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REVIEW

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Nurses' burnout and associated risk factors during the COVID-19 pandemic: A systematic review and meta-analysis

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None.

Abstract

Aims: To examine the nurses' burnout and associated risk factors during the COVID-19 pandemic.

Design: We followed the Cochrane criteria and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines for this systematic review and meta-analysis.

Data Sources: PubMed, Scopus, ProQuest, Cochrane COVID-19 registry, CINAHL and pre-print services (medRχiv and PsyArXiv) were searched from January 1 to November 15, 2020 and we removed duplicates.

Review Methods: We applied a random effect model to estimate pooled effects since the heterogeneity between results was very high.

Results: Sixteen studies, including 18,935 nurses met the inclusion criteria. The overall prevalence of emotional exhaustion was 34.1%, of depersonalization was 12.6% and of lack of personal accomplishment was 15.2%. The main risk factors that increased nurses' burnout were the following: younger age, decreased social support, low family and colleagues readiness to cope with COVID-19 outbreak, increased perceived threat of Covid-19, longer working time in quarantine areas, working in a high-risk environment, working in hospitals with inadequate and insufficient material and human resources, increased workload and lower level of specialized training regarding COVID-19.

Conclusion: Nurses experience high levels of burnout during the COVID-19 pandemic, while several sociodemographic, social and occupational factors affect this burnout.

Impact: We found that burnout among nurses is a crucial issue during the COVID-19 pandemic. There is an urgent need to prepare nurses to cope better with COVID-19 pandemic. Identification of risk factors for burnout could be a significant weapon giving nurses and health care systems the ability to response in a better way against the following COVID-19 waves in the near future.

KEYWORDS
burnout, COVID-19, mental health, meta-analysis, nurses, prevalence, SARS-CoV-2, systematic review

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1 | INTRODUCTION

In December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and related disease (coronavirus disease 2019, COVID-19) emerged from the Wuhan, capital of Hubei province, China (Chan et al., 2020). The spread of SARS-CoV-2 infection is much broader than other recent epidemic infections (SARS, MERS) (Jiang et al., 2020) resulting on 58,712,326 cases globally and 1,388,528 deaths by November 24, 2020 (WHO Coronavirus Disease (COVID-19) Dashboard, 2020).

Health care workers (HCWs) represent a high-risk group for SARS-CoV-2 infection since the seroprevalence of SARS-CoV-2 antibodies among HCWs (Galanis et al., 2020) is higher than the general population (Chen et al., 2020b) worldwide (8.7% vs. 5.3%). A meta-analysis with data until 8 May 2020 found that 25.3% of deaths from COVID-19 among HCWs were nurses (259 of 1024), while mental health nurses were the highest risk group for deaths (Bandyopadhyay et al., 2020). According to the International Council of Nurses, 1500 nurses have died from COVID-19 in 44 countries up to 28 October 2020 (International Council of Nurses, 2020). In the USA, as of 16 September 2020, 31.9% (143 of 448) of the hospital HCWs who have died were nurses, while 12.4% (213 of 1718) of the HCWs who have died were nurses (National Nurses United, 2020). It is extremely likely that these numbers are probably an underestimation of the true number of deaths.

1.1 | Background

Several systematic reviews and meta-analyses have already shown that nurses present moderate to high levels of burnout syndromes (Adriaenssens et al., 2015; De la Fuente-Solana et al., 2019; Gómez-Urquiza et al., 2016; López-López et al., 2019; Owuor et al., 2020; Pradas-Hernández et al., 2018; Woo et al., 2020). The prevalence of burnout syndromes is different between geographical regions and specialties. In particular, Central Asia and Europe had the lowest burnout symptoms prevalence, while the Sub-Saharan Africa region had the highest (Owuor et al., 2020; Woo et al., 2020). Also, paediatric, oncology and emergency nurses had the highest burnout symptoms prevalence (Gómez-Urquiza et al., 2016, 2017; Parola et al., 2017; Pradas-Hernández et al., 2018). Burnout among nurses is a serious and frequent health issue carrying serious negative implications not only for nurses but also for patients, colleagues and health care organizations.

Nurses play an instrumental role in the health systems response to COVID-19 pandemic since they are the frontline health care workers directly involved in the treatment and care of patients (Hu et al., 2020; Liu et al., 2020; Zhan et al., 2020). Nurses are under extreme and persistent psychological pressure since they are particularly exposed to the threat of SARS-CoV-2 infection, and they become overwhelmed by fear for the safety of their own health, their close family members, and their patients (Joo & Liu, 2021). Under these circumstances nurses experience severe psychological and mental problems that could lead to burnout, and then to lower productivity, errors in clinical settings, and lack of concern in handling patients (Al Maqbali et al., 2021; Pappa et al., 2020; Salari et al., 2020). Since the second wave of COVID-19 is hitting worldwide, health care facilities with exhausted nurses are the worst scenario to confront the pandemic. To our knowledge, there is no systematic review to emphasize in nurses and especially in burnout during the COVID-19 pandemic. Also, given the exponential increase of studies on this research area a comprehensive review to examine the nurses' burnout during the COVID-19 pandemic is needed.

2 | THE REVIEW

2.1 | Aims

We aimed to examine the nurses' burnout and associated risk factors during the COVID-19 pandemic.

2.2 | Design

We followed the Cochrane criteria and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines for this systematic review and meta-analysis (Higgins et al., 2019; Moher et al., 2009).

2.3 | Search methods

PubMed, Scopus, ProQuest, Cochrane COVID-19 registry, CINAHL and pre-print services (medRχiv and PsyArXiv) were searched from January 1, 2020 to November 15, 2020 and we removed duplicates. We used the following strategy: ((nurs* OR “nursing staff” OR “health personnel” OR “healthcare workers” OR “healthcare personnel” OR “health care personnel” OR “health care workers”) AND (COVID-19 OR SARS-COV-2)) AND (burnout). Also, we searched the full reference lists of all selected articles.

2.4 | Search outcomes

We initially screened title and abstract of the records and then full-text. Two independent authors performed study selection and disagreements were resolved by a third, senior author. We applied the following inclusion criteria: studies that were published in English, studies examining nurses' burnout and associated risk factors during the COVID-19 pandemic; studies that used standardized and valid instruments to measure burnout; studies that included all types of nurses working in hospitals that treat COVID-19 patients. We

excluded studies reporting results in total for HCWs and not separately for nurses. Also, we excluded case reports, qualitative studies, reviews, protocols, editorials and letters to the Editor and studies that did not measure nurses' burnout.

2.5 | Quality appraisal

We assessed the quality of studies included using the Joanna Briggs Institute critical appraisal tools (Santos et al., 2018). This tool consisted of 9 items for prevalence studies, 8 items for cross-sectional studies and 11 items for cohort studies. One reviewer extracted the data and assessed the quality for all studies and a second reviewer checked this information for validity and completeness.

2.6 | Data abstraction

We used structured forms to extract data from each study, such as authors, location, gender, age, sample size, study design, sampling method, assessment tool, response rate, data collection time, publication (journal or pre-print service), number of nurses with burnout, scores on burnout scales, factors associated with burnout and the level of analysis (univariate or multivariable).

2.7 | Synthesis

For each study, we extracted the sample size and the number of nurses that experienced burnout according to scores on burnout scales. Then, we calculated the prevalence of burnout and the 95% confidence interval (CI) for each included study. Prevalence from each study was transformed with the Freeman-Tukey Double Arcsine method before pooling (Barendregt et al., 2013). We used the Hedges Q statistic and I^2 statistics to assess between-studies heterogeneity. A *p*-value <0.1 for the Hedges Q statistic indicates statistically significant heterogeneity, while I^2 values higher than 75% indicates high heterogeneity(Higgins, 2003). We applied a random effect model to estimate pooled effects since the heterogeneity between results was very high (Higgins, 2003). A priori, we considered sample size, publication type (journal or pre-print service), and the continent that studies were conducted as sources of heterogeneity. Due to the limited variability of these variables and the limited number of studies, we decided to perform meta-regression analysis only with sample size as the independent variable. We performed a leave-one-out sensitivity analysis to determine the influence of each study on the overall effect. We used a funnel plot and the Egger's test to assess the publication bias with a *p*-value <0.05 indicating publication bias (Egger et al., 1997). We did not a perform meta-analysis for the risk factors associated with nurses' burnout since the data were very limited and highly heterogeneous. Statistical analysis was performed with OpenMeta[Analyst] (Wallace et al., 2009).

3 | RESULTS

3.1 | Identification and selection of studies

Flowchart of the literature search is presented in Figure 1 according to PRISMA guidelines. Initially, we identified 439 potential records through electronic databases and 270 were left after removing duplicates. After the screening of the titles and abstracts, we removed 212 records and we added four more records found by the reference lists scanning. Finally, we included 16 studies (Aydin Sayilan et al., 2020; Buselli et al., 2020; Chen et al., 2020a; Chor et al., 2020; Cortina-Rodríguez & Afanador, 2020; Ferry et al., 2020; Hoseinabadi et al., 2020; Hu et al., 2020; Jalili et al., 2020; Khasne et al., 2020; Manzano García & Ayala Calvo, 2020; Matsuo et al., 2020; Prasad et al., 2020; Ruiz-Fernández et al., 2020; Tan et al., 2020; Zhang et al., 2020) in this systematic review that met our inclusion criteria and among them six studies in the meta-analysis included the appropriate data.

3.2 | Characteristics of the studies

Main characteristics of the 16 studies included in our systematic review are shown in Table 1. Study population included only nurses in six studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Hoseinabadi et al., 2020; Hu et al., 2020; Manzano García & Ayala Calvo, 2020; Zhang et al., 2020), while ten studies (Buselli et al., 2020; Chor et al., 2020; Cortina-Rodríguez & Afanador, 2020; Ferry et al., 2020; Jalili et al., 2020; Khasne et al., 2020; Matsuo et al., 2020; Prasad et al., 2020; Ruiz-Fernández et al., 2020; Tan et al., 2020) included HCWs in general. A total of 18,935 nurses were included in this systematic review, while two studies (Matsuo et al., 2020; Prasad et al., 2020) did not report the number of nurses. All studies were cross-sectional, while 13 studies (Buselli et al., 2020; Chen et al., 2020a; Chor et al., 2020; Hoseinabadi et al., 2020; Hoseinabadi et al., 2020; Hu et al., 2020; Jalili et al., 2020; Khasne et al., 2020; Manzano García & Ayala Calvo, 2020; Matsuo et al., 2020; Prasad et al., 2020; Ruiz-Fernández et al., 2020; Tan et al., 2020; Zhang et al., 2020) used a convenience sampling method, two studies (Cortina-Rodríguez & Afanador, 2020; Ferry et al., 2020) used a snowball sampling method, and one study used a random sampling method (Aydin Sayilan et al., 2020). Ten studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Chor et al., 2020; Hoseinabadi et al., 2020; Hu et al., 2020; Jalili et al., 2020; Khasne et al., 2020; Matsuo et al., 2020; Tan et al., 2020; Zhang et al., 2020) were conducted in Asia (China, India, Japan, Turkey, Singapore, Taiwan and Iran), four studies (Buselli et al., 2020; Ferry et al., 2020; García & Calvo, 2020; Ruiz-Fernández et al., 2020) in Europe (United Kingdom, Spain and Italy) and two studies (Cortina-Rodríguez & Afanador, 2020; Prasad et al., 2020) in North America (USA and Puerto Rico). Thirteen studies (Aydin Sayilan et al., 2020; Buselli et al., 2020; Chen et al., 2020a; Chor et al., 2020; Hoseinabadi et al., 2020; Hu et al., 2020; Khasne

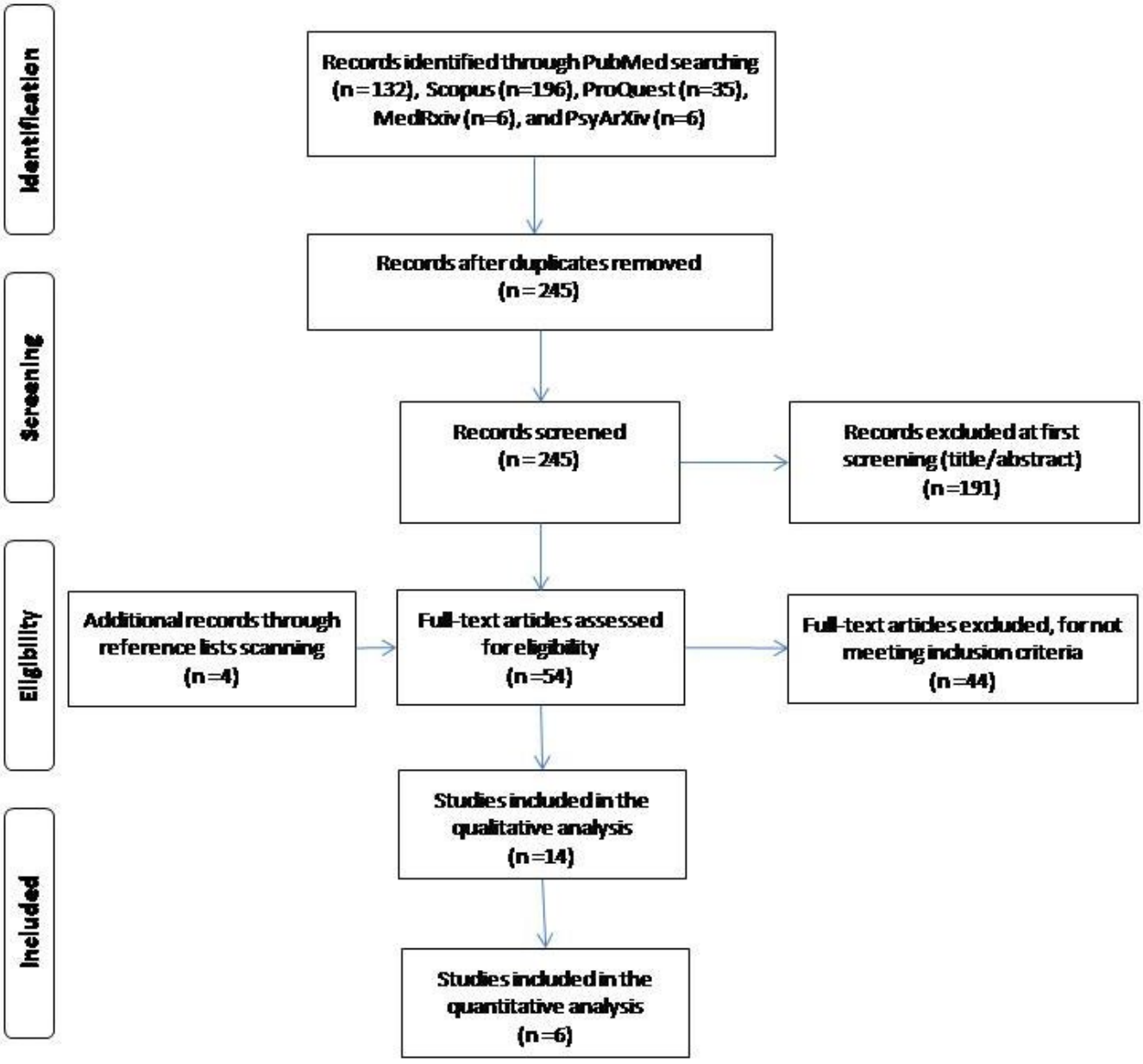

FIGURE 1 Flowchart of the literature search according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

et al., 2020; Manzano García & Ayala Calvo, 2020; Matsuo et al., 2020; Prasad et al., 2020; Ruiz-Fernández et al., 2020; Tan et al., 2020; Zhang et al., 2020) were published in journals and three studies (Cortina-Rodríguez & Afanador, 2020; Ferry et al., 2020; Jalili et al., 2020) in pre-print services. Limited data were available regarding response rate, gender and age.

3.3 | Measurement tools for burnout

Six standardized and valid questionnaires were used to measure burnout among nurses. The majority of studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Cortina-Rodríguez & Afanador, 2020; Hu et al., 2020; Jalili et al., 2020; Matsuo et al., 2020; Zhang et al., 2020) used the Maslach Burnout Inventory (MBI), three studies (Chor et al., 2020; Ferry et al., 2020; Khasne et al., 2020) used the Copenhagen Burnout Inventory, two studies (Buselli et al., 2020; Ruiz-Fernández et al., 2020) used the Professional Quality of Life Scale version 5, two studies (Hoseinabadi et al., 2020; Tan et al., 2020) used the Oldenburg Burnout Inventory (OLBI), one study (Prasad et al., 2020) used the Mini-Z and one study (García & Calvo, 2020) used the Spanish Burnout Inventory.

3.4 | Quality assessment

Quality assessment of cross-sectional studies in this review is shown in Table S1. The most frequent biases were that the studies did not

TABLE 1 Main characteristics of the studies included in this systematic review.

Reference	Location	Females (%)	Age, mean (SD)	Sample size (n)	Study design	Sampling method	Assessment tool	Response rate (%)	Data collection time	Publication in
Chen et al. (2020a)	China and Taiwan	95.6	33.1 (7.5)	12,596	Cross-sectional	Convenience sampling	MBI	NR	April	Journal
Aydin Sayilan et al. (2020)	Turkey	75.3	28 (6)	267	Cross-sectional	Random sampling	MBI	69.5	May 10–20	Journal
Buselli et al. (2020)	Italy	NR	NR	133	Cross-sectional	Convenience sampling	ProQOL-5	NR	April 1 to May 1	Journal
Chor et al. (2020)	Singapore	NR	NR	210	Cross-sectional	Convenience sampling	CBI	55.7	May	Journal
Cortina-Rodríguez and Afanador (2020)	Puerto Rico	NR	NR	23	Cross-sectional	Snowball sampling	MBI	NR	April 25 to May 25	Pre-print service
Ferry et al. (2020)	United Kingdom	NR	NR	286	Cross-sectional	Snowball sampling	CBI	NR	June 17–24	Pre-print service
Hu et al. (2020)	China	87.1	31 (6.2)	2101	Cross-sectional	Convenience sampling	MBI	99.6	February 13–24	Journal
Khasne et al. (2020)	India	NR	NR	198	Cross-sectional	Convenience sampling	CBI	NR	NR	Journal
Jalili et al. (2020)	Iran	NR	NR	300	Cross-sectional	Convenience sampling	MBI	NR	NR	Pre-print service
Manzano García and Ayala Calvo (2020)	Spain	90	42.4 (11.4)	771	Cross-sectional	Convenience sampling	SBI	39	April 15–30	Journal
Matsuo et al. (2020)	Japan	126	NR	NR	Cross-sectional	Convenience sampling	MBI	NR	April 6–19	Journal
Prasad et al. (2020)	USA	NR	NR	NR	Cross-sectional	Convenience sampling	Mini-Z	NR	April 14–25	Journal
Ruiz-Fernández et al. (2020)	Spain	NR	NR	398	Cross-sectional	Convenience sampling	ProQoL-5	NR	March 30 to April 16	Journal
Zhang et al. (2020)	China	90.7	30.3 (5.5)	107	Cross-sectional	Convenience sampling	MBI	97	March 10–14	Journal
Tan et al. (2020)	Singapore	NR	NR	1394	Cross-sectional	Convenience sampling	OLBI	31.1	May 29 to May 24	Journal
Hoseinabadi et al. (2020)	Iran	45.7	31.9 (6.5)	151	Cross-sectional	Convenience sampling	OLBI	92	March 10 to April 3	Journal

Abbreviations: CBI: Copenhagen Burnout Inventory; MBI: Maslach Burnout Inventory; NR: not reported; OLBI: Oldenburg Burnout Inventory; ProQOL-5: Professional Quality of Life Scale version 5; SBI: Spanish Burnout Inventory; SD: standard deviation.

take into account confounding factors and did not apply multivariable methods to eliminate them. Other frequent biases were that the study subjects and the settings were not described in detail and the criteria for inclusion in the sample were not clearly defined.

3.5 | Meta-analysis

Data regarding burnout scales were highly heterogeneous. Regarding the most frequent tool to measure burnout (MBI), the prevalence of nurses' burnout in three subscales (emotional exhaustion, depersonalization and personal accomplishment) was measured in six studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Cortina-Rodríguez & Afanador, 2020; Hu et al., 2020; Jalili et al., 2020; Zhang et al., 2020), while the mean burnout scores and standard deviations were measured in four studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Hu et al., 2020; Zhang et al., 2020). Four different studies (Buselli et al., 2020; Chor et al., 2020; García & Calvo, 2020; Ruiz-Fernández et al., 2020) measured total mean burnout score with four different instruments, while five other studies (Ferry et al., 2020; Khasne et al., 2020; Matsuo et al., 2020; Prasad et al., 2020; Tan et al., 2020) measured the prevalence of total burnout with four different instruments making the synthesis of these results in meta-analysis models counterintuitive. Thus, we decided to include in the meta-analysis the six studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; Cortina-Rodríguez & Afanador, 2020; Hu et al., 2020; Jalili et al., 2020; Zhang et al., 2020) that calculated the prevalence of nurses' burnout in three subscales of the MBI to improve comprehensiveness and clarity.

Descriptive statistics for nurses' burnout according to the measurement tools used in the studies included in this systematic review and meta-analysis are shown in Table 2.

The overall prevalence of emotional exhaustion among nurses according to the MBI was 34.1% (95% CI: 22.5–46.6%) (Figure 2). The prevalence of emotional exhaustion ranged from 5.6% to 69.6% with a very high heterogeneity between results (I^2=98.9%, p-value for the Hedges Q statistic <0.001). According to meta-regression analysis, the prevalence was independent of the sample size (p = 0.39). A leave-one-out sensitivity analysis showed that removal of studies had an influential effect on the pooled prevalence, which varied between 29.3% (95% CI: 17.9–42.2%), with Cortina-Rodríguez and Afanador (2020) excluded, and 41.4% (95% CI: 28.2–55.2%), with Zhang et al. (2020) excluded (Figure S1). The asymmetrical shape of the funnel plot (Figure S2) and p-value <0.05 for Egger's test implied potential publication bias.

Regarding nurses' depersonalization according to the MBI, the pooled prevalence was 12.6% (95% CI: 6.9–19.7%) (Figure 3), while the sample size did not affect it (p = 0.57). The heterogeneity between results was very high (I^2=98%, p-value for the Hedges Q statistic <0.001). Sensitivity analysis showed that removal of studies had a slight effect on the prevalence, which varied between 10.3% (95% CI: 5–17.3%), with Cortina-Rodríguez and Afanador (2020) excluded, and 16.3% (95% CI: 10.7–22.9%), with Aydin Sayilan et al. (2020) excluded (Figure S3). The funnel plot (Figure S4) and Egger's test (p-value <0.05) indicated potential publication bias.

The overall prevalence of nurses' lack of personal accomplishment according to the MBI was 15.2% (95% CI: 1.4–39.8%) (Figure 4). Very high heterogeneity between results was identified (I^2 = 99.8%, p-value for the Hedges Q statistic <0.001). Meta-regression analysis showed that the prevalence was independent of the sample size (p = 0.34). According to leave-one-out sensitivity analysis, removal of studies had a moderate effect on the prevalence, which varied between 10.2% (95% CI: 0–34.9%), with Cortina-Rodríguez and Afanador (2020) excluded, and 20.8% (95% CI: 2.2–51.2%), with Aydin Sayilan et al. (2020) excluded (Figure S5). The asymmetrical shape of the funnel plot (Figure S6) and p-value<0.05 for Egger's test implied potential publication bias.

3.6 | Risk factors for burnout

Five studies (Aydin Sayilan et al., 2020; Chen et al., 2020a; García & Calvo, 2020; Hu et al., 2020; Zhang et al., 2020) investigated risk factors for nurses' burnout during the COVID-19 pandemic and among them three (Aydin Sayilan et al., 2020; Chen et al., 2020a; García & Calvo, 2020; Hu et al., 2020; Zhang et al., 2020) used multivariable models to eliminate confounding factors (Table 3).

Sociodemographic factors (gender, age, educational level and degree) affected nurses' burnout. In particular, two studies (Chen et al., 2020a; Hu et al., 2020) found that females had higher levels of emotional exhaustion, but males had higher level of depersonalization (Hu et al., 2020) and lower level of personal accomplishment (Chen et al., 2020a). Also, younger age (Aydin Sayilan et al., 2020; Zhang et al., 2020), higher educational level (Aydin Sayilan et al., 2020; Hu et al., 2020) and higher degree (Zhang et al., 2020) increased nurses' burnout.

Several social factors increased nurses' burnout such as decreased social support (García & Calvo, 2020), having a relative/friend diagnosed with COVID-19 (Aydin Sayilan et al., 2020), low family and colleagues readiness to cope with the COVID-19 outbreak (Hu et al., 2020), increased perceived threat of Covid-19 (García & Calvo, 2020), and longer working time in quarantine areas (Zhang et al., 2020).

Occupational factors affected nurses' burnout during the COVID-19 pandemic to a large extent. Nurses that work in a high-risk environment e.g. a COVID-19 designated hospital, a COVID-19 unit or a critical care unit (Aydin Sayilan et al., 2020; Chen et al., 2020a) had higher level of burnout as well as nurses that work in hospitals with inadequate and insufficient material and human resources (García & Calvo, 2020). Also, nurses with lower levels of specialized training regarding COVID-19, job experience and self-confidence in caring for COVID-19 patients experienced burnout more frequently (Hu et al., 2020; Zhang et al., 2020). Increased workload, decreased self-confidence in self-protection and decreased working safety while caring for COVID-19 patients were associated with increased burnout (García & Calvo, 2020; Hu et al., 2020; Zhang et al., 2020).

TABLE 2 Descriptive statistics for nurses' burnout scales according to the measurement tools used in the studies included in this systematic review.

Reference	Assessment tool	Emotional exhaustion No. of nurses Mean score (SD)	Depersonalization No. of nurses Mean score (SD)	Lack of personal accomplishment No. of nurses Mean score (SD)	Total burnout No. of nurses Mean score (SD)	Sample size
García & Calvo Chen et al. (2020a)	MBI	2709 19.1 (10)	2279 5.5 (4.6)	145 19 (8.4)	NR	12,596
Aydin Sayilan et al. (2020)	MBI	90 23.7 (7.9)	3 17.1 (4.6)	0 17.6 (4.1)	NR	267
Buselli et al. (2020)	ProQOL-5	NR	NR	NR	19.9 (4.7)	133
Chor et al. (2020)	CBI	NR	NR	NR	112 51.3 (19.6)	210
Cortina-Rodríguez and Afanador (2020)	MBI	16 32 (NR)	9 9.8 (NR)	12 32.7 (NR)	NR	23
Ferry et al. (2020)	CBI	NR	NR	NR	245	286
Hu et al. (2020)	MBI	835 23.4 (13.8)	556 6.8 (7.1)	771 34.8 (10)	NR	2101
Khasne et al. (2020)	CBI	*Personal burnout* 101	*Work-related burnout* 76	*Pandemic-related burnout* 96	NR	198
Jalili et al. (2020)	MBI	159	40	1		300
Manzano García and Ayala Calvo (2020)	SBI	NR	NR	NR	2.5 (0.3)	771
Matsuo et al. (2020)	MBI	NR	NR	NR	59	126
Prasad et al. (2020)	Mini-Z	NR	NR	NR	83	104
Ruiz-Fernández et al. (2020)	ProQoL-5	NR	NR	NR	24.3 (5.7)	398
Zhang et al. (2020)	MBI	6 12.3 (7.1)	2 2.1 (2.8)	52 16.5 (8.4)	NR	107
Tan et al. (2020)	OLBI	*Exhaustion* 2.52 (0.46)	*Disengagement* 2.39 (0.43)	NR	990	1394
Hoseinabadi et al. (2020)	OLBI	*Exhaustion* 2.6 (0.2)	NR	NR	NR	151

Abbreviations: CBI: Copenhagen Burnout Inventory; MBI: Maslach Burnout Inventory; NR: not reported; OLBI: Oldenburg Burnout Inventory; ProQOL-5: Professional Quality of Life Scale version 5; SBI: Spanish Burnout Inventory; SD: standard deviation.

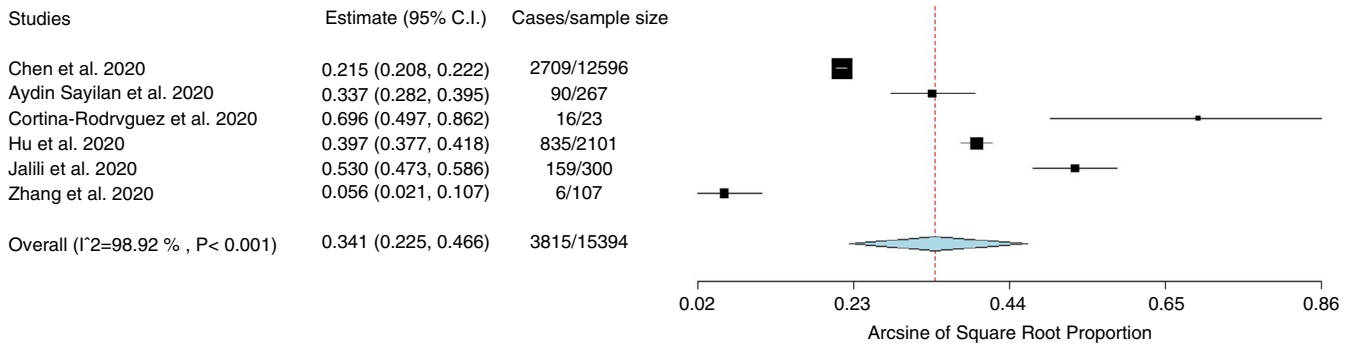

FIGURE 2 Forest plot of the prevalence of emotional exhaustion among nurses according to the Maslach Burnout Inventory.

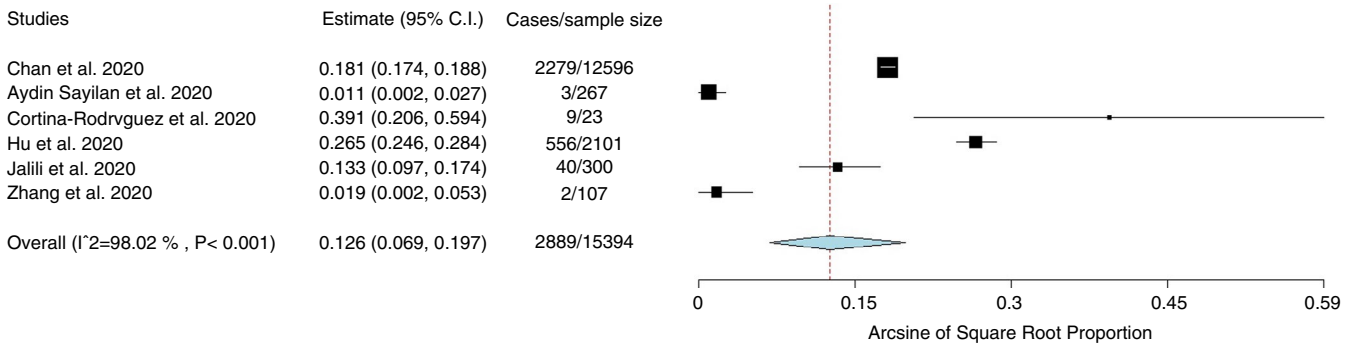

FIGURE 3 Forest plot of the prevalence of depersonalization among nurses according to the Maslach Burnout Inventory.

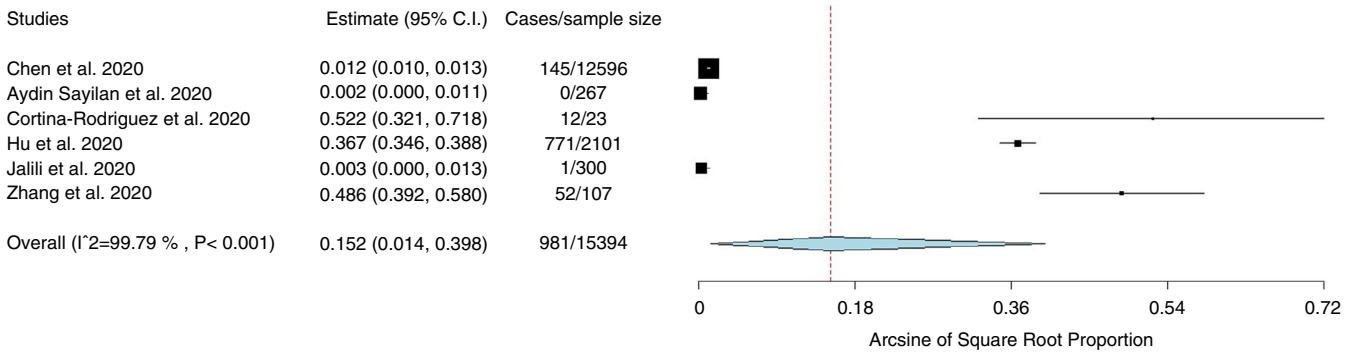

FIGURE 4 Forest plot of the prevalence of lack of personal accomplishment among nurses according to the Maslach Burnout Inventory.

4 | DISCUSSION

We conducted a comprehensive systematic review to investigate the prevalence of nurses' burnout during the COVID-19 pandemic and to identify associated risk factors. Also, we performed a meta-analysis examining the prevalence of three aspects of nurses' burnout according to the MBI; emotional exhaustion, depersonalization and lack of personal accomplishment.

We found a significant prevalence of nurses' burnout during the COVID-19 pandemic according to the MBI. In particular, 34.1%, 15.2% and 12.6% of nurses experienced high levels of emotional exhaustion, low personal accomplishment and depersonalization respectively. These levels of burnout are higher by far even among nurses working in a highly stressful environment such as palliative care; the prevalence of emotional exhaustion, low personal accomplishment and depersonalization is 19.5%, 9.3%, 8.2% respectively (Parola et al., 2017). Another meta-analysis (Woo et al., 2020) included data from 49 countries and found that the overall prevalence of burnout symptoms among nurses is 11.23%. Nurses during the COVID-19 pandemic have a higher level of emotional exhaustion, but lower level of depersonalization and higher level of personal accomplishment than mental health nurses (López-López et al., 2019), nurses in primary health care services (Monsalve-Reyes et al., 2018), nurses in gynecology and obstetrics services (De la Fuente-Solana

TABLE 3 Risk factors for nurses' burnout during the COVID-19 pandemic.

Reference	Emotional exhaustion	Depersonalization	Lack of personal accomplishment	Total burnout	Level of analysis
Chen et al. (2020a)	• Females (OR=1.30; 95% CI=1.09–1.54; $p = 0.003$) • Work in critical care unit (OR=1.23; 95% CI=1.12–1.33; $p < 0.001$) • Work in a COVID-19 unit (OR=1.14; 95% CI=1.04–1.29; $p = 0.006$) • Work in a COVID-19 designated hospital (OR=1.26; 95% CI=1.17–1.36; $p < 0.001$)	• Work in critical care unit (OR=1.15; 95% CI=1.06–1.25; $p = 0.001$) • Work in a COVID-19 unit (OR=1.20; 95% CI=1.08–1.33; $p = 0.001$) • Work in a COVID-19 designated hospital (OR=1.21; 95% CI=1.12–1.31; $p < 0.001$)	• Males (OR=1.96; 95% CI=1.35–2.77; $p < 0.001$) • No work in a COVID-19 unit (OR=2; 95% CI=1.12–3.57; $p = 0.019$)		Multivariable
Aydin Sayilan et al. (2020)	• Younger age (b = −0.35, SE = 0.12, $p = 0.005$) • Higher education (b = 3.6, SE = 1.8, $p = 0.047$) • Having a relative/friend diagnosed with COVID-19 (b = 0.8, SE = 0.2, $p < 0.001$) • Work in a COVID-19 unit (b = 4.1, SE = 0.02, $p < 0.001$)				Multivariable
Hu et al. (2020)	• Females ($0.01 < p < 0.05$) • Higher education ($p < 0.001$) • No prior training about COVID-19 patients ($0.001 < p < 0.01$) • No prior experience about COVID-19 patients ($0.001 < p < 0.01$) • No confidence in caring for COVID- 19 patients ($p < 0.001$) • No confidence in self-protection ($p < 0.001$) • No working safety while caring for COVID-19 patients ($p < 0.001$) • No family/colleagues/hospital readiness to cope with COVID-19 outbreak ($p < 0.001$)	• Males ($p < 0.001$) • Younger age ($p < 0.001$) • Decreased clinical experience ($0.001 < p < 0.01$) • Increased workload ($0.001 < p < 0.01$) • No confidence in caring for COVID- 19 patients ($p < 0.001$) • No confidence in self-protection ($p < 0.001$) • No working safety while caring for COVID-19 patients ($p < 0.001$) • No family/colleagues/hospital readiness to cope with COVID-19 outbreak ($p < 0.001$)	• Younger age ($0.001 < p < 0.01$) • Decreased clinical experience ($0.001 < p < 0.01$) • No prior training about COVID-19 patients ($p < 0.001$) • No confidence in caring for COVID- 19 patients ($p < 0.001$) • No confidence in self-protection ($p < 0.001$) • No working safety while caring for COVID-19 patients ($p < 0.001$) • No family/colleagues/hospital readiness to cope with COVID-19 outbreak ($p < 0.001$)		Univariate

(Continues)

TABLE 3 (Continued)

Reference	Emotional exhaustion	Depersonalization	Lack of personal accomplishment	Total burnout	Level of analysis
Manzano García and Ayala Calvo (2020)				• Increased workload (b = 0.2, 95% CI=0.07–0.15, $p < 0.001$) • Decreased social support (b = −0.15, 95% CI=−0.1 to −0.04, $p < 0.001$) • Decreased material and human resources (b = −0.11, 95% CI=−0.08 to −0.02, $p < 0.001$) • Increased perceived threat of Covid-19 (b = 0.4, 95% CI=0.11–0.16, $p < 0.001$)	Multivariable
Zhang et al. (2020)	• Younger age ($p = 0.042$) • Decreased clinical experience ($p = 0.027$) • Longer working time in quarantine areas ($p = 0.049$)	• Longer working time in quarantine areas ($p = 0.033$)	• Older age ($p = 0.026$) • Higher degree ($p = 0.04$) • Decreased clinical experience ($p = 0.024$)		Univariate

Abbreviations: CI: confidence interval; OR: odds ratio; SE: standard error.

et al., 2019), paediatric nurses (Pradas-Hernández et al., 2018) and emergency nurses (Gómez-Urquiza et al., 2017). Nurses' daily emotions have been greatly challenged during the COVID-19 pandemic since they are a high-risk group, they have close contact with COVID-19 patients, and they are afraid of the consequences of the disease. The negative emotions and feelings of patients, colleagues and family members can trigger similar emotions and feelings in nurses influencing perceived stress among them and making them more vulnerable to emotional exhaustion (Joshi & Sharma, 2020). Also, higher job demands, workload, job complexity, job pressure and working time during the COVID-19 pandemic increases work-related stress among nurses leading to emotional exhaustion. On the other hand, nurses during the COVID-19 pandemic experienced depersonalization and low personal accomplishment but not in higher levels than nurses working in a stressful environment such as mental health nurses, nurses in primary health care services, nurses in gynecology and obstetrics services, paediatric nurses and emergency nurses. This may be explained because of empathy and feelings that nurses have developed toward COVID-19 patients during a frightening situation that impacts all individuals' lives such as a pandemic. A pandemic may trigger compassionate behaviours among nurses connecting them with patients in a deeper level. Also, the effective treatment and care of COVID-19 patients improve nurses' moral feeling competent and successful in their duty.

Apart from burnout, HCWs experience several other negative psychological outcomes during the COVID-19 pandemic like depression, anxiety, post-traumatic stress disorder, psychological distress, sleep disturbances, insomnia and fear (Carmassi et al., 2020; Galli et al., 2020; Kisely et al., 2020; Luo et al., 2020; Pan et al., 2020; Pappa et al., 2020; Raudenská et al., 2020; Salari et al., 2020; Salazar de Pablo et al., 2020; Sanghera et al., 2020; Serrano-Ripoll et al., 2020; Shaukat et al., 2020; Stuijfzand et al., 2020). The situation is even worse for nurses since it is well-known that they struggle with burnout symptoms and other psychological issues more often than other HCWs resulting in negative consequences for themselves, their patients, their family members, their colleagues and the health care organizations (Pappa et al., 2020; Parola et al., 2017). Nurses who are exposed and in contact with verified or suspected COVID-19 patients are more often distressed, nervous and frightened (Rana et al., 2020). Moreover, nurses have extra concerns in the COVID-19 pandemic like the shortage of personal protective equipment, and the fear of being exposed at work, spreading the SARS-CoV-2, and taking the virus home to their close family members (Kisely et al., 2020). Thus, nurses are facing a continuous stress that may trigger post-traumatic stress, suicide ideation and suicide (Okechukwu et al., 2020). Also, this stress leads to burnout which will negatively affect the quality of health care that nurses provide to patients (Rupert & Morgan, 2005).

We found that several sociodemographic, social and occupational factors increase nurses' burnout during COVID-19 burnout. Gender is a controversial issue since our review showed that females have higher levels of emotional exhaustion, but males have higher level of depersonalization and lack of personal accomplishment. Also, three studies (Aydin Sayilan et al., 2020; García & Calvo, 2020; Zhang et al., 2020) did not find relation between gender and nurses' burnout increasing the uncertainty about this relation. After exposure to stressful events, females were more likely to be traumatized than males (De Stefano et al., 2018; Jones et al., 2020; Olff et al., 2007). In contrast, a meta-analysis (Cañadas-De la Fuente et al., 2018) with 57 studies found that being male is related to a higher level of burnout among nurses. Moderator variables (age, job satisfaction, position, clinical experience, etc.) should be taken into consideration to infer more valid results regarding the role of gender on nurses' burnout. Younger nurses are more likely to exhibit burnout during the COVID-19 pandemic than older nurses and this might be related to the fact that younger are less familiar with infection control and protective measures and less experienced in handling extreme events such as a pandemic (Tam et al., 2004). Probably, younger nurses are more vulnerable when facing difficult situations such as patients suffer and die from COVID-19 especially in cases where HCWs cannot offer the standard health care due to sources limitations.

According to our review, decreased social support is related to increased nurses' burnout during the COVID-19 pandemic. Psychological support that HCWs received during and after a pandemic can significantly influence their feelings and emotions handling in a better way during the negative effects of such a devastating event (Balicer et al., 2006; Kahn et al., 2016). Also, we found that longer working time in quarantine increases nurses' burnout. This result is confirmed by studies with nurses that work in quarantine areas during epidemics where loneliness has been recognized as a significant stressor (Hall et al., 2003; Kim, 2018). Loneliness is magnified in cases that nurses have to separate from their families and stay at designated hospitals as has happened in Wuhan, China (Zhang et al., 2020). Especially family and social support is an essential weapon for nurses to confront the psychological distress that have during epidemic outbreaks (Chan, 2004). A systematic review found that lack of social support is a crucial risk factor for the development of psychological problems in HCWs during disasters (Naushad et al., 2019). Support from families, friends, colleagues and health care organizations gives nurses the opportunity to control effectively and avoid negative feelings and emotions decreasing the danger of burnout syndrome. In particular, several studies show that a strong social support network during the COVID-19 pandemic can decrease feelings of isolation and strength resilience among HCWs (Hou et al., 2020; Southwick & Southwick, 2020; Wu et al., 2020).

Moreover, we found that nurses having a relative/friend diagnosed with COVID-19 experience a higher level of burnout. The COVID-19 pandemic and public health response to it ultimately had changed work and life conditions such as other epidemic outbreaks e.g. SARS. In that case, nurses worry more about the health of their close family members/friends/colleagues than their own (Maunder et al., 2003; Tam et al., 2004). Nurses try to avoid close contact in purpose, to reduce the spread of SARS-CoV-2 to their family members/friends/colleagues. Thus, nurses' home and social life are significantly disrupted resulting in fear, anxiety and

psychological distress. Also, caring for relatives/friends/colleagues as patients is emotionally difficult and exhausted. Especially in the case that nurses take care of their colleagues suffer from the fear of their own personal vulnerability (Maunder et al., 2003; Tam et al., 2004).

We found that nurses working in a high-risk clinical environment (a COVID-19 designated hospital, a COVID-19 unit, hospitals with inadequate and insufficient material and human resources, low working safety while caring for COVID-19 patients, etc.) have a higher level of burnout. This finding is confirmed by previous research during the SARS outbreak (Lee et al., 2007). A high-risk clinical environment is an important source of distress for nurses increasing feelings of loss of control or vulnerability and concerns about the spread of SARS-CoV-2, the health of family members/friends/colleagues, and changes in home and work life (Wong et al., 2005). In addition, the severe shortage in personal protective equipment and nursing staff and the increasing number of suspected and actual COVID-19 cases add more pressure to nurses (Chan-Yeung, 2004).

Our review identified that poor working conditions like increased workload, low level of specialized training regarding COVID-19, and increased working times increase the level of burnout among nurses. Several studies have already shown that nurses exhibit burnout due to the prolonged direct personal contact with a great number of patients (Levert et al., 2000; van der Doef et al., 2012) as well as the inadequate staffing and resources (Klopper et al., 2012; Nantsupawat et al., 2017; Toh et al., 2012). Also, poor working conditions are an important risk factor for work-related stress and job dissatisfaction that end up on high levels of emotional exhaustion, depersonalization and low level of personal accomplishment among nurses (Chayu & Kreitler, 2011; Garrosa et al., 2010; Lasebikan & Oyetunde, 2012; Lee & Akhtar, 2011). A low level of specialized training regarding COVID-19 is an issue that needs special attention since knowledge, control measures and personal protective equipment against COVID-19 are limited. Pandemic (H1N1) 2009 (Imai et al., 2010) and SARS epidemic (Liu et al., 2012) underline nurses' concern about inadequate training and expertise in handling challenging health care issues. There is a need for nurses to obtain new knowledge and skills about COVID-19 to built their confidence in providing health care under this extreme situation. Well-trained nurses could improve their self-efficacy that is necessary to confront disasters such a pandemic (Kılıç & Şimşek, 2019).

It is worth noting that protective factors regarding nurses' burnout were found in some studies such as belief in readiness to cope with COVID-19 outbreak, willingness to participate in frontline work, prior training and experience in COVID-19 patients' management, protection safety during the clinical work, and increased social support (García & Calvo, 2020; Hu et al., 2020). Since burnout is a multifactorial issue researchers should emphasize the importance of protective factors revealing at least the most important of them.

Another issue that should be addressed is that some variables found not be significantly associated with burnout in multivariable regression analysis but may have important implications and there is a need for further investigation. For instance, working in a COVID-19 unit, caring for COVID-19 patients who died, role conflict, role ambiguity and autonomy were not related to burnout (Aydin Sayilan et al., 2020; Chen et al., 2020a; García & Calvo, 2020).

4.1 | Limitations

There were some limitations in this systematic review and meta-analysis. There were different sources of bias. First, only three studies of 16 eliminated confounding through multivariable methods. Usually, control of confounding decreases the value of measures of effect (e.g. odds ratio) and the number of independent variables that are related to the dependent variable (e.g. nurses' burnout). Probably this is the case in our review also but the real effect of confounding on nurses' burnout is impossible to determine. Since nine studies included health care professionals in general and not only nurses, the study subjects and the settings were not described in detail in many studies included in our review. Thus, due to the limited data and the limited number of studies, subgroup analysis and meta-regression analysis using nurses' characteristics (e.g. gender, age, response rate, etc.) as the independent variables cannot be performed. Another frequent bias was that the criteria for inclusion in the study sample were not clearly defined. In that case, we cannot be certain about the direction of effects on nurses' burnout since we cannot understand the study participants in a clear way. Finally, in some cases, the exposure was not measured in a valid and reliable way and a misclassification bias is possible.

Also, only one study used a random sample, nine studies had a small sample size (≤300 nurses), and three studies collected data from China. Thus representativeness may be a potential limitation and studies with large random samples worldwide should be conducted.

Data regarding risk factors for nurses' burnout during the COVID-19 pandemic were available only in five studies and among them, three used multivariable methods to eliminate confounders. Also, several risk factors (social support, relatives diagnosed with COVID-19, insufficient resources and longer working time in quarantine areas) were examined only in one study and further research is needed to infer valid results.

Moreover, we searched five major databases and pre-print services as well as the full reference lists of all selected articles but there is still the probability to not identify some studies e.g. in grey literature. Also, we did not use MeSH terms in our search strategy and papers may be omitted. The heterogeneity between results was very high and we applied random effects model to handle this issue. Additionally, we included studies that used standardized and valid instruments to measure burnout but these data are still self-reported and inherently subjective. Moreover, only cross-sectional studies with convenience or snowball sampling method were identified making definite causal relationships impossible.

5 | CONCLUSION

Nurses experience high levels of burnout during the COVID-19 pandemic, while several sociodemographic, social and occupational factors affect this burnout. The COVID-19 pandemic is a significant challenge for nurses worldwide and learning lessons from the first wave is imperative to prepare better strategies for the subsequent waves. Several measures could be introduced to mitigate the mental health impact of the COVID-19 pandemic on nurses, e.g. screening for mental health illness and early supportive interventions for high-risk nurses, immediate access to mental health care services, designated rest periods, social support through hospital support groups to reduce feelings of isolation, sufficient personal protective equipment for all nurses to provide security etc. As the second wave of the COVID-19 pandemic is hitting worldwide and there are predictions for the following waves in the near future, there is a need to decrease nurses' burnout and improve their mental health. Governments, health care organizations, and policymakers should act in this direction to prepare health care systems, individuals and nurses for a better response against the COVID-19 pandemic.

CONFLICTS OF INTEREST

None.

AUTHOR CONTRIBUTIONS

P.G., I.V. and D.K. were responsible for the conception and design of the study. P.G., I.V., D.F. and A.B. were responsible for the acquisition, analysis and interpretation of the data. All the authors drafted the article or revised it critically for important intellectual content, and provided final approval of the version to be submitted.

PEER REVIEW

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