



NURSING

The influencing factors of nurses' well-being in critical care during pandemic era: a systematic review protocol

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Keywords

Intensive care nurses • Well-being • Systematic review protocol • Nursing

Summary

Purpose. To review, identify and disclose predictive and hindering factors of critical care nurse well-being in the COVID-19 era.

Design. Systematic review protocol based on the Joanna Briggs Institute (JBI) guidelines.

Review Methods. All quantitative primary studies focused on factors influencing the well-being of critical care nurses and the relationships among these factors will be included. Based on the review question, six databases will be searched: MEDLINE, The Cochrane Library, SCOPUS, CINAHL, Web of Science, PsycINFO. Time limits will be set according to the COVID-19 pandemic era. To establish the quality of studies JBI tools will be used. Where possible, data will be summarised quantitatively through meta-analysis.

Expected Results. We anticipate that this systematic review will provide an overview of the factors that impacted the professional well-being of critical care nurses during the pandemic period from COVID-19.

Conclusions. This study will be the first to reveal factors that impact intensive care nurses' well-being during the COVID-19 pandemic era. Furthermore, it will provide updated and valid evidence of which factors should be considered predictive of intensive care nurses' well-being and which hinder it.

Implication for the profession. Enhancing the professional well-being of nurses is crucial in addressing the growing trend of their intention to leave the profession. Understanding the factors that positively or negatively impact the well-being of critical care nurses during the pandemic is key to developing effective retention strategies within the nursing field. The results of the review will support managers and leaders in direct health policies toward the implementation of interventions to promote the well-being of healthcare workers and to contrast the intention to leave.

Introduction

Critical care nurses are regularly exposed to high levels of stress, as they manage emotionally challenging situations involving critically ill patients and their families [1-3].

The nature of their work often demands rapid and effective responses in complex and uncertain scenarios, making them vulnerable to psychological challenges such as burnout, compassion fatigue, moral distress, and anxiety, all of which significantly affect their quality of life [4-7]. Ensuring the well-being of critical care nurses is therefore essential to sustain high-quality healthcare delivery and safeguard their professional longevity.

Research has predominantly focused on the negative psychological effects experienced by healthcare workers, particularly in emergency and intensive care settings [8]. However, recent shifts influenced by positive psychology emphasize the importance of balancing this focus on distress with efforts to foster resilience, empowerment, and mindfulness [9-11].

These concepts underline the importance of supporting well-being as "the balance between an individual's resources and the challenges they face," highlighting the potential of workplace wellness initiatives [12]. The well-being of nurses is closely tied to the quality

of their work environment. Studies demonstrate that poor working conditions are associated with job dissatisfaction, burnout, and an increased intention to leave the profession [13-15].

Positive workplace factors, such as empowerment, supportive relationships, and effective communication, have been linked to improved performance, patient satisfaction, and reduced turnover intentions [16]. Additionally, practices such as mindfulness and spirituality have been identified as beneficial tools to enhance well-being and foster resilience in critical care settings [17-20].

The COVID-19 pandemic has further underscored the critical importance of addressing nurse well-being. Intensive care nurses faced unprecedented challenges, including increased workloads, shortages of personal protective equipment (PPE), and prolonged exposure to traumatic events, such as high patient mortality rates [21, 22].

The pandemic intensified pre-existing issues, such as staff shortages and burnout, and introduced new stressors, including isolation from family, fear of infection, and moral distress due to suboptimal care or inequitable resource distribution [23-26].

The psychological toll of the pandemic on nurses has been profound, with increased rates of anxiety,

depression, post-traumatic stress, and other psychological comorbidities being widely reported [27]. Addressing these challenges requires early assessment and targeted interventions to meet the psychological needs of healthcare workers. Failing to do so could not only compromise nurses' health and immunity but also negatively impact the safety and quality of healthcare delivery [28].

The global financial crisis of 2008 led to widespread cuts in healthcare spending [29], resulting in nursing shortages and unfavorable working conditions, which placed significant pressure on nurses and negatively impacted patient care, with higher mortality and readmission rates, complications, longer hospital stays, and dissatisfaction among patients [30, 31].

The SARS-CoV-2 pandemic intensified these challenges, creating new working and living conditions for healthcare professionals. Nurses faced unprecedented psychological burdens from factors such as PPE use, departmental reallocation, increased workloads, and high patient mortality rates [32]. Anxiety and fear among healthcare workers, particularly nurses in COVID-19 units, were heightened by isolation from family and difficult working conditions [33, 34].

ICU nurses, in particular, experienced profound psychological impacts, dealing with increased workloads, long hours, insufficient resources, fear of infection, and moral distress from end-of-life decisions and suboptimal care [35, 36]. These stressors exacerbated existing issues like burnout, depression, and post-traumatic stress, with the pandemic worsening workforce shortages in specialized settings such as intensive care [37, 38].

Unaddressed psychological challenges can lead to a decline in nurses' immunity, increasing their susceptibility to infection and compromising healthcare quality and safety [39]. Moral distress during the pandemic arose from situations such as inadequate nursing care [40], patients dying alone [41], unsafe behaviors by colleagues [42], and poor team collaboration [40-43]. Resource shortages, inequities in resource distribution, and staff deficits further compounded these issues [41, 42].

In emergency and out-of-hospital settings, where rapid clinical decision-making is critical, nurses' emotional well-being is particularly vital [44, 45]. Recognizing the critical role of nurse well-being in maintaining a resilient healthcare workforce, this systematic review aims to identify the factors that predict and hinder the well-being of critical care nurses during the COVID-19 pandemic. The findings will provide actionable insights to inform strategies for fostering a supportive work environment, mitigating psychological distress, and ultimately enhancing nurse retention and healthcare outcomes.

Occupational well-being, therefore, has emerged as a critical focus area for developing effective strategies to address these challenges. It is also a key political strategy to combat the growing intention to leave the profession and to support recruitment and retention efforts.

REVIEW AIM

To identify predictive and hindering factors of critical care nurse well-being in the COVID-19 era.

REVIEW QUESTIONS

Based on the purpose of the study, this literature review will try to answer the following research questions:

- What are the predictors of critical care nurse well-being in the COVID-19 era?
- Which factors hinder the well-being of the critical care nurse in the COVID-19 era?

Methods and analysis

STUDY DESIGN

A systematic review of the literature on factors influencing the well-being of the critical care nurse in the COVID-19 era will be conducted, based on a protocol drawn up according to the recommendations of the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis [46, 48], which was registered on the International Prospective Register of Systematic Reviews (PROSPERO).

This protocol was developed in April 2023. We started data analysis in May 2023 and completed the review at the end of November 2023. In the review, the transparency of the selection process of the studies will be based on the GRADE approach for the reporting of the strength of evidence, including the summary table [48]. The GRADE approach will be applied in this review to assess the certainty of evidence across five domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Each outcome will be graded into one of four levels of certainty (high, moderate, low, very low). A Summary of Findings (SoF) table will be generated, summarizing the number of studies, effect estimates, and the certainty of evidence for each outcome, along with justifications for any downgrading or upgrading decisions. This process will guide the narrative synthesis and inform conclusions by emphasizing high-certainty evidence and identifying areas for future research.

To build the research question for this systematic review, we will use the PEOT (Population, Exposure, Outcome, and Type of studies) format was used to identify the significant components of the review's question [49]. Subsequently, we used the Preferred Reporting Items for Systematic Review and Meta-analyses (PRISMA) guidelines to comprehensively display the identified records' selection process and report the findings [47].

INCLUSION CRITERIA

All quantitative primary studies that examine factors influencing the well-being of critical care nurses, as well as the relationships between these factors, will be considered eligible based on their abstracts.

POPULATION

The review will include all studies involving critical

care nurses employed in critical care settings during the COVID pandemic.

Studies that compare critical care nurses with nurses employed in other clinical settings, or other healthcare workers, will be included if they present data separately.

EXPOSURE

To conduct this review, studies that addressed factors that influence in professional well-being of the critical care nurse were included. The findings from these studies were categorized into favoring factors and hindering factors.

OUTCOMES

All the studies included argue the professional well-being of critical care nurses during the pandemic covid highlighting what factors are protective and what factors hinder.

TIMING

Only studies conducted during the pandemic period, defined from 2020 to 2023, were included.

TYPE OF STUDIES

Our pursuit of a comprehensive systematic review necessitates the inclusion of specific types of studies that meet the following criteria.

The study must be a quantitative primary study, and its abstract should focus on factors influencing the well-being of critical care nurses and the relationships among these factors. Additionally, for inclusion in the review, manuscripts must be primary observational or experimental studies, being published in either English or Italian, being conducted in the critical care setting during the COVID-19 era and providing descriptions of factors that either promote or hinder the well-being of nurses.

Conversely, studies conducted in the pediatric critical care area, editorials, case reports and dissertations, or qualitative studies are to be excluded. Therefore, mixed methods studies are to be included utilizing exclusively quantitative data. However, only primary studies will be included in the review.

THEORETICAL FRAMEWORK

This study adopts the “Three Levels Systems Model of Clinician Burnout and Professional Well-being”, proposed in 2019 by the Committee on Systems Approaches to Improve Patient Care by Supporting Clinician Well-Being [27]. This framework integrates principles from human factors, systems engineering, occupational safety, and work design to conceptualize professional well-being and burnout as systemic issues. It identifies key work demands and resources affecting healthcare professionals across three interconnected levels: frontline care delivery, healthcare organization, and the external environment [56-59].

Burnout, defined as a syndrome of emotional exhaustion, depersonalization, and reduced personal

accomplishment, arises from workplace stress and affects professional behavior and attitudes [51-54]. The framework views burnout as a systemic, work-related issue rather than an individual mental health diagnosis, emphasizing risk reduction and well-being promotion through organizational and systemic changes [55].

PRINCIPAL VARIABLES DEFINITIONS

For this literature review, the following definitions will be used for the main variables:

- **Professional wellbeing:** is related to the broader concept of psychological wellbeing, or subjective wellbeing, which is derived from various sources of life and non-work satisfaction enjoyed by individuals [60]. Professional well-being is defined “as an integrative concept that characterizes the quality of life concerning an individual’s health and work-related environmental, organizational, and psychosocial factors. Well-being is the experience of positive perceptions and the presence of constructive conditions at work and outside work that enable workers to thrive and reach their full potential” [61]. Occupational well-being is further conceptualized as work-related and is a function of being satisfied in one’s work, finding meaning in one’s work, feeling engaged while working, having a quality work life, and finding professional fulfillment in one’s work [62, 63]. Although occupational well-being can be measured by different indicators [61], work engagement, which is related to the motivational aspects of work, has been a common indicator of occupational well-being. Work engagement is a positive and fulfilling state of mind characterized by “vigour, dedication and absorption” in work [52]. Occupational well-being is, therefore, a function of the complex interaction of physical, emotional, mental, social, and spiritual factors that interact with the ecosystem in which the person resides [63].
- **Intensive care medicine or critical care medicine:** is a medical specialty that deals with critically or seriously ill patients who have, are at risk of, or are recovering from life-threatening conditions. Clinicians in this specialty are often called intensive care, critical care, or intensivist professionals. Intensive care relies on multidisciplinary teams composed of many different healthcare professionals. Such teams often include physicians, nurses, physiotherapists, respiratory therapists, and pharmacists, among others. They usually work together in intensive care units [65].
- **Pandemic era:** According to the WHO definition, a pandemic is the worldwide spread of a new disease and generally indicates the involvement of at least two continents, with sustained human-to-human transmission. The severity of a disease is not the decisive parameter for a pandemic to be declared, which instead relates to how effectively a disease spreads. Most pandemics (and particularly influenza pandemics) have often originated from disease-ridden animal populations, which then infected

humans with agents that, with subsequent mutations, are capable of being transmitted from human to human [55].

According to the framework “Three Levels Systems Model of Clinician Burnout and Professional Well-being” [27], when framing work system factors that influence Burnout and professional well-being, it is useful to also define the following variables:

- **Workload:** Nursing workload is defined as the necessary level of basic clinical skills required in the performance of daily nursing activities [66]. The required skills vary depending on the type of clinical performance in which nurses are employed within a specific hospital setting [67]. Workload includes physical and mental elements, which combine and contribute together to an individual’s level of performance in the work environment [68, 69]. The physical workload is determined by physical skills such as moving and handling patients and administering medication [69]. Mental workload includes receiving, understanding, and interpreting information, making decisions, focusing, and interacting with patients and their families [68]. In the literature, physical and mental workload characteristics can impact and influence each other [68].
- **Workflow:** A workflow consists of an orchestrated and repeatable pattern of activities made possible by the systematic organization of resources into processes that transform materials, provide services, or process information. It can be represented as a sequence of operations, the work of a person or group, the work of an organization of personnel, or one or more simple or complex mechanisms. From a more abstract or higher-level perspective, the workflow can be considered a vision or representation of real work. The flow described may refer to a document, service, or product that is transferred from one stage to another [70].
- **Health workforce:** encompasses a range of professions, including health workers “such as licensed nurses, physicians” and support health professionals, “as well as individuals in health care support roles, such as community health workers”, public health workers, “direct support professionals and caregivers” [71]. The term “health workers” is used to encompass the whole range of health professionals and, when necessary, more specific language is used.
- **Staffing levels:** Nursing staff make up half of the health workforce worldwide [54]. Providing staffing levels of nurses that match patient demand is key to providing cost-effective healthcare services [72]. Improved nursing staffing levels and a higher proportion of nurses with degrees have been shown to reduce the likelihood of a hospitalized patient dying within 30 days of admission [30]. The literature increasingly suggests that adequate nursing staffing can influence the quality of patient supervision by allowing nurses to spend more time on direct care [73].
- **Missed care:** “Missed care” refers to those activities deemed necessary by nurses that were missed or

omitted in the last shift due to lack of time [74]. These have a direct impact on variables such as quality of care, safety, and mortality rates [30].

- **Engagement:** Schaufeli et al. defined engagement as ‘a positive, fulfilling, work-related state of mind’ and proposed that an engaged employee has a strong sense of vigour towards, dedication to and absorption in work activities. This refined conceptualisation has similarities to Kahn’s [75] in that engagement is concerned with a psychological experience, while at work, that is highly positive and self-fulfilling. Moreover Schaufeli et al. [52] also support Kahn’s view that engagement is a psychological state that leads to positive personal and organisational behaviours. nurse involvement may involve participation in advisory committees, unit councils, and a range of hospital committees. High levels of nurse involvement have been linked to better workforce outcomes, including lower staff turnover, lower burnout, and higher job satisfaction ratios [76];
- **Moral distress:** occurs when an individual is faced with the dilemma of knowing their ethical responsibility (*e.g.*, appropriate care for their patients) but is unable to act on it due to circumstances beyond their control. Moral injury is related and occurs when individuals are repeatedly engaged, fail to prevent, or witness such dilemmas [77];
- **Leadership:** Leadership has been defined as the relationship between the individual who leads and those who choose to follow him/her; it refers to the behaviour of directing and coordinating the activities of a team or group of people towards a common goal [78]. Numerous publications recognize leadership style as a key element in the quality of healthcare. Effective leadership is among the most critical components that lead an organization to effective and successful results. Significant positive associations have been reported between effective leadership styles and high levels of patient satisfaction and reduced adverse effects [78].
- **Nurses’ Practice Environment:** A good quality nursing practice environment is an environment that promotes nurses’ professional autonomy by providing them with sufficient control over their environment. Good relationships between nurses and physicians result in better outcomes for both nurses and patients [79]. Positive work and learning environments are safe and healthy, support the well-being of health workers and learners, and foster ethical and meaningful training and practice [27].
- **Workplace stress:** the “harmful physical and emotional response that occurs when job requirements do not match the worker’s skills, resources or needs. Workplace stress can lead to health problems or even injury” [27].
- **Job satisfaction:** is a pleasant or positive emotional state resulting from the evaluation of one’s job or work experiences” [80] or “the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs” [81] (Tab. I).

Tab. I. Considered variables explanation.

Professional well-being	Critical care settings	Critical care nurse	Factors	Timing
Wellbeing Well-being Burnout	Critical care Intensive care Intensive care unit* Emergency Emergency Medical Service* Emergency Service Hospital Trauma Center* Triage Emergency Department* ICU* Intensive Therapy* Emergency Room ER	Nurse Nurses Nursing staff Nursing personnel Critical care nurse Emergency nurses	Workload Workflow Health workforce Staffing levels Missed care Engagement Moral distress Leadership Nurses practice environment Workplace stress Job satisfaction	COVID era Pandemic era

SEARCH STRATEGIES

Electronic search

To answer the research questions, the following electronic databases will be explored: PubMed, CINAHL, Scopus, Cochrane, PsycINFO, and Web on Science. Considering the elements of the main research question, a pilot search enabled the identification of keywords consistent with the proposed research questions for the electronic database search (Tab. II).

The keywords were combined with the Boolean operators 'AND' and 'OR' to obtain the search strategy for the databases considered (Tab. III).

Tab. II. Research Question.

Population	Critical care nurses
Exposure	Influencing factors
Outcome	Wellbeing or Burnout
Timing	COVID-19 Pandemic era

Since no similar systematic reviews are present in the literature, time limits will be set according to define the COVID-19 pandemic era. Language restrictions will be applied by including only studies in English and Italian. The search terms will be identified based on the theoretical framework "Three levels systems model of clinician burnout and professional well-being" proposed in 2019 by the Committee on Systems Approaches to Improve Patient Care by Supporting Clinician Well-Being [27], and further searches conducted in the literature. Care services identified by the following terms will be considered: "Intensive Care Unit (ICU)", "intensive therapy", "emergency department (ED)", "Emergency Service Hospital", "Emergency Medical Services", "Trauma Centres", "Triage", "critical care", "intensive care", "emergency", "emergency room (ER)". In the event of a terminological mismatch, alternative terms used in the international literature will be considered provided they express some correspondence in meaning.

To maximize the identification of potentially relevant manuscripts for inclusion, bibliographic references of

the included articles will be screened (reference lists scanning), and sources that have cited the included articles will be searched on the Scopus database (citation searching). Specific search strategies will be adopted for each database.

All identified bibliographic sources will be managed with EndNote 21.2 for Windows software.

The search terms

The terminology employed will encompass synonyms or precise expressions as dictated by the respective database (Tab. I). These terms will be matched in various formats, such as MESH and TEXT WORDS in MEDLINE, Thesaurus terms in PsycINFO, and natural language in Cochrane Library, CINAHL, and SCOPUS. The study selection process consists of two distinct phases. In the initial phase, titles, abstracts, and keywords will be scrutinized based on predefined inclusion and exclusion criteria. This initial screening aims to identify pertinent documents for inclusion while excluding irrelevant ones. Before commencing the first phase, a meticulous evaluation of duplicate publications or multiple reports stemming from the same study will be conducted using EndNote version 20, with oversight by an external researcher.

The papers will be assessed by four independent reviewers, with determinations of "YES" for inclusion, "NO" for exclusion, or "U" signifying an inability to determine eligibility. In cases where any single criterion is not met, studies will be excluded. Full texts of articles classified as relevant or suitable for our review will undergo comprehensive reading and analysis. Similarly, studies that cannot be adequately assessed based solely on their abstracts will be scrutinized, guided by the established inclusion and exclusion criteria.

An external researcher with expertise in systematic reviews will oversee the entire selection process and ensure the quality of the review and analysis. Both phases will entail separate examination of documents by two researchers, adhering to predefined criteria. In instances of disagreement between these two researchers, a third party will be engaged for resolution. If study information is missing or full-text access is unavailable, authors will be contacted, and if no response is received within two

Tab. III. Search concepts and keywords used combined with appropriate Boolean operators.

Database	Population (critical care nurses)	Setting (critical care settings)	Outcome (well-being or burnout)	Timing (Covid pandemic)
PubMed	AND ("nurse s"[All Fields] OR "nurses"[MeSH Terms] OR "nurses"[All Fields] OR "nurse"[All Fields] OR "nurses s"[All Fields] OR ("nurse s"[All Fields] OR "nurses"[MeSH Terms] OR "nurses"[All Fields] OR "nurse"[All Fields] OR "nurses s"[All Fields]) OR ("nursing staff"[MeSH Terms] OR ("nursing"[All Fields] AND "staff"[All Fields]) OR "nursing staff"[All Fields] OR ("nursing staff"[MeSH Terms] OR ("nursing"[All Fields] AND "staff"[All Fields]) OR "nursing staff"[All Fields] OR ("nursing"[All Fields] AND "personnel"[All Fields]) OR "nursing personnel"[All Fields] OR "nurses"[MeSH Terms] OR "nurses"[All Fields] OR ("nursing"[All Fields] AND "personnel"[All Fields])) OR ("crit care nurse"[Journal] OR ("critical"[All Fields] AND "care"[All Fields] AND "nurse"[All Fields]) OR "critical care nurse"[All Fields]) OR (("emerge"[All Fields] OR "emerged"[All Fields] OR "emergence"[All Fields] OR "emergences"[All Fields] OR "emergencies"[MeSH Terms] OR "emergencies"[All Fields] OR "emergency"[All Fields] OR "emergent"[All Fields] OR "emergently"[All Fields] OR "emergents"[All Fields] OR "emerges"[All Fields] OR "emerging"[All Fields]) AND ("nurse s"[All Fields] OR "nurses"[MeSH Terms] OR "nurses"[All Fields] OR "nurse"[All Fields] OR "nurses s"[All Fields]))))	("critical care"[MeSH Terms] OR ("critical"[All Fields] AND "care"[All Fields]) OR "critical care"[All Fields] OR ("critical care"[MeSH Terms] OR ("critical"[All Fields] AND "care"[All Fields]) OR "critical care"[All Fields] OR ("intensive"[All Fields] AND "care"[All Fields]) OR "intensive care"[All Fields]) OR ("intensive care units"[MeSH Terms] OR ("intensive"[All Fields] AND "care"[All Fields] AND "units"[All Fields]) OR "intensive care units"[All Fields]) OR ("emerge"[All Fields] OR "emerged"[All Fields] OR "emergence"[All Fields] OR "emergences"[All Fields] OR "emergencies"[MeSH Terms] OR "emergencies"[All Fields] OR "emergency"[All Fields] OR "emergent"[All Fields] OR "emergently"[All Fields] OR "emergents"[All Fields] OR "emerges"[All Fields] OR "emerging"[All Fields]) OR ("emergency medical services"[MeSH Terms] OR ("emergency"[All Fields] AND "medical"[All Fields] AND "services"[All Fields]) OR "emergency medical services"[All Fields]) OR ("emergency service, hospital"[MeSH Terms] OR ("emergency"[All Fields] AND "service"[All Fields] AND "hospital"[All Fields]) OR "hospital emergency service"[All Fields] OR ("emergency"[All Fields] AND "service"[All Fields] AND "hospital"[All Fields]) OR "emergency service hospital"[All Fields]) OR ("trauma centers"[MeSH Terms] OR ("trauma"[All Fields] AND "centers"[All Fields]) OR "trauma centers"[All Fields]) OR ("triage"[MeSH Terms] OR "triage"[All Fields] OR "trriages"[All Fields] OR "triaged"[All Fields] OR "triaging"[All Fields]) OR ("emergency service, hospital"[MeSH Terms] OR ("emergency"[All Fields] AND "service"[All Fields] AND "hospital"[All Fields]) OR "hospital emergency service"[All Fields] OR ("emergency"[All Fields] AND "department"[All Fields] OR "emergency department"[All Fields]) OR ("intensive care units"[MeSH Terms] OR ("intensive"[All Fields] AND "care"[All Fields] AND "units"[All Fields]) OR "intensive care units"[All Fields] OR "icu"[All Fields]) OR "ICUs"[All Fields] OR (("intensive"[All Fields] OR "intensives"[All Fields]) AND ("therapeutics"[MeSH Terms] OR "therapeutics"[All Fields] OR "therapies"[All Fields] OR "therapy"[MeSH Subheading] OR "therapy"[All Fields] OR "therapy s"[All Fields] OR "therapys"[All Fields])) OR ("emergency service, hospital"[MeSH Terms] OR ("emergency"[All Fields] AND "service"[All Fields] AND "hospital"[All Fields]) OR "hospital emergency service"[All Fields] OR ("emergency"[All Fields] AND "room"[All Fields]) OR "emergency room"[All Fields]) OR "ER"[All Fields]))	((("wellbeing"[All Fields] OR ("health"[MeSH Terms] OR "health"[All Fields] OR "well"[All Fields] OR "well being"[All Fields]) OR ("burnout s"[All Fields] OR "burnout, psychological"[MeSH Terms] OR ("burnout"[All Fields] AND "psychological"[All Fields]) OR "psychological burnout"[All Fields] OR "burnout"[All Fields] OR "burnouts"[All Fields]))	("sars cov 2"[MeSH Terms] OR "sars cov 2"[All Fields] OR "covid"[All Fields] OR "covid 19"[MeSH Terms] OR "covid 19"[All Fields] OR ("covid 19"[All Fields] OR "covid 19"[MeSH Terms] OR "covid 19 vaccines"[All Fields] OR "covid 19 vaccines"[MeSH Terms] OR "covid 19 serotherapy"[All Fields] OR "covid 19 nucleic acid testing"[All Fields] OR "covid 19 nucleic acid testing"[MeSH Terms] OR "covid 19 serological testing"[All Fields] OR "covid 19 serological testing"[MeSH Terms] OR "covid 19 testing"[All Fields] OR "covid 19 testing"[MeSH Terms] OR "sars cov 2"[All Fields] OR "sars cov 2"[MeSH Terms] OR "severe acute respiratory syndrome coronavirus 2"[All Fields] OR "ncov"[All Fields] OR "2019 ncov"[All Fields] OR ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "cov"[All Fields]) AND 2019/11/01:3000/12/31(Date - Publication))) OR "Sars- Cov2"[All Fields] OR ("pandemia"[All Fields] OR "pandemias"[All Fields]) OR (("pandemic s"[All Fields] OR "pandemically"[All Fields] OR "pandemicity"[All Fields] OR "pandemics"[MeSH Terms] OR "pandemics"[All Fields] OR "pandemic"[All Fields]))
Scopus	(nurse OR nurses OR "nursing staff" OR "nursing personnel" OR "critical care nurse" OR "emergency nurses")	("critical care" OR "intensive care" OR "intensive care units" OR emergency OR "Emergency Medical Services" OR "Emergency Service Hospital" OR "Trauma centers" OR triage OR "Emergency Department" OR icu OR icus OR "intensive therapy" OR "Emergency room" OR ER)	(wellbeing OR well- being OR burnout)	(covid OR covid-19 OR sars- cov2 OR pandemic)

Tab. III (follows). Search concepts and keywords used combined with appropriate Boolean operators.

Database	Population (critical care nurses)	Setting (critical care settings)	Outcome (well-being or burnout)	Timing (Covid pandemic)
CINAHL	(nurse OR nurses OR "nursing staff" OR "nursing personnel" OR "critical care nurse" OR "emergency nurses")	("critical care" OR "intensive care" OR "intensive care units" OR emergency OR "Emergency Medical Services" OR "Emergency Service Hospital" OR "Trauma centers" OR triage OR "Emergency Department" OR icu OR icus OR "intensive therapy" OR "Emergency room" OR ER)	(wellbeing OR well-being OR burnout)	(covid OR covid-19 OR sars-cov2 OR pandemic)
Cochrane	(nurse OR nurses OR nursing staff OR nursing personnel OR critical care nurse OR emergency nurses) in All Text	(critical care OR intensive care OR intensive care units OR emergency OR Emergency Medical Services OR Emergency Service Hospital OR Trauma centers OR Triage OR Emergency Department OR ICU OR ICUs OR intensive therapy OR Emergency room OR ER) in All Text	(wellbeing OR well-being OR burnout) in All Text	(Covid OR Covid-19 OR Sars-Cov2 OR pandemic) in All Text
Web on Science	(nurse OR nurses OR nursing staff OR nursing personnel OR critical care nurse OR emergency nurses)	(critical care OR intensive care OR intensive care units OR emergency OR Emergency Medical Services OR Emergency Service Hospital OR Trauma centers OR Triage OR Emergency Department OR ICU OR ICUs OR intensive therapy OR Emergency room OR ER)	(wellbeing OR well-being OR burnout)	(Covid OR Covid-19 OR Sars-Cov2 OR pandemic)
PsycINFO	(nurse OR nurses OR nursing staff OR nursing personnel OR critical care nurse OR emergency nurses)	(critical care OR intensive care OR intensive care units OR emergency OR Emergency Medical Services OR Emergency Service Hospital OR Trauma centers OR Triage OR Emergency Department OR ICU OR ICUs OR intensive therapy OR Emergency room OR ER)	(wellbeing OR well-being OR burnout)	(Covid OR Covid-19 OR Sars-Cov2 OR pandemic)

weeks, the respective article will be excluded from the review. Detailed records will be maintained to document the reasons for excluding full-text articles.

METHODOLOGICAL QUALITY ASSESSMENT

The assessment of the methodological quality of the included studies will be carried out, by the research design, with the standardized tools made available in the JBI Manual for Evidence Synthesis [46, 48]. In particular: JBI Critical Appraisal Checklist for Cohort Studies; JBI Critical Appraisal Checklist for Case-Control Studies; JBI Critical Appraisal Checklist for Case Series; JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies; JBI Critical Appraisal Checklist for Randomized Controlled Trials; JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomized experimental studies). The results of the risk of bias assessment of the included studies will be reported in tabular form in the data extraction table and in narrative form in the results and discussion section. The risk of bias assessment will be carried out independently by two researchers and disagreement resolved through a discussion with the team leader G.C.. Considering the exploratory nature of the review, the methodological quality of the included studies will not be considered an exclusion criterion for the narrative synthesis of the results. Conversely, the reduced methodological quality of the study will be considered as an exclusion criterion for any meta-analytic synthesis of the results.

DATA EXTRACTION

The extracted data will be reported in a structured and previously tested spreadsheet, according to guidelines provided by the Institute of Medicine (US) Committee on Standards for Systematic Reviews of Comparative Effectiveness Research [82].

The data will be extracted independently by at least two researchers. Any discrepancies in the extracted data will be resolved by a third researcher. The following data will be extracted: author, year of publication, country, research design, population, sample, socio-demographic characteristics of the sample, purpose of the study, care intervention(s), outcome(s), measurement instruments, influencing factors, results, and quality of the study.

It will be possible to extract additional data not foreseen in the protocol consistent with the research objectives.

DATA SYNTHESIS AND ANALYSIS

The information extracted from the studies will first be described in narrative and tabular form. The framework "Three Levels Systems Model of clinician burnout and Professional Well-being" [27] will guide us in the presentation of the results. The results will be categorized according to the three levels of the system (frontline care delivery, healthcare organization and external environment). The influencing factors resulting from the results of the review will similarly be categorized according to the needs/resources categorization. Possible

influencing factors on occupational well-being and any significant associations will also be described.

Where possible, data will be summarised quantitatively through meta-analysis, using Jamovi free software [83]. Additional variables will be considered after analysing possible factors influencing occupational well-being. Furthermore, to detect the impact of each study on the meta-analytical results, a sensitivity analysis will be conducted by removing one study at a time.

Data that cannot be included in the meta-analysis will be summarised narratively.

Implication and relevance

We anticipate that this systematic review will provide an overview of the factors that impacted the professional well-being of critical care nurses during the pandemic period from Covid-19. Knowing these factors will be able to direct health policies toward the implementation of interventions to promote the well-being of healthcare workers. Attending to the level of professional well-being of nurses becomes imperative if we aim to counter the emerging phenomenon of intention to leave that is increasingly affecting the profession.

Acknowledgements

None.

Protocol registration

This protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) database (registration number CRD42023446542).

Funding sources

This review protocol did not receive any specific funding.

Authorship statement

All listed authors meet the authorship criteria and all authors agree with the content of the manuscript. All authors have: 1) Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data. 2) Been involved in drafting the manuscript or revising it critically for important intellectual content. 3) Given final approval of the version to be published. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content; and 4) Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. And in particular: MEM, MR and GC made a substantial

contribution to the conception of this paper. MEM, MR, MB and AM were substantially involved in the design, data acquisition, analysis, and interpretation. MEM, MR were mainly involved in drafting and editing the manuscript. GC, MZ, LS and AB contributed to revising it critically for important intellectual content.

Conflicts of interest statement

All the other authors declare that they have no conflicts of interest concerning the research, authorship, and/or publication of this article.

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Received on June 24, 2024. Accepted on December 16, 2024.

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How to cite this article: Musio ME, Russo M, Barbieri M, Moro A, Zanini M, Sasso L, Bagnasco A, Catania G. The influencing factors of nurses' well-being in critical care during pandemic era: a systematic review protocol. *J Prev Med Hyg* 2024;65:E563-E573. <https://doi.org/10.15167/2421-4248/jpmh2024.65.4.3324>

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