intervention: WTC	Traditional Interventions	Technical Interventions
0	0.01	0.83	0.17
0.13	0.13	0.84	0.16
0.25	0.26	0.85	0.15
0.38	0.38	0.87	0.13
0.5	0.5	0.88	0.12
0.63	0.62	0.89	0.11
0.75	0.75	0.9	0.1
0.88	0.87	0.92	0.08
1	0.99	0.93	0.07

At frequency = 0.5, the weight of the traditional intervention is 0.88, whereas the weight of the technical intervention is 0.12. Consequently, this graph indicates that as the priority of criterion WTC rises, the traditional intervention consistently emerges as the preferred choice of alternative. In contrast, the technical intervention consistently ranks as the less preferred alternative.

In Figure 4 the OC criterion priority is arranged on the x-axis while the alternatives priority (all two interventions) is arranged on the y-axis

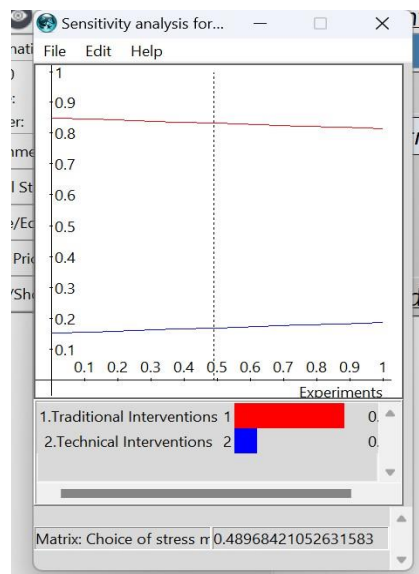


Figure 4 Sensitivity graph for the goal concerning the OC (organization constraints) criterion for two alternatives

Table 5 shows the sensitivity analysis of the goal concerning the OC criterion for two alternatives at nine different data points.

Table 5
Sensitivity analysis for the goal concerning the OC criterion for two alternatives at nine different data points

Input Value	Matrix: Choice of stress management intervention: OC	Traditional Interventions	Technical Interventions
0.00	0.01	0.85	0.15
0.13	0.13	0.85	0.15
0.25	0.26	0.84	0.16
0.38	0.38	0.84	0.16
0.50	0.50	0.83	0.17
0.63	0.62	0.83	0.17
0.75	0.75	0.82	0.18
0.88	0.87	0.82	0.18
1.00	0.99	0.81	0.19

At frequency = 0.5, the weight of the traditional intervention is 0.83, whereas the weight of the technical intervention is 0.17. Consequently, this graph indicates that as the priority of OC rises, the traditional intervention consistently emerges as the preferred choice of alternative. In contrast, the technical intervention consistently ranks as the less preferred alternative among the two.

5. Conclusion

In conclusion, the COVID-19 pandemic made addressing mental health issues among healthcare personnel more urgent and highlighted the need for a holistic approach. This study outlines a range of pressures that physicians, nurses, fellows, and residents face, including conflicts between their personal and professional lives, burnout, and heavy workloads. Scalable approaches to treating anxiety and depression are provided including digital mental health therapies, especially cognitive behavioral therapy (CBT), which prioritizes user accessibility and clinician integration. In addition to considering wearable technology and virtual reality (VR) approaches, traditional interventions like mindfulness and expressive art therapy are still very important. To increase the usefulness of these therapies to reduce workplace stress and boost general well-being, more studies are necessary, particularly long-term trials.

The two main factors affecting healthcare workers mental health are workload and time constraints, which affect the quality of patient care and other resources. Research has shown that the demography of the patient, the severity of the disease, and other organizational characteristics are responsible for the change in the workload and this calls for solutions in the staffing and care given. Stress arises when there is an increase in the tasks demanded and the time constraints which leads to absenteeism and decreased job satisfaction. Despite difficulties in job control and perceived expectations, proper time and workload management is essential for reducing stress to ensure peak performance and promote the well-being of healthcare professionals. These factors emphasize the importance of addressing time management and workload as major stressors in the healthcare environment (Cordero-Guevara et al., 2022; Hertzum & Holmegaard, 2013; Portoghese et al., 2014).

The effectiveness of healthcare professionals is influenced by organizational constraints such as understaffing and lack of resources, organizational challenges, limitations in training and evaluation, and lack of skills, which lead to stress. Lack of training makes staff feel unprepared to deal with complicated medical issues, which might cause discomfort and lead to a lower standard of care. Understaffing increases the workload, which leads to a decrease in productivity and burnout. The unchanged structures in training methods of healthcare workers restrict freedom to make decisions. It is necessary to address these challenges through proper training, sufficient staffing, and efficient procedures to lower stress and promote job satisfaction (Hudson & Shen, 2015; Michael et al., 2022; Puente-Fernández et al., 2020; Stevens et al., 2019).

REFERENCES

- Aczél, J., & T.L. Saaty. (1983). Procedures for synthesizing ratio judgements. *Journal of Mathematical Psychology*, 27(1), 93–102. [https://doi.org/10.1016/0022-2496\(83\)90028-7](https://doi.org/10.1016/0022-2496(83)90028-7)
- Adams, D. R., Meyers, S. A., & Beidas, R. S. (2016). The relationship between financial strain, perceived stress, psychological symptoms, and academic and social integration in undergraduate students. *Journal of American College Health*, 64(5), 362–370. <https://doi.org/10.1080/07448481.2016.1154559>
- Ahmad, A., Chakraborty, R., Goyal, S., Kapoor, A., Sidharth, S., & Ahmad, P. (2022). Psychological effects of COVID-19 pandemic on nurses deployed in high-risk units: A multicentre observational study. *Journal of Marine Medical Society*, 24(Suppl 1), S18–S24. https://doi.org/10.4103/jmms.jmms_101_21
- Al-Adawi, S., Alameddine, M., Al-Saadoon, M., Al Balushi, A. A., Chan, M. F., Bou-Karroum, K., Al-Kindy, H., & Al-Harhi, S. M. (2022). The magnitude and effect of work-life imbalance on cognition and affective range among the non-western population: A study from Muscat. *PLoS ONE*, 17(2), e0263608. <https://doi.org/10.1371/journal.pone.0263608>
- Alborzkouh, P., Nabati, M., Zainali, M., Abed, Y., Ghahfarokhi, S. F. (2015). A review of the effectiveness of stress management skills training on academic vitality and psychological well-being of college students. *Journal of Medicine and Life*, 8(Spec.Iss.4), 39–44.
- Alexander, G. K., Rollins, K., Walker, D., Wong, L., & Pennings, J. (2015). Yoga for self-care and burnout prevention among nurses. *Workplace Health and Safety*, 63(10), 462–470. <https://doi.org/10.1177/2165079915596102>
- Amra, B., Ghadiry, F., Vaezi, A., Nematollahy, A., Radfar, N., Haghjoo, S., Penzel, T., & Morin, C. M. (2023). Effect of one-shot cognitive behavioral therapy on insomnia and heart rate variability of health care workers at the time of COVID-19 pandemic: A randomized controlled trial. *Sleep and Breathing*, 27(4), 1411–1418. <https://doi.org/10.1007/s11325-022-02746-4>
- Andhavarapu, S., Yardi, I., Bzhilyanskaya, V., Lurie, T., Bhinder, M., Patel, P., Pourmand, A., & Tran, Q. K. (2022). Post-traumatic stress in healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Psychiatry Research*, 317, 114890. <https://doi.org/10.1016/j.psychres.2022.114890>
- Arnetz, J. E., Zhdanova, L., & Arnetz, B. B. (2016). Patient involvement: A new source of stress in health care work? *Health Communication*, 31(12), 1566–1572. <https://doi.org/10.1080/10410236.2015.1052872>
- Arpaia, P., D’Errico, G., De Paolis, L. T., Moccaldi, N., & Nuccetelli, F. (2022). A narrative review of mindfulness-based interventions using virtual reality. *Mindfulness*, 13(3), 556–571. <https://doi.org/10.1007/s12671-021-01783-6>
- Baek, S. U., & Yoon, J. H. (2024). Effect of long working hours on psychological distress among young workers in different types of occupation. *Preventive Medicine*, 179, 107829. <https://doi.org/10.1016/j.ypmed.2023.107829>

Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of Managerial Psychology*, 22(3), 309–328. <https://doi.org/10.1108/02683940710733115>

Barattucci, M., Padovan, A. M., Vitale, E., Rapisarda, V., Ramaci, T., & De Giorgio, A. (2019). Mindfulness-based IARA model® proves effective to reduce stress and anxiety in health care professionals: A six-month follow-up study. *International Journal of Environmental Research and Public Health*, 16(22), 4421. <https://doi.org/10.3390/ijerph16224421>

Barzilai, J. (1997). Deriving weights from pairwise comparison matrices. *Journal of the Operational Research Society*, 48(12). <https://www.jstor.org/stable/3010752>

Basuni, & Sopiah. (2023). Work-life balance and burnout on employee: A systematic literature review and bibliometric analysis. *International Journal of Business*, 4(2), 1207–1213. <https://doi.org/10.56442/ijble.v4i2.300>

Beverly, E., Hommema, L., Coates, K., Duncan, G., Gable, B., Gutman, T., Love, M., Love, C., Pershing, M., & Stevens, N. (2022). A tranquil virtual reality experience to reduce subjective stress among COVID-19 frontline healthcare workers. *PLoS ONE*, 17(2 February). <https://doi.org/10.1371/journal.pone.0262703>

Bhatia, R., Hirsch, C., Arnold, A. M., Newman, A. B., & Mukamal, K. J. (2023). Social networks, social support, and life expectancy in older adults: The Cardiovascular Health Study. *Archives of Gerontology and Geriatrics*, 111, 104981. <https://doi.org/10.1016/j.archger.2023.104981>

Bhui, K., Dinos, S., Galant-Miecznikowska, M., de Jongh, B., & Stansfeld, S. (2016). Perceptions of work stress cause and effective interventions in employees working in public, private and non-governmental organizations: A qualitative study. *BJPsych Bulletin*, 40(6), 318–325. <https://doi.org/10.1192/pb.bp.115.050823>

Bhui, K. S., Dinos, S., Stansfeld, S. A., & White, P. D. (2012). A synthesis of the evidence for managing stress at work: A review of the reviews reporting on anxiety, depression, and absenteeism. *Journal of Environmental and Public Health*, 2012, 1-21. <https://doi.org/10.1155/2012/515874>

Bishnoi, N. (2023). Comprehensive analysis of work-life balance literature. *International Journal of Humanities Social Science and Management*, 3(4), 52–62. <https://doi.org/10.35629/5252-45122323>

Borowiec, A. A., & Drygas, W. (2023). Work–life balance and mental and physical health among Warsaw specialists, managers and entrepreneurs. *International Journal of Environmental Research and Public Health*, 20(1), 492. <https://doi.org/10.3390/ijerph20010492>

Bowling, N. A. (2024). Organizational constraints as a source of work stress: A multi-facet perspective. In Nilesh Thakre and B. Udaya Kumar Reddy (Eds). *Stress, wellness, and performance optimization: Promoting sustainable performance in the workplace* (pp. 1–20). Apple Academic Press. <https://doi.org/10.1201/9781003400172-1>

- Bratt, A. S., Johansson, M., Holmberg, M., Fagerström, C., Elmqvist, C., Rusner, M., & Kaldo, V. (2022). An internet-based compassion course for healthcare professionals: Rationale and protocol for a randomized controlled trial. *Internet Interventions*, 28, 100463. <https://doi.org/10.1016/j.invent.2021.100463>
- Bruyneel, A., Smith, P., Tack, J., & Pirson, M. (2021). Prevalence of burnout risk and factors associated with burnout risk among ICU nurses during the COVID-19 outbreak in French-speaking Belgium. *Intensive and Critical Care Nursing*, 65, 103056. <https://doi.org/10.1016/j.iccn.2021.103059>
- Castellini, G., Palamenghi, L., Savarese, M., Barello, S., Leone, S., Previtali, E., Armuzzi, A., & Graffigna, G. (2021). Patient engagement in health management as a mediator between perceived risk and COVID-19 related distress in patients with IBD: A structural equation model. *Frontiers in Psychiatry*, 12, 733544. <https://doi.org/10.3389/fpsyt.2021.733544>
- Chichirez, C.-M., & Purcărea, V.L. (2018). Interpersonal communication in healthcare. *Journal of Medicine and Life*, 11(2), 119-122.
- Chueh, K. H., Yen, C. F., Lu, L., & Yang, M. S. (2011). Association between psychosomatic symptoms and work stress among Taiwan police officers. *Kaohsiung Journal of Medical Sciences*, 27(4), 144-149. <https://doi.org/10.1016/j.kjms.2010.12.008>
- Clemow, L. P., Pickering, T. G., Davidson, K. W., Schwartz, J. E., Williams, V. P., Shaffer, J. A., Williams, R. B., & Gerin, W. (2018). Stress management in the workplace for employees with hypertension: A randomized controlled trial. *Translational Behavioral Medicine*, 8(5), 761-770. <https://doi.org/10.1093/tbm/iby018>
- Cocchiara, R. A., Dorelli, B., Gholamalishahi, S., Longo, W., Musumeci, E., Mannocci, A., & La Torre, G. (2020). Tai chi and workplace wellness for health care workers: A systematic review. *International Journal of Environmental Research and Public Health*, 17(1), 1-8. <https://doi.org/10.3390/ijerph17010343>
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310-357. <https://doi.org/10.1037/0033-2909.98.2.310>
- Coifman, K. G., Disabato, D. D., Seah, T. H. S., Ostrowski-Delahanty, S., Palmieri, P. A., Delahanty, D. L., & Gunstad, J. (2021). Boosting positive mood in medical and emergency personnel during the COVID-19 pandemic: Preliminary evidence of efficacy, feasibility and acceptability of a novel online ambulatory intervention. *Occupational and Environmental Medicine*, 78(8), 541-547. <https://doi.org/10.1136/oemed-2021-107427>
- Cordero-Guevara, J. A., Parraza-Díez, N., Vrotsou, K., Machón, M., Orruño, E., Onaindia-Ecenarro, M. J., Millet-Sampedro, M., & Regalado de los Cobos, J. (2022). Factors associated with the workload of health professionals in hospital at home: A systematic review. *BMC Health Services Research*, 22(1). <https://doi.org/10.1186/s12913-022-08100-4>

- Covington, L., Banerjee, M., Pereira, A., & Price, M. (2023). Mindfulness-based interventions for professionals working in end-of-life care: A systematic review of the literature. *Journal of Palliative Care*, 38(2), 225–238. <https://doi.org/10.1177/08258597221100330>
- De Hert, S. (2020). Burnout in healthcare workers: Prevalence, impact and preventative strategies. *Local and Regional Anesthesia*, 2022(13), 171–183. <https://doi.org/10.2147/LRA.S240564>
- de Witte, M., Pinho, A. da S., Stams, G. J., Moonen, X., Bos, A. E. R., & van Hooren, S. (2022). Music therapy for stress reduction: A systematic review and meta-analysis. *Health Psychology Review*, 16(1), 134–159. <https://doi.org/10.1080/17437199.2020.1846580>
- de Oliveira, C., Saka, M., Bone, L., & Jacobs, R. (2023). The role of mental health on workplace productivity: A critical review of the literature. *Applied Health Economics and Health Policy*, 21(2), 167–193. <https://doi.org/10.1007/s40258-022-00761-w>
- Demerouti, E., & Bakker, A. B. (2011). The job demands-resources model: Challenges for future research. *SA Journal of Industrial Psychology*, 37(2), a974. <https://doi.org/10.4102/sajip.v37i2.974>
- D’etorre, G., Pellicani, V., & Ceccarelli, G. (2020). Post-traumatic stress disorder symptoms in healthcare workers: A ten-year systematic review. *Acta Biomedica*, 91(12-S), 1–10. <https://doi.org/10.23750/abm.v91i12-S.9459>
- do Prado, J. M., Kurebayashi, L. F. S., & da Silva, M. J. P. (2018). Experimental and placebo auriculotherapy for stressed nurses: Randomized controlled trial. *Revista Da Escola de Enfermagem*, 52, 1-8. <https://doi.org/10.1590/S1980-220X2017030403334>
- Dyrbye, L. N., West, C. P., Sinsky, C. A., Trockel, M., Tutty, M., Satele, D., Carlasare, L., & Shanafelt, T. (2022). Physicians’ experiences with mistreatment and discrimination by patients, families, and visitors and association with burnout. *JAMA Network Open*, 5(5), E2213080. <https://doi.org/10.1001/jamanetworkopen.2022.13080>
- Eskildsen, A., Fentz, H. N., Andersen, L. P., Pedersen, A. D., Kristensen, S. B., & Andersen, J. H. (2017). Perceived stress, disturbed sleep, and cognitive impairments in patients with work-related stress complaints: A longitudinal study. *Stress*, 20(4), 371–378. <https://doi.org/10.1080/10253890.2017.1341484>
- Etingen, B., Martinez, R. N., Smith, B. M., Hogan, T. P., Miller, L., Saban, K. L., Irvin, D., Jankowski, B., & Weaver, F. M. (2020). Developing an animal-assisted support program for healthcare employees. *BMC Health Services Research*, 20(1). <https://doi.org/10.1186/s12913-020-05586-8>
- Ferri, P., Guadi, M., Marcheselli, L., Balduzzi, S., Magnani, D., & Di Lorenzo, R. (2016). The impact of shift work on the psychological and physical health of nurses in a general hospital: A comparison between rotating night shifts and day shifts. *Risk Management and Healthcare Policy*, 9, 203–211. <https://doi.org/10.2147/RMHP.S115326>

Finney, C., Stergiopoulos, E., Hensel, J., Bonato, S., & Dewa, C. S. (2013). Organizational stressors associated with job stress and burnout in correctional officers: A systematic review. *BMC Public Health*, 13, 82. <https://doi.org/10.1186/1471-2458-13-82>

Fiol-DeRoque, M. A., Serrano-Ripoll, M. J., Jiménez, R., Zamanillo-Campos, R., Yáñez-Juan, A. M., Bennasar-Veny, M., Leiva, A., Gervilla, E., García-Buades, M. E., García-Toro, M., Alonso-Coello, P., Pastor-Moreno, G., Ruiz-Pérez, I., Sitges, C., García-Campayo, J., Llobera-Cánaves, J., & Ricci-Cabello, I. (2021). A mobile phone-based intervention to reduce mental health problems in health care workers during the COVID-19 pandemic (PsyCovidApp): Randomized controlled trial. *JMIR mhealth and UHealth*, 9(5), e27039. <https://doi.org/10.2196/27039>

Frank, C., Davis, C. G., & Elgar, F. J. (2014). Financial strain, social capital, and perceived health during economic recession: A longitudinal survey in rural Canada. *Anxiety, Stress, & Coping*, 27(4), 422–438. <https://doi.org/10.1080/10615806.2013.864389>

Frisone, F., Sicari, F., Settineri, S., & Merlo, E. M. (2021). Clinical psychological assessment of stress: A narrative review of the last 5 years. *Clinical Neuropsychiatry*, 18(2), 91–100. <https://doi.org/10.36131/cnfioritieditore20210203>

Ganster, D. C., & Dwyer, D. J. (1995). The effects of understaffing on individual and group performance in professional and trade occupations. *Journal of Management*, 21(2), 175–190. <https://doi.org/10.1177/014920639502100201>

Ghawadra, S. F., Lim Abdullah, K., Choo, W. Y., Danaee, M., & Phang, C. K. (2020). The effect of mindfulness-based training on stress, anxiety, depression and job satisfaction among ward nurses: A randomized control trial. *Journal of Nursing Management*, 28(5), 1088–1097. <https://doi.org/10.1111/jonm.13049>

Gilbody, S., Bower, P., & Rick, J. (2012). Better care for depression in the workplace: Integrating occupational and mental health services. *British Journal of Psychiatry*, 200(6), 442–443. <https://doi.org/10.1192/bjp.bp.111.103598>

Glazer, S., & Liu, C. (2017). Work, stress, coping, and stress management. In Frank Worrell (Ed). *Oxford Research Encyclopedia of Psychology*. Oxford University Press. <https://doi.org/10.1093/acrefore/9780190236557.013.30>

Golany, B., & Kress, M. (1993). A multicriteria evaluation of methods for obtaining weights from ratio-scale matrices. *European Journal of Operational Research*, 69(2), 210–220. [https://doi.org/10.1016/0377-2217\(93\)90165-J](https://doi.org/10.1016/0377-2217(93)90165-J)

Golden, L. (2012). *The effects of working time on productivity and firm performance: Research synthesis paper*. Conditions of Work and Employment Series No. 33, Geneva: International Labor Office. <https://www.researchgate.net/publication/256035039>

González Ramírez, M. L., García Vázquez, J. P., Rodríguez, M. D., Padilla-López, L. A., Galindo-Aldana, G. M., & Cuevas-González, D. (2023). Wearables for stress management: A scoping review. *Healthcare (Switzerland)*, 11(17), 2369. <https://doi.org/10.3390/healthcare11172369>

Greenhaus, J. H., & Beutell, N. J. (1985). Sources of conflict between work and family roles. *Academy of Management Review*, 10(1), 76–88. <https://doi.org/10.5465/amr.1985.4277352>

Harty, S., Enrique, A., Akkol-Solakoglu, S., Adegoke, A., Farrell, H., Connon, G., Ward, F., Kennedy, C., Chambers, D., & Richards, D. (2023). Implementing digital mental health interventions at scale: One-year evaluation of a national digital CBT service in Ireland. *International Journal of Mental Health Systems*, 17(1). <https://doi.org/10.1186/s13033-023-00592-9>

Hasson, D., & Arnetz, B. B. (2005). Validation and findings comparing VAS vs. Likert scales for psychosocial measurements. *International Electronic Journal of Health Education*, 8, 178–192.

Havermans, B. M., Boot, C. R. L., Brouwers, E. P. M., Houtman, I. L. D., Heerkens, Y. F., Zijlstra-Vlasveld, M. C., Twisk, J. W. R., Anema, J. R., & van der Beek, A. J. (2018). Effectiveness of a digital platform-based implementation strategy to prevent work stress in a healthcare organization: A 12-month follow-up controlled trial. *Scandinavian Journal of Work, Environment, and Health*, 44(6), 613–621. <https://doi.org/10.5271/sjweh.3758>

Heath, C., Sommerfield, A., & von Ungern-Sternberg, B. S. (2020). Resilience strategies to manage psychological distress among healthcare workers during the COVID-19 pandemic: A narrative review. *Anaesthesia*, 75(10), 1364–1371. <https://doi.org/10.1111/anae.15180>

Hertzum, M., & Holmegaard, K. D. (2013). Perceived time as a measure of mental workload: Effects of time constraints and task success. *International Journal of Human-Computer Interaction*, 29(1), 26–39. <https://doi.org/10.1080/10447318.2012.676538>

Ho, W. (2008). Integrated analytic hierarchy process and its applications - A literature review. *European Journal of Operational Research*, 186(1), 211–228. <https://doi.org/10.1016/j.ejor.2007.01.004>

Hoedl, M., Bauer, S., Eglseder, D. (2021). Influence of nursing staff working hours on the stress level during the COVID-19 pandemic: A cross-sectional online survey. *HBScience* 12, 92–98. <https://doi.org/10.1007/s16024-021-00354-y>

Hossain, F., & Clatty, A. (2021). Self-care strategies in response to nurses' moral injury during COVID-19 pandemic. *Nursing Ethics*, 28(1), 23–32. <https://doi.org/10.1177/0969733020961825>

Hudson, C. K., & Shen, W. (2015). Understaffing: An under-researched phenomenon. *Organizational Psychology Review*, 5(3), 244–263. <https://doi.org/10.1177/2041386615576016>

Hwang, W. J., & Jo, H. H. (2019). Evaluation of the effectiveness of mobile app-based stress-management program: A randomized controlled trial. *International Journal of Environmental Research and Public Health*, 16(21), 4270. <https://doi.org/10.3390/ijerph16214270>

Jalagat, R. (2017). Determinants of job stress and its relationship on employee job performance. *American Journal of Management Science and Engineering*, 2(1), 1. <https://doi.org/10.11648/j.ajmse.20170201.11>

Jeung, D. Y., Kim, C., & Chang, S. J. (2018). Emotional labor and burnout: A review of the literature. *Yonsei Medical Journal*, 59(2), 187–193. <https://doi.org/10.3349/ymj.2018.59.2.187>

Jin, M. J., Kim, J. S., Lee, H. S., Kwon, Y. J., Shim, S. H., Choi, B. S., Lee, D. W., Paik, J. W., Lee, B. C., Jung, S. W., & Lee, H. Y. (2020a). The impact of emotional exhaustion on psychological factors in workers with secondary traumatic experiences: A multi-group path analysis. *Psychiatry Investigation*, 17(11), 1064–1072. <https://doi.org/10.30773/pi.2019.0313>

Jin, M. J., Kim, J. S., Lee, H. S., Kwon, Y. J., Shim, S. H., Choi, B. S., Lee, D. W., Paik, J. W., Lee, B. C., Jung, S. W., & Lee, H. Y. (2020b). The impact of emotional exhaustion on psychological factors in workers with secondary traumatic experiences: A multi-group path analysis. *Psychiatry Investigation*, 17(11), 1064–1072. <https://doi.org/10.30773/pi.2019.0313>

Johnston, D., Bell, C., Jones, M., Farquharson, B., Allan, J., Schofield, P., Ricketts, I., & Johnston, M. (2016). Stressors, appraisal of stressors, experienced stress, and cardiac response: A real-time, real-life investigation of work stress in nurses. *Annals of Behavioral Medicine*, 50(2), 187–197. <https://doi.org/10.1007/s12160-015-9746-8>

Joseph, B., & Joseph, M. (2016). The health of the healthcare workers. *Indian Journal of Occupational and Environmental Medicine*, 20(2), 71–72. <https://doi.org/10.4103/0019-5278.197518>

Kao, P. C. (2024). Exploring the roles of academic expectation stress, adaptive coping, and academic resilience on perceived English proficiency. *BMC Psychology*, 12(1). <https://doi.org/10.1186/s40359-024-01630-y>

Kim, B., Liu, L., Ishikawa, H., & Park, S. H. (2019). Relationships between social support, job autonomy, job satisfaction, and burnout among care workers in long-term care facilities in Hawaii. *Educational Gerontology*, 45(1), 57–68. <https://doi.org/10.1080/03601277.2019.1580938>

Kim, J., & Jung, H. S. (2022). The effect of employee competency and organizational culture on employees' perceived stress for better workplace. *International Journal of Environmental Research and Public Health*, 19(8). <https://doi.org/10.3390/ijerph19084428>

Kriakous, S. A., Elliott, K. A., Lamers, C., & Owen, R. (2020). The effectiveness of mindfulness-based stress reduction on the psychological functioning of healthcare professionals: A systematic review. *Mindfulness*, 12, 1-28 <https://doi.org/10.1007/s12671-020-01500-9/Published>

Lakey, B., & Cohen, S. (2015). Social support theory and measurement. In S. Cohen, L. G. Underwood, & B. H. Gottlieb (Eds.), *Social support measurement and intervention* (pp. 29–52). Oxford University Press. <https://doi.org/10.1093/med:psych/9780195126709.003.0002>

- Landrum, B., Knight, D. K., & Flynn, P. M. (2012). The impact of organizational stress and burnout on client engagement. *Journal of Substance Abuse Treatment*, 42(2), 222–230. <https://doi.org/10.1016/j.jsat.2011.10.011>
- Lin, R. T., Lin, Y. T., Hsia, Y. F., & Kuo, C. C. (2021). Long working hours and burnout in health care workers: Non-linear dose-response relationship and the effect mediated by sleeping hours—A cross-sectional study. *Journal of Occupational Health*, 63(1). <https://doi.org/10.1002/1348-9585.12228>
- Liswandi, & Muhammad, R. (2023). The association between work-life balance and employee mental health: A systemic review. *Asia Pacific Journal of Health Management*, 18(3). <https://doi.org/10.24083/apjhm.v18i3.2565>
- Lomas, T., Medina, J. C., Ivtzan, I., Rupprecht, S., & Eiroa-Orosa, F. J. (2019). A systematic review and meta-analysis of the impact of mindfulness-based interventions on the well-being of healthcare professionals. *Mindfulness*, 10(7), 1193–1216. <https://doi.org/10.1007/s12671-018-1062-5>
- Lu, L., Liu, G., Xu, Y., Jiang, J., & Wei, Z. (2024). A systematic review of studies on stress during the COVID-19 pandemic by visualizing their structure through COOC, VOS viewer, and Cite Space software. *Frontiers in Psychiatry*, 15. <https://doi.org/10.3389/fpsy.2024.1297112>
- Manchia, M., Gathier, A. W., Yapici-Eser, H., Schmidt, M. V., de Quervain, D., van Amelsvoort, T., Bisson, J. I., Cryan, J. F., Howes, O. D., Pinto, L., van der Wee, N. J., Domschke, K., Branchi, I., & Vinkers, C. H. (2022). The impact of the prolonged COVID-19 pandemic on stress resilience and mental health: A critical review across waves. *European Neuropsychopharmacology*, 55, 22–83. <https://doi.org/10.1016/j.euroneuro.2021.10.864>
- Mandal, S., Misra, P., Sharma, G., Sagar, R., Kant, S., Dwivedi, S. N., Lakshmy, R., & Goswami, K. (2021). Effect of structured yoga program on stress and professional quality of life among nursing staff in a tertiary care hospital of Delhi—A small scale phase-II trial. *Journal of Evidence-Based Integrative Medicine*, 26. <https://doi.org/10.1177/2515690X21991998>
- Maran, D. A., Capitanelli, I., Cortese, C. G., Ilesanmi, O. S., Gianino, M. M., & Chirico, F. (2022). Animal-assisted intervention and health care workers' psychological health: A systematic review of the literature. *Animals*, 12(3). <https://doi.org/10.3390/ani12030383>
- Mariotti, A. (2015). The effects of chronic stress on health: New insights into the molecular mechanisms of brain-body communication. *Future Science OA*, 1(3). <https://doi.org/10.4155/fso.15.21>
- Maslach, C. (2014). Burned-out. *Human Relations*, 9(5), 16-20. <https://www.researchgate.net/publication/263847499>
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology*, 52, 397–422. <https://doi.org/10.1146/annurev.psych.52.1.397>

Massoud, M. F., Younis, J., & Abbas Ibrahim, P. N. (2020). Managing stress through work-life balance: A study on Jinan Lebanon University staff. *Research in Economics and Management*, 5(4), 1. <https://doi.org/10.22158/rem.v5n4p1>

Mathad, M. D., Pradhan, B., & Sasidharan, R. K. (2017). Effect of yoga on the psychological functioning of nursing students: A randomized wait-list control trial. *Journal of Clinical and Diagnostic Research*, 11(5), KC01–KC05. <https://doi.org/10.7860/JCDR/2017/26517.9833>

Mediavilla, R., McGreevy, K. R., Felez-Nobrega, M., Monistrol-Mula, A., Bravo-Ortiz, M. F., Bayón, C., Rodríguez-Vega, B., Nicaise, P., Delaire, A., Sijbrandij, M., Witteveen, A. B., Purgato, M., Barbui, C., Tedeschi, F., Melchior, M., van der Waerden, J., McDaid, D., Park, A. La, Kalisch, R., ... Ayuso-Mateos, J. L. (2022). Effectiveness of a stepped-care program of internet-based psychological interventions for healthcare workers with psychological distress: Study protocol for the RESPOND healthcare workers randomized controlled trial. *Digital Health*, 8. <https://doi.org/10.1177/20552076221129084>

Melnyk, B. M., Kelly, S. A., Stephens, J., Dhakal, K., McGovern, C., Tucker, S., Hoying, J., McRae, K., Ault, S., Spurlock, E., & Bird, S. B. (2020). Interventions to Improve Mental Health, Well-Being, Physical Health, and Lifestyle Behaviors in Physicians and Nurses: A Systematic Review. *American Journal of Health Promotion*, 34(8), 929–941. <https://doi.org/10.1177/0890117120920451>

Michael, G. C., Bala, A. A., & Mohammed, M. (2022). Snakebite knowledge assessment and training of healthcare professionals in Asia, Africa, and the Middle East: A review. *Toxicon: X*, 16, 100142. <https://doi.org/10.1016/j.toxcx.2022.100142>

Mistretta, E. G., Davis, M. C., Temkit, M., Lorenz, C., Darby, B., & Stonnington, C. M. (2018). Resilience training for work-related stress among health care workers. *Journal of Occupational and Environmental Medicine*, 60(6), 559–568. <https://doi.org/10.1097/JOM.0000000000001285>

Mittal, S., Mahendra, S., Sanap, V., & Churi, P. (2022). How can machine learning be used in stress management: A systematic literature review of applications in workplaces and education. *International Journal of Information Management Data Insights*, 2(2). <https://doi.org/10.1016/j.jjime.2022.100110>

Miyoshi, Y. (2019). Restorative yoga for occupational stress among Japanese female nurses working night shift: Randomized crossover trial. *Journal of Occupational Health*, 61(6), 508–516. <https://doi.org/10.1002/1348-9585.12080>

Mohammad, A. (2014). Factors affecting medical service quality. *Iranian Journal of Public Health*, 43(2), 210-220. <http://ijph.tums.ac.ir>

Montero-Marín, J. (2016). El síndrome de burnout y sus diferentes manifestaciones clínicas: Una propuesta para la intervención. *Anestesia Analgesia Reanimación*, 29(1), 1-16.

Montero-Marín, J., Gaete, J., Araya, R., Demarzo, M., Manzanera, R., Álvarez de Mon, M., & García-Campayo, J. (2018). Impact of a blended web-based mindfulness programme for general practitioners: A pilot study. *Mindfulness*, 9(1), 129–139. <https://doi.org/10.1007/s12671-017-0752-8>

Montibeler, J., Domingos, T. da S., Braga, E. M., Gnatta, J. R., Kurebayashi, L. F. S., & Kurebayashi, A. K. (2018). Effectiveness of aromatherapy massage on the stress of the surgical center nursing team: A pilot study. *Revista Da Escola de Enfermagem*, 52. <https://doi.org/10.1590/S1980-220X2017038303348>

Muriithi, J. W., & Kariuki, P. W., Wango, G.M. (2020). The relationship between coping strategies and burnout among nurses at Pumwani maternity hospital *Asian Journal of Research in Nursing and Health*, 3(1), 179–191.

Muyambi, K., Dennis, S., Parange, N., Walsh, S. M., Gray, R., Martinez, L., Gunn, K., Kenyon, K., & Jones, M. (2022). Rural health workers' perspectives and experience with an online educational program in behavioural activation: A thematic analysis. *Health and Social Care in the Community*, 30(6), e5539–e5548. <https://doi.org/10.1111/hsc.13978>

Nandamuri, P. P., & Gowthami, C. H. (2011). Sources of academic stress: A study on management students. *Journal of Management and Science*, 1(2), 95–106. <https://doi.org/10.26524/jms.2011.12>

Nazari, F., Mirzamohamadi, M., & Yousefi, H. (2015). The effect of massage therapy on occupational stress of Intensive Care Unit nurses. *Iranian Journal of Nursing and Midwifery Research*, 20(4), 508–515. <https://doi.org/10.4103/1735-9066.161001>

O'Donovan, J., Bersin, A., & O'Donovan, C. (2015). The effectiveness of mobile health (mHealth) technologies to train healthcare professionals in developing countries: A review of the literature. *BMJ Innovations*, 1(1), 33–36. <https://doi.org/10.1136/bmjinnov-2014-000013>

Pallavicini, F., Orena, E., di Santo, S., Greci, L., Caragnano, C., Ranieri, P., Vuolato, C., Pepe, A., Veronese, G., Stefanini, S., Achille, F., Dakanalis, A., Bernardelli, L., Sforza, F., Rossini, A., Caltagirone, C., Fascendini, S., Clerici, M., Riva, G., & Mantovani, F. (2022). A virtual reality home-based training for the management of stress and anxiety among healthcare workers during the COVID-19 pandemic: Study protocol for a randomized controlled trial. *Trials*, 23(1). <https://doi.org/10.1186/s13063-022-06337-2>

Panari, C., Caricati, L., Pelosi, A., & Rossi, C. (2019). Emotional exhaustion among healthcare professionals: The effects of role ambiguity, work engagement, and professional commitment. *Acta Biomedica*, 90, 60–67. <https://doi.org/10.23750/abm.v90i6-S.8481>

Park, J. H., Jung, S. E., Ha, D. J., Lee, B., Kim, M. S., Sim, K. L., Choi, Y. H., & Kwon, C. Y. (2022). The effectiveness of e-healthcare interventions for the mental health of nurses: A PRISMA-compliant systematic review of randomized controlled trials. *Medicine (United States)*, 101(25), E29125. <https://doi.org/10.1097/MD.00000000000029125>

Patel, R. S., Bachu, R., Adikey, A., Malik, M., & Shah, M. (2018). Factors related to physician burnout and its consequences: A review. *Behavioral Sciences*, 8(11), 98. <https://doi.org/10.3390/bs8110098>

- Pettus, M., Netter, B., Perlmutter, L., Perlmutter, J. C., & Hosler, A. S. (2023). The effects of mantra-based AMI Meditation on burnout, secondary traumatic stress, and compassion satisfaction levels in healthcare providers. *Lifestyle Medicine*, 4(1). <https://doi.org/10.1002/lim2.72>
- Phillips, C. S., & Becker, H. (2019). Systematic review: Expressive arts interventions to address psychosocial stress in healthcare workers. *Journal of Advanced Nursing*, 75(11), 2285–2298. <https://doi.org/10.1111/jan.14043>
- Pindek, S., & Spector, P. E. (2016). Organizational constraints: A meta-analysis of a major stressor. *Work and Stress*, 30(1), 7–25. <https://doi.org/10.1080/02678373.2015.1137376>
- Portoghese, I., Galletta, M., Coppola, R. C., Finco, G., & Campagna, M. (2014). Burnout and workload among health care workers: The moderating role of job control. *Safety and Health at Work*, 5(3), 152–157. <https://doi.org/10.1016/j.shaw.2014.05.004>
- Pospos, S., Young, I. T., Downs, N., Iglewicz, A., Depp, C., Chen, J. Y., Newton, I., Lee, K., Light, G. A., & Zisook, S. (2018). Web-based tools and mobile applications to mitigate burnout, depression, and suicidality among healthcare students and professionals: A systematic review. *Academic Psychiatry*, 42(1), 109–120. <https://doi.org/10.1007/s40596-017-0868-0>
- Oketunbi O.A., & Olumide, P. (2019). Job stress and job performance among academic staff in public universities in Ogun State. *A Journal of Studies in Education*, 18(1), 35–49.
- Prentice, C., Dominique-Ferreira, S., Wang, X., Tuominen, J., Duarte, M., & Rocha, H. (2024). Work-life imbalance, burning out, feeling down, I will quit, but quietly—The case of hospitality employees. *Journal of Hospitality Marketing and Management*, 34(1), 24–45. <https://doi.org/10.1080/19368623.2024.2389074>
- Prudenzi, A., Graham, C. D., Flaxman, P. E., Wilding, S., Day, F., & O'Connor, D. B. (2022). A workplace Acceptance and Commitment Therapy (ACT) intervention for improving healthcare staff psychological distress: A randomized controlled trial. *PLoS ONE*, 17(4 April), 1–22. <https://doi.org/10.1371/journal.pone.0266357>
- Puente-Fernández, D., Lozano-Romero, M. M., Montoya-Juárez, R., Martí-García, C., Campos-Calderón, C., & Hueso-Montoro, C. (2020). Nursing professionals' attitudes, strategies, and care practices towards death: A systematic review of qualitative studies. *Journal of Nursing Scholarship*, 52(3), 301–310. <https://doi.org/10.1111/jnu.12550>
- PVS, H. (2018). Work-related stress: A literature review. *Annals of Social Sciences & Management Studies*, 2(3), 555586. <https://doi.org/10.19080/asm.2018.02.555586>
- Quick, J. C., Quick, J. D., Nelson, D. L., & Hurrell, J. J. (2004). *Preventive stress management in organizations*. American Psychological Association. <https://doi.org/10.1037/10238-000>

Ranjbar, N., Erb, M., Tomkins, J., Taneja, K., & Villagomez, A. (2022). Implementing a mind-body skills group in psychiatric residency training. *Academic Psychiatry*, 46(4), 460–465. <https://doi.org/10.1007/s40596-021-01507-x>

Reith, T. P. (2018). Burnout in United States healthcare professionals: A narrative review. *Cureus* 10(12), e3681. <https://doi.org/10.7759/cureus.3681>

Riches, S., Taylor, L., Jeyarajaguru, P., Veling, W., & Valmaggia, L. (2023). Virtual reality and immersive technologies to promote workplace wellbeing: A systematic review. *Journal of Mental Health*, 33(2). <https://doi.org/10.1080/09638237.2023.2182428>

Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., Barengo, N. C., Beaton, A., Benjamin, E. J., Benziger, C. P., Bonny, A., Brauer, M., Brodmann, M., Cahill, T. J., Carapetis, J. R., Catapano, A. L., Chugh, S., Cooper, L. T., Coresh, J., ... Fuster, V. (2020). Global burden of cardiovascular diseases and risk factors, 1990–2019: Update from the GBD 2019 study. *Journal of the American College of Cardiology*, 76(25), 2982–3021. <https://doi.org/10.1016/j.jacc.2020.11.010>

Saaty, T. L. (1977). A scaling method for priorities in hierarchical structures. *Journal of Mathematical Psychology*, 15(3), 234–281. [https://doi.org/10.1016/0022-2496\(77\)90033-5](https://doi.org/10.1016/0022-2496(77)90033-5)

Saaty, T. L. (1990). Eigenvector and logarithmic least squares. *European Journal of Operational Research*, 48(1), 156–160. [https://doi.org/10.1016/0377-2217\(90\)90073-K](https://doi.org/10.1016/0377-2217(90)90073-K)

Saaty, T. L. (2003). *Decision-aiding decision-making with the AHP: Why is the principal eigenvector necessary*. *European Journal of Operational Research*, 145(1), 85–91. [https://doi.org/10.1016/S0377-2217\(02\)00227-8](https://doi.org/10.1016/S0377-2217(02)00227-8)

Saaty, T. L. (2008). Decision-making with the analytic hierarchy process. *International Journal of Services Sciences*, 1(1), 83–98. <https://doi.org/10.1504/IJSSci.2008.01759>

Saaty, T. L., & Hu, G. (1998). Ranking by eigenvector versus other methods in the Analytic Hierarchy Process. *Applied Mathematics Letters*, 11(4), 121–125. [https://doi.org/10.1016/S0893-9659\(98\)00068-8](https://doi.org/10.1016/S0893-9659(98)00068-8)

Sani, M. M., Jafaru, Y., Ashipala, D. O., & Sahabi, A. K. (2024). Influence of work-related stress on patient safety culture among nurses in a tertiary hospital: A cross-sectional study. *BMC Nursing*, 23(1). <https://doi.org/10.1186/s12912-023-01695-x>

United Nations Statistics Division. (2022). *SDG indicators*. Retrieved January 30, 2025 from <https://unstats.un.org/sdgs/report/2022/Goal-03/>

Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. *Journal of Organizational Behavior*, 25(3), 293–315. <https://doi.org/10.1002/job.248>

Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology, 1*, 607–628. <https://doi.org/10.1146/annurev.clinpsy.1.102803.144141>

Semmer, N. K. (2006). Job stress interventions and the organization of work. *Scandinavian Journal of Work, Environment & Health, 32*(6), 515–527. <https://doi.org/10.5271/sjweh.1056>

Singh, P., Bhardwaj, P., Sharma, S. K., & Mishra, V. (2022). Effect of organizational factors on psychological stress and job satisfaction. *Vision, 0*(0). <https://doi.org/10.1177/09722629221106265>

Smoktunowicz, E., Lesnierowska, M., Carlbring, P., Andersson, G., & Cieslak, R. (2021). Resource-based internet intervention (med-stress) to improve well-being among medical professionals: Randomized controlled trial. *Journal of Medical Internet Research, 23*(1). <https://doi.org/10.2196/21445>

Snyder, J. D., Boan, D., Aten, J. D., Davis, E. B., Van Grinsven, L., Liu, T., & Worthington, E. L. (2020). Resource loss and stress outcomes in a setting of chronic conflict: The conservation of resources theory in the Eastern Congo. *Journal of Traumatic Stress, 33*(3), 227–237. <https://doi.org/10.1002/jts.22448>

Sohail, M., & Abdul Rehman, C. (2015). Stress and health at the workplace: A review of the literature. *Journal of Business Studies Quarterly, 6*(3). <https://www.researchgate.net/publication/342130907>

Sonnentag, S., & Frese, M. (2012). Stress in organizations. In *Handbook of Psychology* (2nd ed.). Wiley. <https://doi.org/10.1002/9781118133880.hop212021>
Spoorthy, M. S. (2020). Mental health problems faced by healthcare workers due to the COVID-19 pandemic—A review. *Asian Journal of Psychiatry, 51*, 102119. <https://doi.org/10.1016/j.ajp.2020.102119>

Stevens, N. R., Ziadni, M. S., Lillis, T. A., Gerhart, J., Baker, C., & Hobfoll, S. E. (2019). Perceived lack of training moderates the relationship between healthcare providers' personality and sense of efficacy in trauma-informed care. *Anxiety, Stress & Coping, 32*(6), 679–693. <https://doi.org/10.1080/10615806.2019.1645835>

Strauss, C., Gu, J., Pitman, N., Chapman, C., Kuyken, W., & Whittington, A. (2018). Evaluation of mindfulness-based cognitive therapy for life and a cognitive behavioral therapy stress-management workshop to improve healthcare staff stress: Study protocol for two randomized controlled trials. *Trials, 19*(1). <https://doi.org/10.1186/s13063-018-2547-1>

Suleman, Q., Hussain, I., Shehzad, S., Syed, M. A., & Raja, S. A. (2018). Relationship between perceived occupational stress and psychological well-being among secondary school heads in Khyber Pakhtunkhwa, Pakistan. *PLoS ONE, 13*(12). <https://doi.org/10.1371/journal.pone.0208143>

Szabo, S., Tache, Y., & Somogyi, A. (2012). The legacy of Hans Selye and the origins of stress research: A retrospective 75 years after his landmark brief “letter” to the Editor of Nature. *Stress, 15*(5), 472–478. <https://doi.org/10.3109/10253890.2012.710919>

Tamminga, S. J., Emal, L. M., Boschman, J. S., Levasseur, A., Thota, A., Ruotsalainen, J. H., Schelvis, R. M. C., Nieuwenhuijsen, K., & van der Molen, H. F. (2023). Individual-level interventions for reducing occupational stress in healthcare workers. *Cochrane Database of Systematic Reviews*, 2023(5). <https://doi.org/10.1002/14651858.CD002892.pub6>

Taslicali, A. K., & Ercan, S. (2006). The Analytic Hierarchy and The Analytic Network Processes in Multicriteria Decision Making: A comparative study. [Master's Thesis, Old Dominion University].

Taylor, H., Cavanagh, K., Field, A. P., & Strauss, C. (2022). Health care workers' need for headspace: Findings from a multisite definitive randomized controlled trial of an unguided digital mindfulness-based self-help app to reduce healthcare worker stress. *JMIR mHealth and uHealth*, 10(8). <https://doi.org/10.2196/31744>

Tetrick, L. E., & Winslow, C. J. (2015). Workplace stress management interventions and health promotion. *Annual Review of Organizational Psychology and Organizational Behavior*, 2, 583–603. <https://doi.org/10.1146/annurev-orgpsych-032414-111341>

Tiwary, A., Rimal, A., Paudyal, B., Sigdel, K. R., & Basnyat, B. (2019). Poor communication by health care professionals may lead to life-threatening complications: Examples from two case reports. *Wellcome Open Research*, 4(7). <https://doi.org/10.12688/wellcomeopenres.15042.1>

Torrence, B., Barrett, J., Bryant, M., Pierce, L., & Buck, J. (2020). *Evaluation and validation of a stress management training course for air traffic control trainees: Final report*. Federal Aviation Administration. <http://www.faa.gov/go/oamtechreports>

Vance, M. C., Mash, H. B. H., Ursano, R. J., Zhao, Z., Miller, J. T., Clarion, M. J. D., West, J. C., Morganstein, J. C., Iqbal, A., & Sen, S. (2021). Exposure to workplace trauma and posttraumatic stress disorder among intern physicians. *JAMA Network Open*, 4(6), e2112837. <https://doi.org/10.1001/jamanetworkopen.2021.12837>

Vila, J. (2021). Social support and longevity: Meta-analysis-based evidence and psychobiological mechanisms. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.717164>

Vinodh, S., Shivraman, K. R., & Viswesh, S. (2011). AHP-based lean concept selection in a manufacturing organization. *Journal of Manufacturing Technology Management*, 23(1), 124–136. <https://doi.org/10.1108/17410381211196320>

Wechsler, J. G., & Leopold, K. (1996). A simulation-based evaluation of the approximate and the exact eigenvector methods employed in AHP. *European Journal of Operational Research*, 95(3), 656–662. <https://doi.org/10.1007/s00423-003-0377-3>

West, C. P., Dyrbye, L. N., Rabatin, J. T., Call, T. G., Davidson, J. H., Multari, A., Romanski, S. A., Henriksen Hellyer, J. M., Sloan, J. A., & Shanafelt, T. D. (2014). Intervention to promote physician well-being, job satisfaction, and professionalism a randomized clinical trial. *JAMA Internal Medicine*, 174(4), 527–533. <https://doi.org/10.1001/jamainternmed.2013.14387>

Witkoski Stimpfel, A., Goldsamt, L., Liang, E., & Costa, D. K. (2022). Work organization factors associated with nurses' stress, sleep, and performance: A pre-pandemic analysis. *Journal of Nursing Regulation*, 13(3), 4–12. www.journalofnursingregulation.com

Wu, H., Qiu, S., Dooley, L. M., & Ma, C. (2020). The relationship between challenge and hindrance stressors and emotional exhaustion: The moderating role of perceived servant leadership. *International Journal of Environmental Research and Public Health*, 17(1). <https://doi.org/10.3390/ijerph17010282>

W.J., N., Sekar, L., Manikandan, A., K, M. K., T, G., Shriram, V., Silambanan, S., & R, P. (2021). Mahamantra chanting as an effective intervention for stress reduction among nursing professionals—A randomized controlled study. *Advances in Integrative Medicine*, 8(1), 27–32. <https://doi.org/10.1016/j.aimed.2020.05.007>

Yang, C., Chen, A., & Chen, Y. (2021). College students' stress and health in the COVID-19 pandemic: The role of academic workload, separation from school, and fears of contagion. *PLOS ONE*, 16(2), e0246676. <https://doi.org/10.1371/journal.pone.0246676>

Yaribeygi, H., Panahi, Y., Sahraei, H., Johnston, T. P., & Sahebkar, A. (2017). The impact of stress on body function: A review. *EXCLI Journal*, 16, 1057–1072. <https://doi.org/10.17179/excli2017-480>

Yorita, A., Egerton, S., Chan, C., & Kubota, N. (2023). Chatbots and robots: a framework for the self-management of occupational stress. *ROBOMECH Journal*, 10(1). <https://doi.org/10.1186/s40648-023-00261-z>

Zabin, L. M., Zaitoun, R. S. A., Sweity, E. M., & de Tantillo, L. (2023). The relationship between job stress and patient safety culture among nurses: A systematic review. *BMC Nursing*, 22(1). <https://doi.org/10.1186/s12912-023-01198-9>

Zahedi, F. (1986). A simulation study of estimation methods in the analytic hierarchy process. *Socio-Economic Planning Sciences*, 20(6), 347–354. [https://doi.org/10.1016/0038-0121\(86\)90046-7](https://doi.org/10.1016/0038-0121(86)90046-7)

Zakay, D., & Wooler, S. (1984). Time pressure, training, and decision effectiveness. *Ergonomics*, 27(3), 273–284. <https://doi.org/10.1080/00140138408963489>

Zhang, M., Murphy, B., Cabanilla, A., & Yidi, C. (2021). Physical relaxation for occupational stress in healthcare workers: A systematic review and network meta-analysis of randomized controlled trials. *Journal of Occupational Health*, 63(1). <https://doi.org/10.1002/1348-9585.12243>