

REVIEW

The Prevalence of Nurses' Emotional Exhaustion during COVID-19 Pandemic: A Systematic Review and Meta-Analysis



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Abstract

Background: Nurses in many countries face a high prevalence of psychological pressure while caring for COVID-19 patients. Several determinants of emotional exhaustion leading to occupational burnout risk were documented. However, a recent review examining nurses' emotional exhaustion during the COVID-19 pandemic is lacking in nursing literature.

Purpose: This review aimed to examine the prevalence of nurses' emotional exhaustion during the COVID-19 pandemic. This review also describes the organizational contributing factors to nurses' emotional exhaustion.

Methods: A systematic review and meta-analysis of the literature following the PRISMA guidelines was conducted in March 2022. Four databases, including PubMed, ProQuest Platform, Wiley, and Google Scholar, were searched from 1 January 2020 to 28 February 2022. The prevalence of nurses' emotional exhaustion (EE) was pooled using random effect meta-analyses. The quality appraisal of the studies was done using the Joanna Briggs Institute (JBI) checklist. Data analysis utilized a random effect model to evaluate the pooled effects of the studies due to the high heterogeneity between results.

Results: Nine studies were included with a total number of 16,810 subjects surveyed, of whom, 8,150 (48.50%) met the criteria for emotional exhaustion. Based on the standard effect model, the pooled estimate for EE prevalence was 48.9% (95% CI:48.1% to 49.6%). Several organizational factors contributing to nurses' emotional exhaustion included working in critical care units or isolation wards, longer working hours in COVID-19 quarantine units, night shifts, working with confirmed or suspected co-workers, monthly salary income, and inadequate hospital resources.

Conclusion: This review found that nurses were suffering from high to moderate emotional exhaustion levels during the COVID-19 pandemic. Furthermore, several organizational factors influence this emotional exhaustion. These findings highlight the necessity for urgent interventions to decrease psychological impacts on frontline nurses.

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1. Introduction

Globally, as of March 2022, over 462 million confirmed cases of the Coronavirus Disease (COVID-19) have expanded into more than 60 countries (Al-Rabiaah et al., 2020; WHO, 2022). Based on the global data reported to the World Health Organization (WHO), the pandemic has caused 6,056,725 deaths among the global population. Moreover, WHO estimated up to 180,000 deaths occurred between January 2020 and May 2021 among healthcare professionals during the pandemic (WHO, 2021).

Healthcare professionals are at higher risk of being infected by the COVID-19 virus than the general population (Chen et al., 2020). Unfortunately, a meta-analysis conducted during the first wave of the pandemic found that 25.3% of deaths from COVID-19 among health care professionals were nurses (Bandyopadhyay et al., 2020). Based on the International Council of Nurses, an estimated 1,500 deaths among nurses were reported due to COVID-19 in 44 countries as of October 2020 (International Council of Nurses, 2020). However, the burden of accurate mortality numbers is likely under-reports worldwide (WHO, 2021).

Nurses are frontline health care professionals who come close to COVID-19 patients and undertake most direct tasks with inadequate protection from contamination (Kang et al., 2020; Liu et al., 2020; Zhan et al., 2020). This fact threatens nurses' safety and their family members, putting them under extreme and constant physical and psychological pressure (Bao et al., 2020; Hu et al., 2020; Joo & Liu, 2021). Under these severe psychological and physical threats, nurses could experience burnout, emotional exhaustion, stress, fear, depression, and social prejudice, and then diminish professional productivity, errors in clinical care, and lower patient care outcomes (Al Maqbali et al., 2021; Pappa et al., 2020).

The current data report the startling levels of EE prevalence among nurses in various countries. Several studies conducted during the COVID-19 pandemic confirmed that nurses suffered from moderate to high levels of EE (Clinton et al., 2022; Hu et al., 2020; Salari et al., 2020). According to the results of Chen et al. (2020), moderate degrees of EE were reported by 6,051 Chinese nurses, 48% of the total sample. Similarly, Wan et al. (2022) presented moderate to high degrees of EE among 200 Chinese nurses, 22.6% of the total sample. In Iran, Kakemam et al. (2021) revealed that 703 nurses were suffering from moderate to high degrees of EE, which is 48.3% of the total sample. Similar EE levels were reported by nurses from the United States, displaying that 61% of nurses experienced EE during the COVID-19 pandemic (Sagherian et al., 2020). These levels are like that found in Bellanti et al. (2021), who confirmed that 76.5% of Italian nurses had moderate to high scores in the EE dimension. Jose et al. (2020) also reported that 54.16% of nurses working in the emergency department experienced severe EE, and 37% reported a moderate level in India. The international literature has shown a range of moderate to high EE levels among nurses, which call for further analysis and improvement strategies for the future development of nurses' work, patients' quality of care, and organizational outcomes (Galanis et al., 2021).

The consequences of EE can be examined from personal and organizational aspects. For instance, EE not only impacts nurses' health and well-being but also leads to organizational malfunctioning (Zhang et al., 2020). It may negatively affect patient care, nurse dissatisfaction, lack of quality sustainability in health care systems, reduced work commitment, and increased nurse turnover (Aiken et al., 2012; Lee et al., 2016). Recognizing those factors and preventing EE that leading to occupational burnout can play a crucial role in improving nurses' performance and well-being, thus enhancing the quality of healthcare services provided at hospitals (Ahola et al., 2017). The emotional exhaustion dimension among nurses was reported to be higher and most affected in most of the previous studies during COVID-19, while the other two dimensions of burnout presented with lower scores (Hu et al., 2020; Kakemam et al., 2021; Sagherian et al., 2020; Zhang et al., 2020). In addition, as far as our knowledge and search, there is no meta-analysis or systematic review that examined nurses' EE prevalence during the COVID-19 pandemic. Therefore, it is vital to estimate the nurses' EE during the crisis of COVID-19. Such knowledge can be devised to protect and preserve frontline nurses and to increase future attention and support from organizations and policymakers.

This study aims to analyze the prevalence of nurses' emotional exhaustion and describe the influence of organizational factors during the COVID-19 pandemic. The theoretical framework of this review is based on the Maslach Burnout theory. Maslach's theory describes burnout as an occupationally triggered condition, including emotional exhaustion, depersonalization, and decreased one's feeling of personal accomplishment (Dall'Ora et al., 2020). EE is one of the three dimensions of burnout syndrome resulting from accumulating prolonged stressors in one's working conditions (Clinton et al., 2022). Therefore, analyzing EE levels with antecedents from institutional factors and presenting a systematic review may help the global nurse community better understand nurse burnout during the COVID-19 pandemic.

2. Methods

2.1 Research design

A systematic review and meta-analysis of the literature was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

2.2 Search method

The search was conducted in March 2022. The search terms were (("Nurs* Or "Nursing") AND ("Emotional exhaustion" Or "Burnout") AND ("Coronavirus" Or "COVID-19")) in English.

The authors conferred the following scientific databases: PubMed, ProQuest Platform, Wiley, and Google Scholar from 1 January 2020 to 28 February 2022, and removed duplicates.

2.3 Inclusion and exclusion criteria

The following inclusion criteria were considered for the search: (a) quantitative studies; (b) studies that assessed nurses' occupational burnout; (c) studies that were conducted during the COVID-19 period; (d) sample of nurses provided direct care to COVID-19 patients; (e) English language papers; (f) studies utilized the Maslach Burnout Inventory (MBI) involved in the meta-analysis.

The authors excluded studies that examined the entire healthcare professional and did not focus on nurses. Even preprints, mixed-methods, qualitative studies, protocols, editorials, book chapters, non-published papers, the abstracts of the conferences, and letters to editors, sample of nursing students or midwives, studies without adequate statistical information to perform meta-analysis estimations, and final studies (dissertations and thesis) were also excluded.

2.4 Screening of articles

The search strategy consisted of four steps according to the PRISMA guidelines of identification, screening, eligibility, and inclusion (Moher et al., 2015). Initially, the electronic databases searches identified 1,152 records, and 15 additional records were identified through an inverse search from the reference lists of the included studies or studies located from the included systematic reviews and a forward search of studies cited from the included studies.

Then, after removing the duplicates (n=469), screening was performed for each title and abstract of the document (n=698), followed by filtering the full texts to be included in the systematic review. In this phase, 638 records were excluded from the initial title and abstract screening. Then, 60 full-text documents were screened.

After that, another 51 records were excluded for not meeting the inclusion criteria as they utilized other scales to measure nurses' burnout and not the MBI-Emotional Exhaustion subscale (n=25); studies used MBI but in non-English versions (n=3); studies did not measure nurses' EE during COVID-19 period (n=9) but was published in COVID-19 period; studies with samples of nurses did not provide direct care to COVID-19 patients (n=3); unable to reach full text of studies (n=4); studies with a mixed method design (n=2); a study used cohort design (n=1); a study with sample of nurses and midwives (n=1); a study with sample of nurses and nursing students (n=1); and preprint studies (n=2). Finally, the documents were reduced to a final sample of nine studies utilized and measured the EE subscale of the MBI assessment tool (see Figure 1).

2.5 Data extraction

A structured form was used to extract data from each study. The following data were considered for extraction: (a) Authors; (b) year of publication; (c) country of the study; (d) sample size; (e) sampling method; (f) study design; (g) response rate; (h) data collection time; and (i) main results for the presence of nurse's EE and associated factors (Table 1, Appendix 1).

2.6 Quality appraisal

The study's quality was evaluated using the Joanna Briggs Institute (JBI) checklist to assess the risk of bias in each study. Two reviewers (RA; MB) evaluated all the included studies in this systematic review to assess each article' methodological quality and minimize errors. Each article had a calculated score for selecting participants, study methods, and outcome assessment to determine the inclusion or exclusion of the study in the final sample. In addition, the Joanna Briggs Institute (JBI) critical appraisal tools were used to assess the research quality of the quantitative designs (JBI, 2021). There were eight criteria for evaluating the quality of cross-sectional studies. These criteria are specific to quantitative data and stipulated as a checklist. Quality ratings of each study are considered if a study meets a predetermined set of questions (Table 2). These questions were answered with a reviewer response of whether "yes," "no," "unclear," or "not applicable" (JBI, 2021).

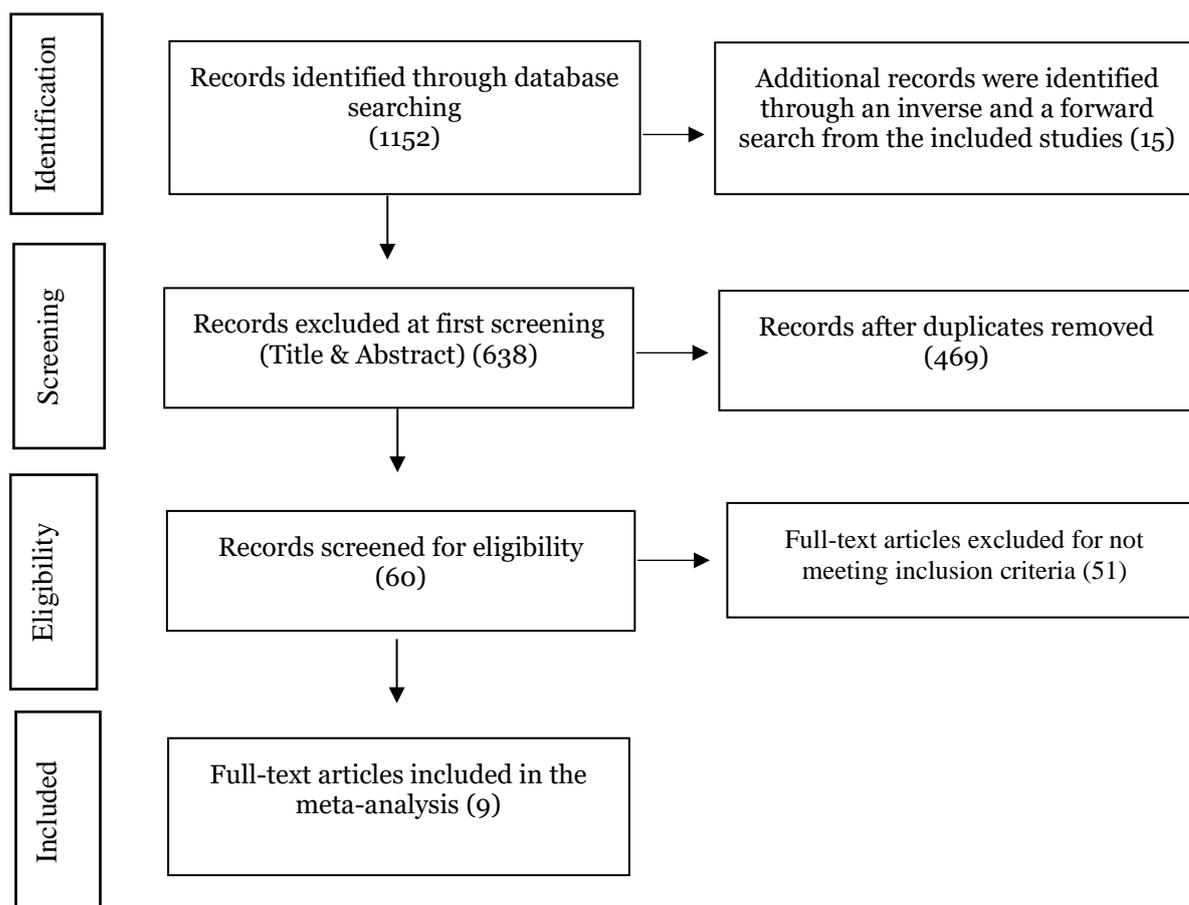


Figure 1. PRISMA flow diagram

2.7 Data analysis

A random intercept logistic regression model was used to estimate the pooled prevalence of EE using data from the included studies in the current meta-analysis. Heterogeneity was assessed using a maximum likelihood estimator for τ^2 statistic calculation. The authors also calculated I^2 and Q statistics and evaluated between-study heterogeneity using the Wald and likelihood ratio tests. The risk of publication bias was evaluated using a visual display of study estimates plotted against their precision and evaluating the expected inverted funnel plot. A formal assessment of publication bias was undertaken using Duval & Tweedie's trim and fill procedure. The authors contrasted a pooled estimate using Duval & Tweedie's trim and fill procedure with the observed pooled estimate. The authors did not perform a meta-analysis for the organizational factors associated with nurses' emotional exhaustion since the data were limited to different contexts and highly heterogeneous.

3. Results

3.1 Search outcomes

The search was performed in March 2022. After applying the inclusion and exclusion criteria and critically appraising the studies, a total of nine studies were selected. All selected studies were cross-sectional with sample population of 16,810 nurses. Four studies were published in 2020, two in 2021, and three in 2022. Moreover, four studies were conducted in China (Chen et al., 2020; Wan et al., 2022; Zhang et al., 2020; Zhou et al., 2022), (1) study in the United States (Sagherian et al., 2020), (1) study in Italy (Bellanti et al., 2021), (1) study in Iran (Kakemam et al., 2021), (1) study in Indonesia (Susila & Laksmi, 2022), and (1) study in India (Jose et al., 2020).

Most of the studies used a convenience sampling method (Chen et al., 2020; Sagherian et al., 2020; Wan et al., 2022; Zhang et al., 2020), while Zhou et al. (2022) used both convenience and multistage-stratified sampling methods, and two studies used a simple random method

(Jose et al., 2020; Susila & Laksmi, 2022). However, one study (Bellanti et al., 2021) did not mention the sampling method. The response rate ranged from 65% to 100%. Zhou et al. (2022) reported 65%, Wan et al. (2022) reported 87.5%, Bellanti et al. (2021) presented 71%, Jose et al. (2020), and Kakemam et al. (2021) reported a 100% response rate, while two studies did not indicate the response rates (Chen et al., 2020; Susila & Laksmi, 2022).

The overall prevalence of EE among nurses was 48.9%, and the accumulated percentage of moderate to high levels of EE ranged from 21.5%% to 76.5%% with a remarkably high heterogeneity between results. To emphasize, Kakemam et al. (2021) reported a moderate degree of EE among 218 nurses (21.7%) and a high degree of EE among 485 nurses (48.3%) from the total sample. Jose et al. (2020) reported a moderate degree of EE, 21.93%, and a high degree of EE 36.46%, among nurses from the total sample. Sagherian et al. (2020) reported overall results of increased EE among 451 nurses, showing a degree of EE in 61% of nurses providing direct care to COVID-19 patients. In addition, Chen et al. (2020) reported that 45.14% of nurses experienced EE; of them, 26.58% (n=3342) showed a moderate degree of EE, and 21.55% (n=2709) with a high degree of EE.

Also, Zhang et al. (2020) reported that EE was observed among 78.5% of the sample; 15.9% experienced moderate levels, and 6.6% experienced high levels. Moreover, Bellanti et al. (2021) reported moderate to high emotional exhaustion levels in 76.5% of the sample. Zhou et al. (2022) presented that 25.41% of nurses experienced moderate levels of EE, and 26.30% reported a severe level. Furthermore, Susila & Laksmi (2022) revealed that 20% of the nurses suffer from moderate levels of EE, while 7.1 % were at a severe level of EE. Finally, Wan et al. (2022) documented that 14.58% of the nurses (n=129) suffered from moderate levels of EE, and 8.02% of the nurses (n=71) were at a severe level. Descriptive statistics for nurses' emotional exhaustion according to the MBI tool in the studies included in this meta-analysis are shown in Table 1.

3.2 Quality assessment results

Quality assessment of the included studies showed acceptable quality ranges (see Table 2). However, considerable biases were found because some studies did not report the confounding factors and controlling strategies to eliminate them. Another frequent bias was that the studies' subjects or settings were not clearly defined in detail.

3.3 Organizational factors associated with nurses' emotional exhaustion

Organizational factors influenced nurses' EE during the COVID-19 pandemic to a considerable extent. For instance, nurses that work in high-risk work environments such as isolation departments, emergency departments, COVID-19-designated hospitals, a COVID-19 quarantine, or a critical care unit (Bellanti et al., 2021; Jose et al., 2020; Sagherian et al., 2020; Zhang et al., 2021) had a higher level of EE. In addition, increased workload, working three or more night shifts, and working more than 40 hours per week were associated with nurses' EE (Sagherian et al., 2020; Wan et al., 2022; Zhang et al., 2021; Zhou et al., 2022).

Also, nurses who perceived inadequate workplace safety against COVID-19 with insufficient personal protective equipment or worked in an unpleasant workplace environment while caring for COVID-19 patients experienced EE more frequently (Bellanti et al., 2021; Jose et al., 2020; Kakemam et al., 2021; Sagherian et al., 2020; Susila & Laksmi, 2022; Zhang et al., 2021). Other associated organizational factors were reported as living in a hospital dormitory, working with suspected or confirmed COVID-19 medical staff (Wan et al., 2022), skipping the 30-minute breaks (Sagherian et al., 2020), lower monthly salaries (Zhou et al., 2022), and current or previous direct contact with patients having infectious diseases (Bellanti et al., 2021; Kakemam et al., 2021; Sagherian et al., 2020; Susila & Laksmi, 2022).

Measures of organizational support were reported to reduce EE, such as support from team leaders (Zhang et al., 2021), emotional support, and social relationship (Bellanti et al., 2021). Table 3 presents the organizational factors associated with nurses' EE in each study.

3.4 The analytical findings

The prevalence of nurses' emotional exhaustion was measured by the standardized and valid questionnaires of the MBI in all nine studies indicating high homogeneity. However, it is

worth mentioning that numerous studies in the nursing literature have measured the prevalence of total burnout dimensions with different instruments, which may provoke counterintuitive results in this meta-analysis model. Thus, it was decided to include studies using the Maslach Burnout Inventory only to calculate the prevalence of nurses' emotional exhaustion to improve the comprehensiveness and clarity of the results.

Table 3. Organizational factors associated with nurses' emotional exhaustion

Study	Organizational factors associated with nurses' emotional exhaustion
Chen et al. (2020)	Working in a COVID-19-designated hospital, working in critical care units, and departments related to COVID-19.
Wan et al. (2022)	Living in a hospital dormitory, working for three or more night shifts weekly, and having confirmed or suspected medical staff around.
Zhang et al. (2020)	Longer working time in the COVID-19 frontline quarantine areas. Support measures were reported to reduce EE, such as support from team leaders and sufficient material supply.
Kakemam et al. (2021)	Close interpersonal interaction with patients in complicated practice environments.
Sagherian et al. (2020)	Work status (Full time or part-time), hours worked per week, the unit of practice, shift length (extended shifts ≥10 hours or traditional shifts 8–9 hours), and shift types (fixed or rotating). Nurses who skipped 30-minute breaks, worked more than 40 hours per week, and provided care for a patient with COVID-19 had higher scores of EE.
Jose et al. (2020)	Inadequate workplace safety against COVID-19, inadequate PPE, and working in the emergency department.
Bellanti et al. (2021)	Working in COVID-19 units and emergency departments, workload, and direct contact with infected patients. Measures of organizational support, emotional support, social relationship, and availability of PPE.
Zhou et al. (2022)	Working at night shifts, working more than 40 hours per week, and lower monthly salaries.
Susila & Laksmi (2022)	Inadequate hospital resources and facilities, current or previous providing care for patients with infectious diseases.

Figure 2 shows the Forest plot for the effects of individual studies included in the meta-analysis and the pooled overall EE prevalence effect size. The total number of subjects surveyed was 16,810, of whom, 8,150 (48.50%) met the criteria for emotional exhaustion. The pooled estimate for EE prevalence of moderate to high levels of EE experienced by nurses was 48.9% (95% CI: 48.1% to 49.6%) based on the common effect model. However, based on the random effects model, the pooled estimate for the prevalence of EE would be 47.8% (95% CI: 34.5% to 61.4%). The random-effects analysis also determined the accepted variance weight of the individual study with a small sample size.

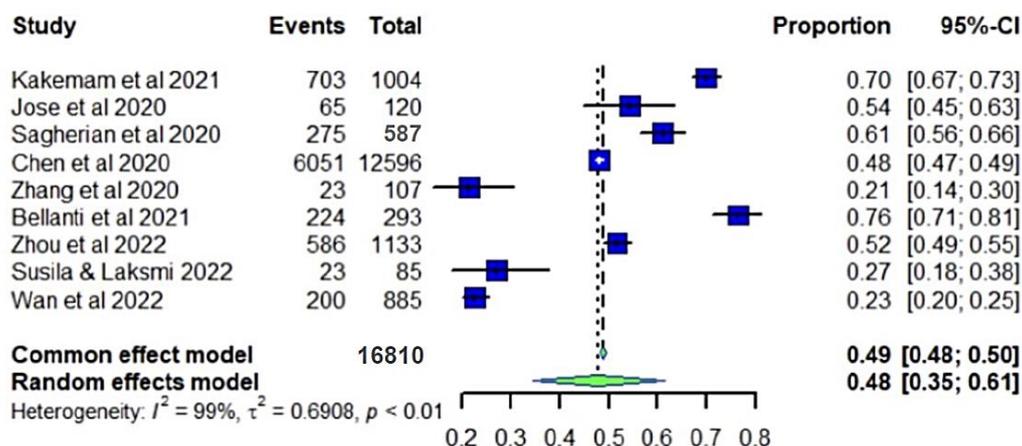


Figure 2. The pooled overall EE prevalence effect size

Regarding between-study heterogeneity, the estimate for τ^2 was 69.1% (indicative of substantial between-study heterogeneity). For the I² estimate, it was 98.5% (95% CI: 98% to 98.9%); therefore, the random effects modeling would be more appropriate for the current dataset, given the high heterogeneity, H statistic = 8.23 [95% CI: 7.14 to 9.49]. This indicates a massive difference between fixed and random effects variability estimates. More formal testing of between-study heterogeneity was conducted using the Q statistic, which was 542.41 (8 degrees of freedom) and indicated statistically significant between-study heterogeneity ($p < 0.0001$) (Table 4).

Table 4. The formal test of between-study heterogeneity

Q statistic	Degrees of freedom	p-value	Test type
542.41	8	<0.0001	Wald-type
623.52	8	<0.0001	Likelihood-Ratio

In terms of assessment of publication bias, we adopted a visual examination of the studies' findings based on a funnel plot and trim-and-fill procedure. Notably, we could not find strong evidence for publication bias based on Duval & Tweedie's trim and fill procedure. The effect size for EE prevalence imputed by the trim-and-fill procedure was 47.9% which was close to the observed effect size. Due to the small number of studies used in this meta-analysis, it was not feasible to run a full Egger's test for the assessment of the symmetry of the funnel plot. See Figure 3 for a visual display of the funnel plot.

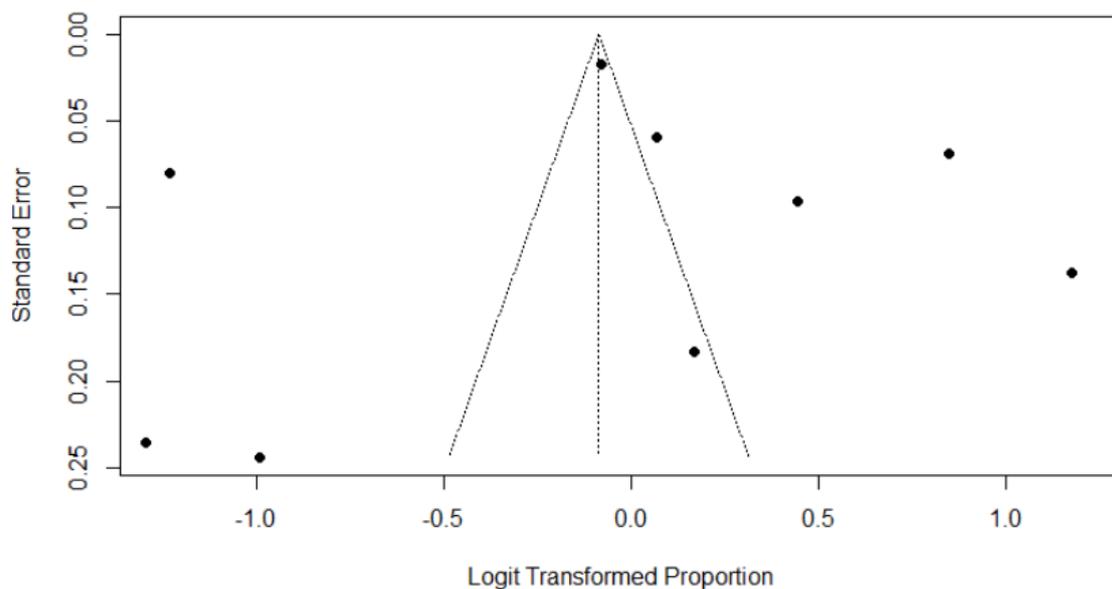


Figure 3. Funnel plot for the standard errors of estimates derived from individual studies plotted against their effect estimates.

The finding is interpretable as an overall EE prevalence of 47.8% among nursing staff; however, between-study heterogeneity was quite high, indicating substantial variability in EE estimates across different settings. There was little evidence to support publication bias among the chosen studies in this meta-analysis.

4. Discussion

This review aimed to examine the prevalence of nurses' emotional exhaustion during the COVID-19 pandemic and describe the organizational contributing factors to nurses' emotional exhaustion. This review found a significant prevalence of nurses' burnout during the COVID-19 pandemic, according to the MBI. As expected, significant differences were noted between EE levels across the nine included studies from different countries. The prevalence of moderate to high levels of EE experienced by nurses was 48.9%. In comparison with another meta-analysis,

it was found that the prevalence of EE was 34.1% in Galanis et al. (2021), conducted in the first year of the pandemic in 2020, with a total of 18,935 nurses, which is lower than the current study result. A possible explanation for the current high prevalence of the pooled mean of EE is that the current meta-analysis included studies from 2020 to 2022, which means that during the start of the COVID-19 pandemic crisis and all the sudden changes in healthcare systems, as well as high rate of infected cases and dealing with a new pandemic is increasing (Bellanti et al., 2021; Jose et al., 2020). These results indicate that overall EE estimates in nurses have to be considered alarming and demand solutions to improve nurses' work conditions.

According to this review, EE is a work-related syndrome resulting from working in a highly stressful environment such as emergency departments, critical care units, COVID-19 departments units, and isolation wards. For example, nurses working in emergency departments experienced moderate to high levels of EE (Bellanti et al., 2021; Jose et al., 2020; Kakemam et al., 2021; Sagherian et al., 2020). Perhaps, the reasons may be due to uncertainty about safety, the fear of becoming infected, the urgent need for COVID-19 patient care organization across the department, and insufficient personal protective equipment (PPE) in the initial wave of the COVID-19 could be the major sources of anxiety and EE in the emergency department (Ahorsu et al., 2021).

Also, burnout and EE increased among nurses working in the critical care units during the pandemic (Bellanti et al., 2021; Chen et al., 2020; Kakemam et al., 2021; Sagherian et al., 2020). A possible reason could be because of the poor patient prognosis, especially for the elderly patients who have another respiratory problem, the increased mortality rate among confirmed COVID-19 patients, and the lack of family presence. Another possible reason is that hospitals increased the critical care bed capacity, which required transferring more nurses from general wards to the critical care units. This may contribute to nurses feeling unpreparedness or lack of competence in providing care to severely ill patients leading to EE (Bellanti et al., 2021).

Working in COVID-19 department units (Chen et al., 2020) and isolation wards (Wan et al., 2022) increased nurses' stress, EE, and feelings of isolation. In addition, nurses working in quarantine environments have to possess higher proficiency in facing greater challenges to the specifics of COVID-19 patient care and disease prevention. As a result, those nurses may be more vulnerable to stress and more likely developed to EE (Zhang et al., 2020).

Also, higher job demands, workload, and direct contact with COVID-19 patients increase work-related stress leading to EE (Bellanti et al., 2021; Sagherian et al., 2020; Zhang et al., 2020). Moreover, extended working hours, three or more night shifts per week, working with other healthcare professionals who have confirmed or suspected COVID-19 results (Wan et al., 2022), lack of emotional support (Bellanti et al., 2021), inadequate hospital resources (Susila & Laksmi, 2022) were found as negative organizational factors leading to EE (Wan et al., 2022). Therefore, future interventional studies on workload, stressful environments, and higher workplace demands during a crisis should focus on effective actions and strategies to prevent and reduce EE and burnout symptoms.

Notably, decreased self-confidence in self-protection, lack of specialized training, and lack of working safety were further influences associated with increased EE among the nurses (Jose, 2020; Zhang et al., 2020). This indicates the significant need for regular training and professional development for infection prevention and control strategies among nurses (Al Maqbali et al., 2021; Bellanti et al., 2021). These results suggest that EE levels among nurses could vary significantly between different departments and be influenced by several organizational factors. The results of this review align with the Maslach theory of burnout. Most previous results consider that significant associated factors within the workplace can contribute to nurses' EE. The present review synthesized and described the character and the sources of work-related antecedents that can result in nurses experiencing EE.

5. Implications and limitations

Nurses working on the frontline play a crucial role in health care services, especially during crises. Nurse managers should pay attention to their demands, occupational development, and personal well-being and make additional efforts. Establishing psychological consultation clinics should be prioritized to enhance nurses' mental health status. Then, a structured reward system, including improving nurses' salaries, nurse recognition, and appreciation, is highly mandated.

Providing career development plans and learning opportunities would empower nurses and increase their readiness to face challenging circumstances.

This systematic review faced some limitations. The first limitation is the limited number of included studies, so meta-regression analysis to assess further nurses' characteristics as the independent variables on EE cannot be performed. Furthermore, diverse samples in the included studies with insufficient information about the sample inclusion criteria restricted the author from understanding and analyzing the direct relationship between the dependent and independent variables. Moreover, most of the included studies were conducted in Asia, reducing the generalization of the results. In addition, there is a possibility that other studies from different databases were not included in this systematic review, although this review used several MeSH terms and four databases. Finally, all included studies were cross-sectional design, which reduced the analysis options to signify the effect of the organizational factors on nurses' EE.

6. Conclusion

As far as our knowledge, this is the first systematic review and meta-analysis to estimate the pooled prevalence of EE among nurses during the COVID-19 period. The findings confirmed that nurses have been struggling with high to moderate EE levels since the beginning of the pandemic till the current year. Furthermore, several organizational factors influence this EE level. These findings highlight the necessity for urgent interventions that can decrease psychological impacts on frontline nurses.

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The authors would like to appreciate the efforts of all nurses in dealing with COVID-19.

Author contribution

RA, OG, and MB: Plan and design the systematic review and meta-analysis. RA: Search and data extraction. RA: Paper writing. RA and MB: Articles appraisal and data analysis. OG and MB: A paper review. All authors are responsible for the study report and provide approval of the manuscript submission.

Conflict of interest

The authors declare no personal or financial conflict of interest in this study.

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Appendix 1.

Table 1. Data extraction of the included studies

Authors	Country	Study design	Sample size & method	Data Collection Time	Results	Database
Chen et al. 2020	China	Large-scale cross-sectional study.	12,596 nurses Convince sample. Response rate not mentioned	April 2020	Moderate degrees of EE among 6051 nurses, 48% of the total sample. Influential factors relating to EE were being a woman, working in a COVID-19-designated hospital, working in critical care units, and departments related to COVID-19.	PubMed
Wan et al. 2022	China	cross-sectional	885 nurses Convince sample 87.5% response rate.	February 2020	Moderate to high degrees of EE among 200 nurses, 22.6% of the total sample. Nurses with longer than five years of work experience had higher EE. Working in isolation wards, three or more-night shifts per week, living in hotels, and being surrounded by confirmed\ suspected medical staff were all negative factors that influenced nurse's EE.	PubMed
Zhang et al. 2020	China	A cross-sectional survey	107 nurses Convince sampling. 97% response rate.	March 2020	EE was observed among 78.5% of the nurses. Moderate to severe EE among 23 nurses 21.5% of the total sample. Participants with longer working hours in COVID-19 quarantine units. EE increased with younger age and decreased with increasing working experience years	PubMed
Kakemam et al. 2021	Iran	A cross-sectional study	1,004 nurses convenience sample. Response rate not mentioned.	September - November 2020.	A moderate degree of EE was found for 218 nurses (21.7%), and a high degree among 485 nurses (48.3%) from the total sample. EE is related to low patient care quality and adverse events.	Wiley
Sagherian et al. 2020	United States	Cross-sectional study.	587 nurses convenience sample. 100% response rate.	May-June 2020	The EE among 275 nurses 61% of the total sample. EE related to worked hours per week and participants who skipped 30-min breaks.	PubMed

Table 1. Continued

Authors	Country	Study design	Sample size & method	Data Collection Time	Results	Database
Jose et al. 2020	India	cross-sectional design	120 nurses simple random sampling. 100% response rate.	August 2020	56 nurses working in the emergency experienced a severe level of EE of 36.46% and a moderate level of 21.93% among nurses from the total sample. EE was higher among nurses who had a fear of infecting family members, had confidence in self-protection, and had felt poor safety in the workplace.	PubMed
Bellanti et al. 2021	Italy	A cross-sectional study	293 nurses The sampling Method is not indicated. 71.8% response rate.	June- September 2020	A moderate to high EE 224 of nurses 76.5%. EE score was higher in females, nurses with at least one chronic disease, and nurse working for more than 20 years as compared to those working 1–5 years.	PubMed
Zhou et al. 2022	China	Multisite cross-sectional online survey	1133 nurses multistage, stratified sampling & convenient. 65% response rate.	September- October 2020	586 nurses reported EE 51.72%. Female nurses had higher EE, stage of COVID-19 outbreak, job tenure, monthly salary income, and night shift associated with EE.	PubMed
Susila & Laksmi 2022	Indonesia	cross-sectional study	85 nurses simple random. Response rate not mentioned	June 2021	Most of the respondents (72.9%) were in mild EE, 20% moderate, and 7.1 % were at a severe level of EE. Hospital resources, have comorbidities, and previous experience of treating patients with infectious diseases were associated with nurses EE.	PubMed

Table 2. Quality of the included cross-sectional studies

Item\Study	Chen et al. (2020)	Wan et al. (2022)	Zhang et al. (2020)	Kakemam et al. (2021)	Sagherian et al. (2020)	Jose et al. (2020)	Bellanti et al. (2021)	Zhou et al. (2022)	Susila & Laksmi (2022)
1. Were the criteria for inclusion in the sample clearly defined?	√	Unclear	√	√	√	√	unclear	√	√
2. Were the study subjects and the setting described in detail?	√	√	√	unclear	unclear	√	√	√	√
3. Was the exposure measured in a valid and reliable way?	√	√	√	√	√	√	√	√	√
4. Were objective, standard criteria used for measurement of the condition?	√	√	√	√	√	√	√	√	√
5. Were confounding factors identified?	√	No	√	No	√	No	No	No	No
6. Were strategies to deal with confounding factors stated?	√	No	√	No	√	No	No	No	No
7. Were the outcomes measured in a valid and reliable way?	√	√	√	√	√	√	√	√	√
8. Was appropriate statistical analysis used?	√	√	√	√	√	√	√	√	√