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REVIEW ARTICLE

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Moral injury and mental health among health-care workers during the COVID-19 pandemic: meta-analysis

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ABSTRACT

Background: During the COVID-19 pandemic, health-care workers (HCWs) may have been confronted with situations that may culminate in moral injury (MI). MI is the psychological distress that may result from perpetrating or witnessing actions that violate one's moral codes. Literature suggests that MI can be associated with mental health problems.

Objective: We aimed to meta-analytically review the literature to investigate whether MI is associated with symptoms of posttraumatic stress disorder (PTSD), anxiety, depression, burnout, and suicidal ideation among active HCWs during the COVID-19 pandemic.

Method: We searched eight databases for studies conducted after the onset of the COVID-19 pandemic up to 18 July 2023, and performed random-effects meta-analyses to examine the relationship between MI and various mental health outcomes.

Results: We retrieved 33 studies from 13 countries, representing 31,849 individuals, and pooled 79 effect sizes. We found a positive association between MI and all investigated mental health problems ($rs = .30–.41$, all $ps < .0001$). Between-studies heterogeneity was significant. A higher percentage of nurses in the samples was associated with a stronger relationship between MI and depressive and anxiety symptoms. Samples with a higher percentage of HCWs providing direct care to patients with COVID-19 exhibited a smaller effect between MI and depressive and anxiety symptoms. We observed a stronger effect between MI and PTSD symptoms in US samples compared to non-US samples.

Conclusion: We found that higher MI is moderately associated with symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation among HCWs during the COVID-19 pandemic. Our findings carry limitations due to the array of MI scales employed, several of which were not specifically designed for HCWs, but underscore the need to mitigate the effect of potentially morally injurious events on the mental health of HCWs.

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KEYWORDS

Moral injury; healthcare workers; mental health; meta-analysis; COVID-19; PTSD; nurses; betrayal; depression; suicide

PALABRAS CLAVE

Daño moral; trabajadores de la salud; salud mental; metanálisis; COVID-19; trastorno de estrés postraumático; enfermeras; traición; depresión; suicidio

HIGHLIGHTS

- We conducted the first meta-analysis of moral injury and mental health among healthcare workers.
- Moral injury is moderately associated with symptoms of PTSD, depression, anxiety, burnout, and suicidal ideation.
- There was a stronger association between MI and anxiety and depressive symptoms for samples with more nurses.

Daño moral y salud mental entre los trabajadores de la salud durante la pandemia de COVID-19: metanálisis

Antecedentes: Durante la pandemia de COVID-19, los trabajadores de la salud (PS) pueden haberse enfrentado a situaciones que pueden culminar en un daño moral (MI en su sigla en inglés). MI es el malestar psicológico que puede resultar de perpetrar o presenciar acciones que violan los propios códigos morales. La literatura sugiere que el MI puede estar asociada con problemas de salud mental.

Objetivo: Nuestro objetivo fue revisar metanalíticamente la literatura para investigar si el MI está asociado con síntomas de trastorno de estrés postraumático (TEPT), ansiedad, depresión, burnout e ideación suicida en los trabajadores sanitarios activos durante la pandemia de COVID-19.

Método: Buscamos en ocho bases de datos estudios realizados después del inicio de la pandemia de COVID-19 hasta el 18 de julio de 2023 y realizamos metanálisis de efectos aleatorios para examinar la relación entre el MI y diversos resultados de salud mental.

Resultados: Recuperamos 33 estudios de 13 países, que representan a 31.849 personas, y agrupamos 79 tamaños del efecto. Encontramos una asociación positiva entre el MI y todos los problemas de salud mental investigados ($rs = .30$ a $.41$, todos $ps < .0001$). La heterogeneidad entre estudios fue significativa. Un mayor porcentaje de enfermeros en las

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muestras se asoció con una relación más fuerte entre el MI y los síntomas depresivos y de ansiedad. Las muestras con un mayor porcentaje de trabajadores sanitarios que brindaban atención directa a pacientes con COVID-19 mostraron un efecto menor entre el MI y los síntomas depresivos y de ansiedad. Observamos un efecto más fuerte entre los síntomas de MI y TEPT en muestras de los EE. UU. en comparación con muestras de fuera de los EE. UU.
Conclusión: Descubrimos que un MI más alto se asocia moderadamente con síntomas de trastorno de estrés postraumático, ansiedad, depresión, burnout e ideación suicida en los trabajadores sanitarios durante la pandemia de COVID-19. Nuestros hallazgos tienen limitaciones debido a la variedad de escalas de MI empleadas, varias de las cuales no fueron diseñadas específicamente para los trabajadores sanitarios, pero destacan la necesidad de mitigar el efecto de eventos potencialmente moralmente dañinos en la salud mental de los trabajadores sanitarios.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic emerged as a significant threat to global health and represented a major challenge to healthcare systems worldwide (Arshad Ali et al., 2020). Health-care workers (HCWs) are highly exposed to COVID-19 in the work environment. The high incidence of infection rates, development of severe symptoms, hospitalisations, and mortality among HCWs are well documented, leading governments and health organisations to acknowledge COVID-19 as an occupational disease (Kambhampati et al., 2020; Limb, 2021; Mutambudzi et al., 2020; Rothan & Byrareddy, 2020; Sandal & Yildiz, 2021).

In addition to the physical health risks, the pandemic also caused severe psychosocial disruptions for HCWs, as many were forced to live separately from their loved ones to limit virus exposure (Williams et al., 2020). Furthermore, increased demands and workload, redeployment, job insecurities, and acquiring new practices further burdened HCWs throughout the pandemic (Smallwood et al., 2022). These difficulties were elevated by resource scarcity experienced in many hospitals across the world, leaving HCWs without the means to provide adequate treatment for patients and often forcing HCWs to make difficult decisions, such as whom to assign a ventilator or a bed in an intensive care unit (Rosenbaum, 2020). This is inconsistent with therapeutic values (Amsalem et al., 2021; Litam & Balkin, 2021). As a result, some HCWs may have been challenged to face exceptional ethical dilemmas that are morally stressful, potentially generating significant degrees of distress known as moral injury (Riedel et al., 2022; Williamson et al., 2020).

Moral injury (MI) is the profound psychological distress that may result from exposure to multiple situations involving perpetrating or witnessing actions that violate one's core beliefs (Litz et al., 2009; Yeterian et al., 2019). MI is about the transgressions of the individual's moral codes when one betrays 'what is right' and the overwhelming feelings of self-condemnation, spiritual struggles, and inner conflict over the moral implications of those transgressions (Jinkerson, 2016; Koenig et al., 2019; Shay, 2014). MI imposes high emotional risks, as the individual can feel that their violations are beyond repair, resulting in shame, guilt, despair, and demoralisation (Jones, 2020; Litz et al., 2009). Evidence suggests that MI is associated with cognitive and behavioural alterations such as social withdrawal and suicidal behaviour, burnout, and with psychiatric disorders such as posttraumatic stress disorder (PTSD), depression, and anxiety (Bryan et al., 2018; Fani et al., 2021; Hall et al., 2022; Rodríguez et al., 2021; Testoni et al., 2022; Williamson et al., 2023, 2018).

MI was first theorised as a consequence of experiences related to military activity (Shay, 2010). Combatants who harm others (whether or not within the rules of engagement), who fail to prevent immoral acts, and who witness atrocities that are irreconcilable with their moral codes are at risk of developing significant levels of MI (Frankfurt & Frazier, 2016; Schorr et al., 2018). Moreover, MI may involve the belief that the individual has been betrayed by a person or institution of legitimate authority, who compelled them to act or omit themselves in ways that culminated in severe ethical violations (Griffin et al., 2019). Although MI has been recognised as a common syndrome among veterans, only recently has it been considered to affect HCWs (Kopacz et al., 2019; ter Heide & Olff, 2023). HCWs often work extended hours in 'high-stakes situations' and are frequently burdened by pressures from hospital administrators and the healthcare system (Mantri et al., 2020). The COVID-19 pandemic aggravated these pressures unprecedentedly, leaving HCWs directly involved in COVID-19 care to make difficult decisions regarding patient care and consequently at increased risk of MI (Greenberg et al., 2020). However, these struggles may have also affected HCWs who are not necessarily providing direct care for patients with COVID-19. Since most resources may have been invested to

mitigate symptoms of patients suffering from COVID-19, patients with other illnesses may have been left unattended, with subsequential increases in morbidity and mortality (Lai et al., 2020; Zhu et al., 2021).

Two published meta-analyses examined the effect of moral injury on mental health. Williamson et al. (2018) found a positive association between MI and symptoms of PTSD, depression, and suicidal ideation (Williamson et al., 2018). More recently, McEwen et al. (2021) confirmed the findings by Williamson et al. and reported an effect of MI on anxiety symptoms (McEwen et al., 2021). However, both meta-analyses included articles of studies conducted before the COVID-19 pandemic, and none of the included studies enrolled samples of HCWs, suggesting a complete lack of meta-analytical evidence to date on the impact of MI on mental health in this population.

In the present article, we aimed to meta-analytically review the literature and investigate whether moral injury is associated with symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation among active health-care workers worldwide during the COVID-19 pandemic. We hypothesised that we would find statistically significant positive associations between MI and all investigated mental health problems. Further, we hypothesised that we would find a stronger association between MI and mental health problems among those caring directly for patients with COVID-19 than those caring for other conditions. Understanding the magnitude of the association between MI and mental health problems during the pandemic may help minimise suffering among HCWs. Furthermore, despite the World Health Organization's declaration of the conclusion of the COVID-19 emergence, the associated stressors may continue to persist among a substantial number of healthcare workers (Wise, 2023). Thus, it is warranted to investigate the effects of MI on mental health among those who were providing health care during the COVID-19 emergence.

2. Method

2.1. Search strategy

We retrieved articles from Embase, PubMed, PsycINFO, PTSDpubs, and Scopus with a publication date between 2019 and 18 July 2023. We used MeSH terms related to moral injury, COVID-19, and mental health and performed a comprehensive literature search (see supplementary material, Part 1, for search strategy). Two reviewers (BMC and CZ) screened the initial 50 retrieved records together and the subsequent 150 retrieved records independently. The independent search yielded an excellent interrater agreement (kappa coefficient = .78), and one reviewer (BMC) screened the remaining records. Additionally, one reviewer (BMC) performed a non-systematic search of studies in Google Scholar and a search for eligible theses in ProQuest Dissertations and EThOS. We also hand-searched references of eligible articles to identify potential missing studies in our search strategy. The meta-analytic review was performed according to the updated guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Page et al., 2021). The protocol for the meta-analysis was preregistered at PROSPERO (International prospective register of systematic reviews) in December 2022 with the preregistration code CRD42022382075.

2.2. Eligibility criteria

Eligible studies were those that performed a quantitative investigation of the relationship between MI and symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation among active HCWs during the COVID-19 pandemic. Studies enrolling HCWs not active in the COVID-19 frontline – and therefore not providing direct care to patients suffering from COVID-19 – were also eligible. Articles must have used a previously validated instrument to measure mental health symptomatology to be eligible. Furthermore, articles must have used a validated instrument to measure MI to be eligible. Studies measuring potentially morally injurious events without a validated MI instrument were excluded. However, we included studies using an abbreviated version of a validated MI scale. Furthermore, to investigate the association between MI and PTSD symptoms, we included studies that did not necessarily use a PTSD scale with the presence of a criterion A event, as exemplified by scales like the PTSD Checklist for DSM-5 (PCL-5) or the International Trauma Questionnaire (ITQ). For studies using the Professional Quality of Life Scale (PROQOL) and the Compassion Fatigue Scale (CF-S), we pooled the effect size related to the secondary traumatic stress dimension to investigate the relationship between MI and PTSD symptoms. For studies measuring burnout with the Maslach Burnout Inventory (MBI), we pooled the effect size related to the emotional exhaustion dimension. Qualitative studies, reviews, and articles written in languages other than English were excluded.

2.3. Data extraction and studies quality rating

One reviewer (BMC) extracted the following data from each study, if available: (a) author name, (b) publication year, (c) mean participant age with standard deviation, (d) the percentage of female-identifying individuals, (e) health-care workers profession (with the percentage of nurses and physicians), (f) years of practice (mean), (g) the percentage of the sample caring directly for patients with COVID-19,

(h) instrument used to measure MI, (i) instrument(s) used to measure PTSD, anxiety, depression, burnout and/or suicidal ideation; (j) location (country), (k) effect sizes (Pearson's *r*) for the relationship between MI and mental health without covariates. Another reviewer (CZ) double-checked the data extraction to identify potential errors.

The quality ratings of the selected studies were performed by two independent reviewers (BMC and CZ) using the Joanna Briggs Institute (JBI) Critical Appraisal checklist for Analytical Cross-Sectional studies (Moola et al., 2020). The JBI quality tool is divided into eight dichotomous items covering several aspects of the evaluated study. Raters score each item *yes* or *no* and then sum all the eight items scored *yes* to give a final score (range 0–8). A higher score represents better study quality. Disagreements on the quality of the studies were resolved with the help of a third reviewer (AFM).

2.4. Statistical analyses and moderators

We performed all meta-analyses using the *Metafor* package in the statistical programming environment R V.4.1.3 (Team, 2022; Viechtbauer, 2010). We determined the association between MI and mental health by pooling the effect sizes (without covariates) measured as Pearson's correlation coefficient (*r*) between MI and symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation. The aggregated effect sizes were calculated with a 95% confidence interval using a random-effect model with the *rma* function in *Metafor*. A positive Pearson's *r* would indicate a positive relationship between MI and the investigated mental health problem. If the eligible studies did not provide sufficient data for calculating the effect size(s), we contacted the authors and requested additional data. Of the 23 studies from which we could not determine Pearson's *r* in the papers, we obtained 19 responses from authors with the requested data. Authors from one article did not respond to our e-mails, and authors from three articles responded that they were unable to share data.

We assessed heterogeneity between studies through random-effects models using Cochran's Q index and I^2 statistic (Higgins & Thompson, 2002). If the Q index was below $p < .05$ and the I^2 value was over 50% (indicating significant heterogeneity), we performed moderation analyses with a meta-regression approach by fitting mixed-effect models. Meta-regression allows determining which study-level characteristics account for heterogeneity (West et al., 2010). We examined the following variables as potential moderators of the relationship between MI and mental health problems: mean age, years of practice (mean), percentage of female-identifying individuals, percentage of nurses and physicians, percentage of individuals in the sample caring directly for patients with COVID-19, study quality ratings, location, and MI measure. We compared the MISS-HP with other MI scales for MI measure, as the MISS-HP was designed to assess MI specifically among HCWs (Mantri et al., 2020). We compared studies that measured secondary traumatic stress symptoms with those employing PTSD symptom measures. If studies did not include our selected moderators, we contacted authors and requested data.

To explore publication bias, we visually inspected funnel plots for asymmetry coupled with two rank tests to assess statistical evidence for funnel asymmetry: Kendall's tau correlation coefficient (Begg & Mazumdar, 1994) and Egger's test (Egger et al., 1997). Furthermore, we used Duval and Tweedie's trim and fill procedure to inform the number of missing studies in the analysis, adjusting for the potential effect on the overall effect (Duval & Tweedie, 2000). If missing studies were filled in the funnel plot after Duval and Tweedie's method, it indicated publication bias. Lastly, if the results of the meta-analyses were statistically significant, we used Rosenberg's, Rosenthal's, and Orwin's fail-safe tests to assess the robustness of the results (Orwin, 1983; Rosenberg, 2005; Rosenthal, 1979). Fail-safe statistics are relevant because they provide a perspective of the stability of the obtained results. They estimate the number of null-effect studies needed to bring the aggregated effect to a nonsignificant level (i.e. $p > .05$). If the fail-safe *N* is large, the aggregated effect of the meta-analysis suggests reliability (Carson et al., 1990).

3. Results

3.1. Search results

The complete study identification process is delineated in the PRISMA diagram (Figure 1). Our search strategy yielded 902 records through PubMed, Embase, PsycINFO, PTSDpubs, and Scopus, of which 173 were duplicates that were removed using *Endnote* software's automation tool. The automation tool did not identify several duplicates, and we removed these duplicates manually ($k = 289$). Of the remaining 440 records, we excluded 232 based on the title. Further, we assessed the abstracts of the remaining records and excluded 124 records based on their abstracts as studies did not meet inclusion criteria (see Figure 1 for reasons). We retrieved 84 full-text articles, of which 40 were excluded (see Figure 1 for reasons). Thus, 44 articles investigating associations between MI and mental health among HCWs were identified through the systematic search. No studies were identified through reference list review or EThOS. However, we identified one eligible thesis (de Groot, 2021), one accepted manuscript in press (Lennon et al., 2023), two pre-prints in Google Scholar

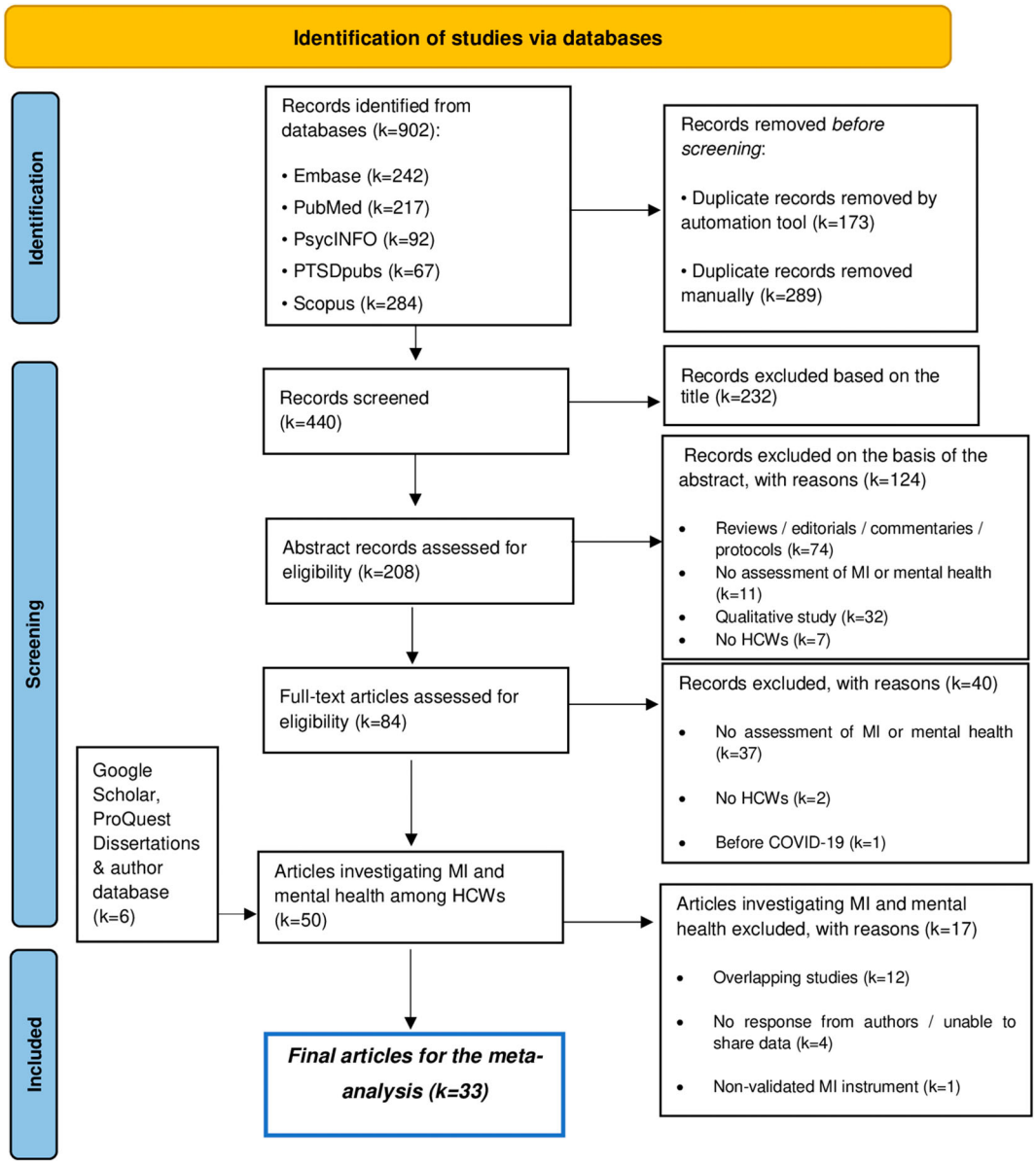

Figure 1. Flow diagram of the systematic search.

(Ma et al., 2022; Thomas et al., 2023), and one eligible thesis in ProQuest Dissertations (Kimble, 2023). Additionally, when contacting authors from one eligible article (Morris et al., 2022), they shared data from a recently finalised, unpublished study (Morris, 2022). Of the 50 articles investigating MI and mental health, we removed 17 articles from the quantitative synthesis (see Figure 1 for reasons). Our search resulted in 33 eligible articles for the quantitative synthesis.

3.2. Characteristics of the included studies and pooled effect sizes

We present the characteristics of the eligible articles in Table 1 and all the pooled effect sizes for the meta-analysis in Table 2. The 33 eligible studies were from 13 different countries, of which the US was the most frequent contributor in the number of studies (k = 11) and the UK in enrolled HCWs number (n = 14,815).[1] Six studies were from Asia, 12 from Europe, two from Latin America (Cooper-Bribiesca et al., 2023; Rodríguez et al., 2021), and one enrolled participants from several countries (Thomas et al., 2023). The 33 studies involved n = 31,849 participants (range of n = 33–12,965). Except for one study (sertozen & kalaycioglu, 2022), female-identifying individuals were the majority in all studies. The samples' mean age was >28 years for all studies where the mean age was available. On average, 62.1% of HCWs in the samples were directly caring for patients with COVID-19; however, this information was only accessible for 12 studies. The average number of years of experience for HCWs was 11.1, but participant inquiries regarding years on the job were only conducted in seven studies. Most studies (k = 23) collected data in 2020 and/or 2021, while four collected data in 2022, two in 2021–22, and four did not specify the year.

Table 1. Selected characteristics of studies examining the association between moral injury and mental health problems.

Study	*N*	Mean age (SD)	Females (%)	Profession (with % of physicians and nurses)	Years of practice (mean)	MI measure	Providing care for patients with COVID-19 (%)	Psychiatric measures	Location	Quality ratings
Amsalem et al. (2021)	350	34.8 (11.5)	74	Physicians (15), nurses (68), pharmacists, physical therapists, other	NR	MIES	NR	PTSD (PC-PTSD), depression (PHQ-9), anxiety (GAD-7), suicidal ideation (PHQ-9)	US	7
Dale et al. (2021)	265	37.62 (11.08)	81.9	NR	NR	MIES (reduced)	NR	PTSD (PCL-5), depression (PHQ-9), anxiety (GAD), PFI (burnout)	US	6
de Groot (2021)	33	28.9 (11.2)$^{++}$	93.9^{++}	NR	NR	MIAS	100	PTSD (PCL-5)	Netherlands	4
Dias et al. (2021)	86	40.6 (11.7)	65.1	Physicians (25.6), nurses (47.7), other	NR	MISS-SF	100	PTSD (PCL-5), burnout (PFI)	US	4
Litam and Balkin (2021)	109	35.5 (NR)	76	Physicians (36.7), nurses (56.88)	12.30	MIES	NR	PTSD (PROQOL), burnout (PROQOL)	US	6
Mantri et al. (2021)	1831	NR	90	Physicians (15.4), nurses (50.4), APP	NR	MISS-HP	NR	Burnout (MBI)	US	7
Rodríguez et al. (2021)	169	36.04 (10.46)	76.33	Physicians (86.39), nurses (13.61)	8.84	MISS-HP	NR	Depression (PHQ-9), anxiety (GAD-7), suicidal ideation (PHQ-9)	Honduras	7
Zerach & Levi-Belz (2021)	296	40.28 (10.83)	77.6	Physicians (36.3), nurses (43.4), social workers, other	12.67	MISS-HP	31.75	PTSD (ITQ), depression (PHQ-9), anxiety (GAD-7), suicidal ideation (PHQ-9)	Israel	8
Chandrabhatla et al. (2022)	37	NR	54	Physicians (100)	6.8	MIES	NR	Burnout (Mini Z Burnout Survey)	US	4
Chug & Babasa (2022)	129	35.77 (8.5)	52.7	Physicians (100)	NR	MISS-HP	100^{++}	Depression (K10), anxiety (K10), burnout (MBI)	Philippines	4
Gherman et al. (2022)	614	38.1 (8.6)	85.3	Nurses (100)	12.7	MIES	NR	Burnout (MBI)	Romania	7
Hagerty & Williams (2022)	1122	39.29 (NR)	88.8	Physicians (5), nurses (60.4), physician assistants, respiratory therapists	NR	MIES	NR	PTSD (PCL-5), suicidal ideation (PHQ-9)	US	7
Jovarauskaite et al. (2022)$^{+}$	206	42.34 (11.68)	97.1	Nurses (100)	NR	MIOS	NR	PTSD (ITQ)	Lithuania	7
Ma et al. (2022)	3465	35.8 (8.3)	75.4	Physicians (55.3), nurses (44.3)	12.8	MISS-HP	13.3	PTSD (PCL-5-SF)	China	8
Malakoutikhah et al. (2022)	455	33.39 (7.07)$^{++}$	83.1	Nurses (73.6)$^{++}$, other	NR	MISS-HP	NR	PTSD (IES)	Iran	5
Morris (2022)*	322	NR	70.8^{++}	Forensic mental HCWs	NR	MIESS-C	0	PTSD (PCL-5), depression (PHQ-9), anxiety (GAD-7), burnout (PROQOL)	UK	4
Morris et al. (2022)	237	NR	65.8	Physicians (.8), nurses (72.9), psychologists, occupational therapists, other	NR	MIES	0	PTSD (PROQOL), burnout (PROQOL)	UK	8
Nieuwsma et al. (2022)	1088^{++}	NR	NR	Physicians, nurses	NR	MIES (reduced)	NR	Depression (PROMIS Emotional Distress-Depression Scale), burnout (one six-Likert item)	US	5
Sert-Ozen & Kalaycioglu (2022)	201	40.43 (8.57)$^{++}$	41.8	Physicians (100)	NR	MIES (reduced)	NR	Burnout (six items)	Turkey	5
Testoni et al. (2022)	270	44.54 (12.23)	70.0	Physicians (65.19), nurses (20.7), physiotherapists, health technicians, other	NR	MIES	78.0	PTSD (PTSD-8), depression (PHQ-9), burnout (one Likert item), suicidal ideation (PHQ-9)	Italy	7
Ulusoy & Çelik (2022)	124	33.3 (6.37)	74.2	Physicians (67.7), nurses (21.8), other	NR	MIES	100	Depression (DASS-21), anxiety (DASS-21), burnout (MBI)	Turkey	7
Üstün (2022)	125	31.93 (8.2)	79.2	Nurses (100)	NR	MISS-HP	NR	PTSD (CF-SS), Burnout (CF-SS)	Turkey	6
Wang et al. (2022)	3006	35.4 (8.1)	65.01	Physicians (80.6), nurses (19.4)	11.6	MISS-HP	22.2		China	8

								Depression (PHQ-9), anxiety (GAD-7), burnout (MBI), suicidal ideation (PHQ-9)		
Dumarkaite et al. (2023)[+]	206	42.34 (11.68)	97.1	Nurses (100)	NR	MIOS	NR	Depression (PHQ-4), anxiety (PHQ-4)	Lithuania	7
Behnampour et al. (2023)	333	NR	58.6	Physicians (67.9), nurses (32.1)	NR	MISS-HP	NR	Depression (DASS-21), anxiety (DASS-21)	Iran	4
Cooper-Bribiesca et al. (2023)	108	30.4 (4.9)	57.4	Physicians (100)	NR	MIES	100	PTSD (EGS-R), Depression (HADS), Anxiety (HADS), Burnout (BMS)	Mexico	7
Greene et al. (2023)	1056	41.7 (.2)	92.6	Health and social care workers	NR	MIES	NR	PTSD (ITQ)	UK	7
Kimble (2023)	41	NR	70	Clinical social workers, psychologists	NR	MISS	NR	Burnout (CBI)	US	4
Lennon et al. (2023)	1323[++]	NR	76.9[++]	Physicians (23.6), nurses (26.3)	NR	MISS-HP	NR	Depression (PHQ-9), anxiety (GAD-7), burnout (CBI), suicidal ideation (PHQ-9)	US	7
Norman et al. (2023)	356	49.8[++]	83.4[++]	Physicians (7), nurses (45.8), other	NR	MIDS	NR	PTSD (PCL-5), depression (PHQ), suicidal ideation (PHQ-9)	US	7
Sharma & Cousins (2023)	235	NR	89.4	NR	NR	MISS-HP	100	Burnout (2-item inventory)	UK	6
Thomas et al. (2023)*	382 / 324	33.17/35.17[++]	75.39/71.91[++]	Physicians (13.08), nurses (26.43), other / Physicians (11.11), nurses (25.92), other	NR / NR	OMIS	NR / NR	PTSD (PCL-5), depression (PHQ-9), burnout (PROQOL), suicidal ideation (PHQ-9)	Several countries	8
Williamson et al. (2023)	12965	44.0 (12)	77.0	Physicians (7), nurses (27), other	NR	MIES	NR	PTSD (PCL-6), depression (PHQ-9), anxiety (GAD-7), burnout (BAT-12)	UK	8

Note: APP: advanced practice provider; BAT-12: Burnout Assessment Tool; BMS: Burnout Measure – Short Version; CBI: Copenhagen Burnout Inventory; DASS-21: Depression Anxiety and Stress Scale; EGS-R: The Posttraumatic Stress Disorder Symptom Severity Scale-Revised; GAD: General Anxiety Disorder-7; HADS: The Posttraumatic Stress Disorder Symptom Severity Scale-Revised; IES: Impact of event scale; ITQ: International Trauma Questionnaire; K10: Kessler Psychological Distress Scale; MBI: Maslach Burnout Inventory; MI: Moral injury; MIAS: The Moral Injury Appraisals Scale; MIES: Moral Injury Events Scale; MIESS-C: Moral Injury Exposure and Symptom Scale-Civilian; MIDS: Moral Injury and Distress Scale; MIOS: Moral Injury Outcome Scale; MISS-HP: Moral Injury Symptom Scale-Health Professional; MISS-SF: Moral Injury Symptom Scale – Short Form; NR: not reported; OMIS: Occupational Moral Injury Scale; PC-PTSD: Primary Care PTSD Screen; PCL-5: PTSD Checklist for DSM-5; PCL-5-SF: PTSD Checklist for DSM-5 Short Form; PCL-6: Abbreviated PTSD Checklist; PFI: Professional Fulfillment Index; PHQ-4: Patient Health Questionnaire – four items; PHQ-9: Patient Health Questionnaire – nine items; PROQOL: Professional Quality of Life Scale. * Thomas et al. contains two studies with separate samples (study I contains the effect sizes for PTSD and burnout). [+] Jovarauskaite et al and Dumarkaite et al. used the same sample. [++] Data provided by the authors.

Table 2. Effect sizes (Pearson's *r* with level of significance) for the relationship between moral injury and mental health problems.

Study	PTSD	Anxiety	Depression	Burnout	Suicidal Ideation
Amsalem et al. (2021)	.42***	.56***	.59***		.44***
Dale et al. (2021)	.30***+	.22***+	.27***+	.37***+	
de Groot (2021)	.77***+				
Dias et al. (2021)	.60**+			.54**+	
Litam & Balkin (2021)	.49***			.41**	
Mantri et al. (2021)				−.43***	
Rodríguez et al. (2021)		.46***	.48***		.40**+
Zerach & Levi-Belz (2021)	.40***	.41***	.42***		.35**+
Chandrabhatla et al. (2022)				.48**	
Chug & Babasa (2022)		.33**+	.28**+	.29**+	
Gherman et al. (2022)				.44***+	
Hagerty & Williams (2022)	.49NR				.24NR
Jovarauskaite et al. (2022)	.29***				
Ma et al. (2022)	.43*				
Malakoutikhah et al. (2022)	.40***				
Morris (2022)	.29***+	.41***+	.35***+	.51***+	
Morris et al. (2022)	.46***			.54***	
Nieuwsma et al. (2022)			.24NR+	.20NR+	
Sert-Ozen & Kalaycioglu (2022)				.37**	
Üstün (2022)	.34***+			.33***+	
Testoni et al. (2022)	.20**		.26***	.20***	.18*+
Ulusoy & Çelik (2022)		.30***+	.31***+	.26*	
Wang et al. (2022)		.41***	.44***	.41***	.30***+
Dumarkaite et al. (2023)		.54***+	.54***+		
Behnampour et al. (2023)		.43***	.47***		
Cooper-Bribiesca et al. (2023)	.20*+	.12+	.13+	.22*+	
Greene et al. (2023)	.35 + NR				
Kimble (2023)				.65***+	
Lennon et al. (2023)		.19***+	.16***+	.23***+	.12***+
Norman et al. (2023)	.64***+		.60***+		.49***+
Sharma & Cousins (2023)				.38***	
Thomas et al. (2023)	.33***+		.35***+	.50***+	.21***+
Williamson et al. (2023)	.30***	.27***+	.28***+	.30***	

Note: * $p < .05$; ** $p < .01$; *** $p < .001$; +Effect size provided by the author(s); NR Level of significance not reported.

The MIES ($k = 14$) and the MISS-HP ($k = 12$) were the most frequently used MI measures. Two studies used the same sample but investigated different mental health problems, and therefore both were included (Dumarkaite et al., 2023; Jovarauskaite et al., 2022). Twenty-five studies had undergone peer review, while eight remained unreviewed at the time of our article's completion. Two studies were ascertained via the analysis of published abstracts within conference proceedings, in both of which the authors provided data subsequent to our request (Chug & Babasa, 2022; Dias et al., 2021). While physicians and nurses make up the majority of participants, the studies are representative of a wide range of health professions, including mental health and social workers, health technicians, physiotherapists, and pharmacists. In total, we pooled 79 effect sizes for the relationship between moral injury and the investigated mental health problems. Of these 79 effect sizes, the contacted authors provided 46. We present all our analyses' forest and funnel plots as supplementary material (part 3).

3.3. Moral injury and PTSD symptoms

We included 19 articles assessing the relationship between MI and PTSD symptoms. Studies were from ten different countries and included 22,188 individuals. We found an association between MI and PTSD symptoms ($r = .41$, 95%CI: .35–.46, $p < .0001$), which meets criteria for a moderate effect. We found significant heterogeneity between studies ($Q(18) = 258.40$, $p < .0001$; $I^2 = 93.03\%$). Thus, we examined whether study characteristics accounted for differences in the results. Table 3 presents the results of the moderation analysis. Location had a moderating effect on our analysis. Studies conducted in the US showed a larger association between MI and PTSD symptoms compared to studies conducted in other countries ($r = .49$, 95%CI: .39–.59, $p < .0001$ versus $r = .36$, 95%CI: .30–.43, $p < .0001$). All other investigated moderators were not significant. We found no indication of publication bias in the analysis after performing Kendal's tau ($\tau = -.12$, $p = .49$) and Egger's test ($t = 1.66$, $p = .11$). However, the trim and fill procedure filled two missing studies in the analysis, suggesting publication bias. Figure 2 shows the adjusted funnel plot when missing studies are filled. The adjusted effect decreased to $r = .37$ (95%CI: .31–.43, $p < .0001$) after correcting for bias, keeping the moderate effect, and remaining statistically significant. The fail-safe tests confirmed the robustness of our results ($N_{Rosenthal} = 17{,}527$; $N_{Rosenberg} = 19{,}090$; $N_{Orwin} = 135$).

3.4. Moral injury and anxiety symptoms

We included 13 articles examining the relationship between MI and anxiety symptoms. Studies were from ten countries and enrolled a total of 19,596 individuals. We found an association between MI

Table 3. Effect of moral injury on mental health and moderation analysis.

PTSD symptoms	*k*	Pearson's *r*	95% CI	*p*-value
Overall outcome (*n* = 22,188)	19	.41	.35–.46	**<.0001**
Moderation Analyses				
Mean age	17	−.0007	−.014–.13	.92
Sex	19	.004	−.003–.01	.25
Quality	19	−.034	−.08–.012	.14
Nurses	16	.001	−.0009–.003	.27
Physicians	15	−.001	−.004–.0008	.20
Direct care	8	.001	−.002–.004	.55
Years of practice	3	−.08	−.36–.20	.57
MI measure	19	.012	−.14–.17	.88
PTSD vs secondary trauma	19	.031	−.15–.21	.74
Location (Europe vs other)	19	.06	−.06–.19	.32
Location (US vs other)	19	.12	.002–.25	**.04**
Anxiety symptoms	***k***	**Pearson's *r***	**95% CI**	***p*-value**
Overall outcome (*n* = 19,596)	13	.36	.30–.43	**<.0001**
Moderation Analyses				
Mean age	10	.007	−.016–.03	.54
Sex	13	.003	−.003–.01	.33
Quality	13	−.005	−.06–.04	.85
Nurses	11	.003	.0008–.005	**.007**
Physicians	11	−.001	−.003–.001	.44
Direct care	6	−.002	−.003 to −.0005	**.006**
Years of practice	4	−.04	−.12–.04	.36
MI measure	13	−.01	−.16–.13	.86
Location (Europe vs other)	13	−.02	−.18–.14	.77
Location (US vs other)	13	−.05	−.22–.11	.56
Depressive symptoms	***k***	**Pearson's *r***	**95% CI**	***p*-value**
Overall outcome (*n* = 21,604)	17	.37	.30–.43	**<.0001**
Moderation Analyses				
Mean age	13	.009	−.006–.02	.26
Sex	16	.005	−.001–.012	.12
Quality	17	.007	−.046–.06	.79
Nurses	14	.004	.001–.006	**.004**
Physicians	14	−.001	.004–.0009	.23
Direct care	7	−.002	−.003 to −.0003	**.01**
Years of practice	4	−.05	−.15–.06	.37
MI measure	17	−.01	−.16–.13	.87
Location (Europe vs other)	17	.03	−.12–.18	.72
Location (US vs other)	17	.006	−.14–.16	.93
Burnout	***k***	**Pearson's *r***	**95% CI**	***p*-value**
Overall outcome (*n* = 23,508)	21	.34	.22–.46	**<.0001**
Moderation Analyses				
Mean age	13	−.003	−.017–.01	.68
Sex	19	−.0001	−.005–.005	.97
Quality	21	−.03	−.10–.04	.46
Nurses	17	−.0001	−.004–.004	.94
Physicians	17	−.0004	−.003–.003	.79
Direct care	9	−.002	−.003–.0001	.07
Years of practice	5	−.02	−.08–.04	.49
MI measure	21	−.13	−.33–.07	.21
Location (Europe vs other)	21	.08	−.12–.27	.44
Location (US vs other)	21	.07	−.13–.28	.46
Suicidal ideation	***k***	**Pearson's *r***	**95% CI**	***p*-value**
Overall outcome (*n* = 7,186)	9	.30	.24–.37	**<.0001**
Moderation Analyses				
Mean age	8	.004	−.01–.02	.57
Sex	9	.004	−.008–.02	.42
Quality	9	−.02	−.2–.2	.82
Nurses	9	.002	−.002–.007	.26
Physicians	9	.001	−.003–.002	.95
Direct care	3	−.02	−.005–.0005	.10
Years of practice	4	−.04	−.12–.04	.32
MI measure	9	−.03	−.02–.15	.75
Location (US vs other)	9	−.03	−.2–.14	.73

Note: Mean age, sex (percentage of female-identifying individuals), quality assessment, nurses (percentage of nurses), physicians (percentage of physicians), direct care (percentage of individuals providing care for patients with COVID-19), and years of practice were continuous variables. Location and MI measure were categorical variables.

and anxiety symptoms ($r = .36$, 95%CI: .30, .43, $p < .0001$), yielding a moderate effect. The heterogeneity between studies was significant ($Q(12) = 184.26$, $p < .0001$; $I^2 = 93.49\%$). Moderation analysis revealed that the percentage of nurses in the samples influenced the effect. The higher the percentage of nurses, the larger the effect size of MI on anxiety symptoms ($r = .003$, 95%CI: .001, .005, $p = .003$). Furthermore, the percentage of the samples engaged in direct care for patients with COVID-19 moderated the effect. Notably, a higher percentage of healthcare workers caring for COVID-19 patients was associated with a smaller effect between MI and anxiety symptoms ($r = -.002$, 95%CI:−.003 to −.0005, $p = .006$). Kendall's tau ($\tau = -.23$, $p = .30$) and Egger's test ($t = 1.40$, $p = .18$) showed no evidence for publication bias, and the trim and fill method did not add missing studies in the analysis. Fail-safe tests indicated stability in our results ($N_{Rosenthal} = 7318$; $N_{Rosenberg} = 8088$; $N_{Orwin} = 80$).

3.5. Moral injury and depressive symptoms

Seventeen studies were included that investigated the relationship between MI and depressive symptoms. These studies were from eleven countries and enrolled 21,604 individuals. Our analysis showed that higher MI was associated with the severity of depressive symptoms ($r = .37$, 95%CI .30–.43, $p < .0001$), which indicates a moderate effect. Heterogeneity between studies was significant ($Q(16) = 304.04$, $p < .0001$; $I^2 = 94.74\%$). More nurses in the samples yielded a stronger relationship between MI and depressive symptoms ($r = .004$, 95%CI: .001–.006, $p = .004$). Moreover, a greater proportion of healthcare workers involved in direct patient care for individuals with COVID-19 exhibited a diminished effect in the relationship between MI and depressive symptoms ($r = -.002$, 95%CI: −.003 to −.0003, $p = .01$) Fail-safe tests were robust ($N_{Rosenthal} = 12,450$; $N_{Rosenberg} = 13,352$; $N_{Orwin} = 107$). The Kendall's tau coefficient ($\tau = -.13$, $p = .49$) and the Egger's test ($t = 1.20$, $p = .25$) were nonsignificant. Trim and fill procedure did not input any missing study in the analysis.

3.6. Moral injury and burnout

Twenty-one included studies assessed the relationship between MI and burnout. Studies came from eight countries and enrolled 23,508 individuals. We found a statistically significant association between MI and burnout ($r = .34$, 95%CI: .22, .46, $p < .0001$), which meets criteria for a moderate effect. Heterogeneity between studies was significant ($Q(20) = 1641.76$; $p < .0001$; $I^2 = 98.78\%$). None of the moderators reached statistically significant levels. Publication bias was not detected through Kendall's tau coefficient ($\tau = -.24$, $p = .14$) or Egger's test ($t = .53$, $p = .60$), and trim and fill analysis did not input missing studies. Fail-safe tests indicated our findings were stable ($N_{Rosenthal} = 10,551$; $N_{Rosenberg} = 11,575$; $N_{Orwin} = 124$).

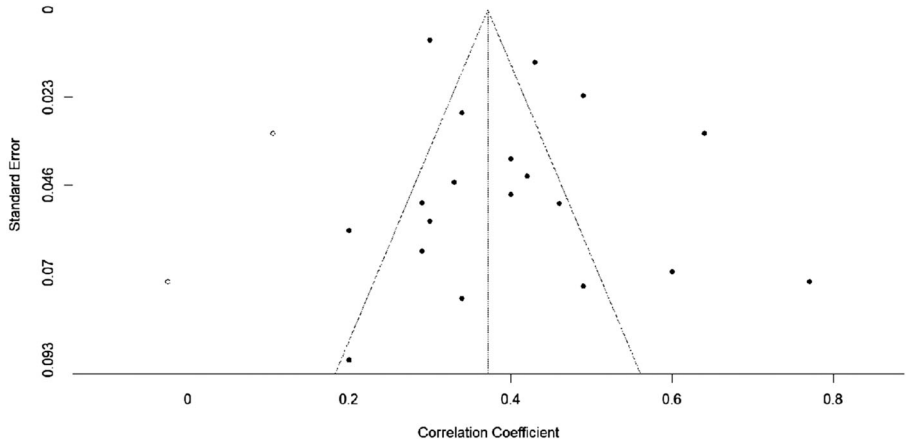

Figure 2. Adjusted funnel plot for missing studies ($k = 2$) with Pearson's correlation coefficient (r) between moral injury and PSTD symptoms.

When visually inspecting the funnel plot, we identified the study by Mantri and colleagues as a potential outlier (Mantri et al., 2021). The authors found a moderate negative correlation between MI and burnout ($r = -.43$). This result is discrepant with the other 20 studies investigating MI and burnout, where effect sizes ranged from $r = .20$ to $r = .65$. If Mantri et al. are removed from the analysis, the pooled effect size of the association between MI and burnout increases to test value = .37 (95%CI: .32, .42, $p < .0001$). However, Mantri et al. were rated as good quality according to our quality assessment (see supplementary material, Part 2). Moreover, they enrolled a significant sample size ($n = 1831$) and used the same burnout scale as other eligible studies (Chug & Babasa, 2022; Gherman et al., 2022; Ulusoy & Çelik, 2022). Thus, we considered that Mantri et al. yielded a reliable effect size and retained it in the analysis.

3.7. Moral injury and suicidal ideation

Nine included studies from five countries enrolling 7,186 individuals investigated the association between MI and suicidal ideation. We found that higher MI was associated with more severe suicidal ideation ($r = .30$, 95%CI: .22, .37, $p < .0001$), which indicates a moderate effect. Between-studies heterogeneity was significant ($Q(8) = 86.76$, $p < .0001$; $I^2 = 90.78\%$). None of the moderators reached statistical significance level. We found no indication of publication bias with Kendall's tau coefficient ($\tau = .00$, $p = 1.00$) and Egger's test ($t = .54$, $p = .60$), and the trim and fill approach did not add missing studies in the analysis. The fail-safe tests confirmed the stability of the results ($N_{\text{Rosenthal}} = 1954$; $N_{\text{Rosenberg}} = 1587$; $N_{\text{Orwin}} = 42$).

3.8. Quality appraisal of the studies

The full quality assessment of the included studies, based on the JBI quality assessment tool, is provided in supplementary material, Part 2. The quality scores of the 33 studies ranged from 4 to 8, with an average score of 6.24 and a median value of 7, suggesting that the overall study quality is satisfactory. Studies using non-abbreviated MI scales and validated instruments for measuring mental health problems tended to receive higher quality scores, as did studies that provided a more comprehensive participant description, including the percentage of HCWs involved in direct patient care for COVID-19 and the sample's mean years of practice.

On average, non-peer-reviewed studies ($k = 8$) had a lower mean quality score than their peer-reviewed counterparts ($k = 25$), scoring 5 versus 6.5, respectively. To explore the potential moderating effect of quality scores on the relationship between MI and mental health problems, we incorporated the study's quality score as a continuous variable in our analysis (see Table 3 for the results). Our findings indicate that the quality score did not exert a moderating effect on the relationship between MI and mental health problems, thus having no influence on our results.

4. Discussion

In the present meta-analysis, we investigated whether moral injury is associated with symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation among active health-care workers during the COVID-19 pandemic. We retrieved 33 eligible articles from 13 countries using eight databases and pooled 79 effect sizes for our analysis. Our results showed that MI is associated with moderately increased symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation. We found no evidence for publication bias in the performed analyses except for the relationship between MI and PTSD symptoms. After adjusting for missing studies, the observed effect of MI on PTSD symptoms was smaller but remained moderate

and statistically significant. Fail-safe tests confirmed the stability of our results. Thus, we confirmed the hypothesis that MI is associated with mental health problems among active HCWs amid the COVID-19 global crisis.

To our knowledge, ours is the first meta-analysis investigating MI and mental health in HCWs (during the COVID-19 pandemic or ever) and, as of yet, the first meta-analysis of MI and burnout. Interestingly, the observed moderate effect sizes of the relationship between MI and symptoms of PTSD, depression, and anxiety in our study are similar to meta-analyses using studies predominately of veterans (McEwen et al., 2021; Williamson et al., 2018). However, whereas the previous meta-analyses found a small effect of MI on suicidal ideation, we found a moderate effect. Thus, although first theorised as a phenomenon primarily affecting combat veterans, our meta-analysis suggests that MI can be as equally burdensome – or more burdensome regarding suicidal ideation – for HCWs' mental health in the COVID-19 era. HCWs serving on the frontline against an 'invisible enemy' is a wartime analogy that is not merely theoretical, as many have fallen ill or have been forced to carry the psychological weight of making or witnessing life-and-death decisions more often (Akram, 2021).

Although mental health problems are generally prevalent in HCWs, times of crisis may elevate these problems significantly (Bismark et al., 2022). This was previously found for active HCWs in the aftermath of massive catastrophes (Armagan et al., 2006; Shrestha, 2015). However, the COVID-19 pandemic was a different kind of crisis because it put enormous, unprecedented strain on all healthcare systems worldwide. During the course of the pandemic, healthcare professionals faced extensive waitlists, public scrutiny, controversies surrounding compensation and retirement benefits, and challenges related to recruiting and retaining staff, resulting in persistent understaffing across many public healthcare systems (Boamah et al., 2023; Mahase, 2022; Shimizu & Lin, 2022). Some of these stressors have been associated with MI and may continue to persist even after the conclusion of the global emergence of COVID-19 (Kok et al., 2023; Rabin et al., 2023). Furthermore, the repercussions of long COVID remain inadequately comprehended and may continue to pose a significant threat to the lives of numerous patients (Meza-Torres et al., 2022), thereby prolonging HCWs' exposure to severe occupational stressors. Thus, to minimise the negative effect of MI on mental health, recent efforts have targeted specific treatment for individuals suffering from MI (Smith-MacDonald et al., 2022; Williamson et al., 2022). Some of these efforts have effectively treated MI in war veterans (Jones et al., 2022). However, emerging methods must be validated to treat MI in HCWs. In addition, such methods should align with more research on the social, contextual, and systemic issues that potentially lead to MI (Nieuwsma et al., 2022). The COVID-19 crisis may have triggered what some authors called an invisible MI epidemic among HCWs (Dean et al., 2020). Therefore MI should be recognised as a public health concern (Williamson et al., 2021).

Contrary to our initial hypothesis, moderation analyses revealed that caring directly for patients with COVID-19 was not associated with a more significant effect of MI on mental health problems. Surprisingly, the effect of MI on both depressive and anxiety symptoms was less pronounced within samples featuring a higher proportion of healthcare workers engaged in caring for patients with COVID-19. These findings suggest that the pandemic may have put enormous pressure on active HCWs regardless of their practice area. Research reported that the prevalence of MI is equivalent to those in COVID-19 and non-COVID-19 units (Maftei & Holman, 2021). Moreover, one systematic review found that HCWs caring for patients with COVID-19 scored less on stress scales than their peers working in different units (Sheraton et al., 2020). Perhaps the scant resources left to treat patients with other medical conditions increased morally distressing dilemmas for HCWs not directly involved in fighting COVID-19. These situations may have elevated MI and mental health problems among HCWs active in overlooked frontlines, possibly as challenging as the COVID-19 frontline.

On the other hand, it is reasonable that fighting COVID-19 may have given some individuals a sense of personal accomplishment and purpose, possibly mitigating adverse effects on mental health (Tempski et al., 2021; Villar et al., 2021). As our findings raise concerns about HCWs' mental health in the COVID-19 era, it is essential to underscore that these concerns apply to active HCWs regardless of setting. As society may have moved on from the COVID-19 pandemic, its impact on the mental health of HCWs may persist (Lennon et al., 2023). Further studies should investigate in the long term if the relationship between MI and mental health problems increases in different areas of practice.

Research found elevated levels of MI and PTSD symptoms in HCWs who perceive a higher risk of COVID-19 infection and, therefore, a threat to their safety (Dale et al., 2021; D'Alessandro et al., 2022). Higher infection rates have been reported to be more frequent among nurses than other HCWs (Čartolovni et al., 2021; Rushton et al., 2022; Smallwood et al., 2022). Despite the particularly heightened threat to nurses' health, we did not observe a moderating effect of the percentage of nurses in the samples on the relationship between MI and PTSD symptoms. However, we did observe a moderation effect for an association of MI with depression and anxiety; i.e. a

higher percentage of nurses within the samples were associated with a more significant association between MI and anxiety and depressive symptoms. Nurses have close contact with patients and spend considerable time with them and their relatives (Üstün, 2022). Thus, nurses may be particularly vulnerable to potentially morally injurious events and may have witnessed difficult ethical situations more often throughout the pandemic (Williamson et al., 2023).

Further moderation analysis unveiled that the association between MI and PTSD symptoms exhibited greater strength in US samples in comparison to non-US samples. The COVID-19 pandemic underwent considerable politicisation in the US, potentially yielding adverse implications for public health (Bolsen & Palm, 2022; Sehgal et al., 2022). Evidence suggests that the detrimental impacts of COVID-19's politicisation on health-protective behaviours and vaccine acceptance were more pronounced within the US context than in global samples (Stroebe et al., 2021). These trends have persisted over time, even amidst heightened infection risk (Fridman et al., 2021; Wood & Schulman, 2021). As a result, public skepticism to adopt protective measures aimed at minimising infection exposure and consequences may have heightened occupational stressors among healthcare workers, jeopardising their personal safety. This phenomenon could elucidate our observation of a more robust relationship between MI and PTSD symptoms in US studies.

Several articles in our meta-analysis found significant associations between specifically betrayal-related MI and mental health difficulties (Amsalem et al., 2021; Chandrabhatla et al., 2022; Hagerty & Williams, 2022; Williamson et al., 2023). Betrayal is a central element of MI because it is perceived as a violation of trust by institutions or people that hold legitimate authority and on which a person may rely for survival (Hagerty & Williams, 2022; Shay, 2014). Qualitative studies reported that many HCWs perceived that those with authority did little to minimise their exposure to potentially morally injurious events during the pandemic (Berkhout et al., 2022; Hegarty et al., 2022). In addition, HCWs have been reporting indifference and disconnection by those in management positions, whose performance in addressing HWCs' needs falls short of protecting them (Kok et al., 2023). Insufficient access to personal protective equipment, inadequate training, lack of rapid testing, and working extended hours without compensation are some factors related to betrayal-related MI (Song et al., 2021). As a result, HCWs feel abandoned, self-alienated, and unmotivated, eventually losing faith in the healthcare system (French et al., 2022; Hegarty et al., 2022).

Our meta-analysis has limitations. First, we lack quantitative evidence predating COVID-19 to compare differences in the magnitude of the relationship between MI and mental health before and after the virus onset, so we cannot conclude any causal impact of the COVID-19-related stressors on MI and mental health in HCWs. Moreover, even as society transitions beyond the COVID-19 pandemic, the enduring mental health repercussions stemming from the moral distress encountered by healthcare workers throughout the crisis may endure. Future research will need to determine whether, in post-pandemic times, the relationship between MI and mental health is less significant. Second, although we retrieved articles from 13 countries, studies from South America, Africa, and Eastern Europe were missing. Thus, developing countries are underrepresented in our included articles, and healthcare systems in several developing countries collapsed during the peak pandemic (e.g. India and Brazil). Investigating MI and mental health in more countries may bring more insights into the literature and more accurately represent the global challenges imposed on HCWs. Third, heterogeneity analyses were significant for all investigated mental health problems. Our approach with the moderation analysis revealed a few variables accounting for heterogeneity. For burnout, the heterogeneity was extreme, and we could not find any significant moderator explaining between-studies differences. Fourth, the evidence is predominantly cross-sectional and needs more longitudinal data. Thus, we cannot investigate the relationship between MI and mental health over time, a goal that future studies should pursue. The prolonged stressors related to the COVID-19 pandemic may yield different long-term effects of MI on mental health. Fifth and perhaps most critically, several of the studies included in our meta-analysis relied on scales originally designed to assess MI in veterans. Adapting terminology and concepts developed in the context of war-related experiences may not be the most precise way to capture MI symptoms among HCWs. Furthermore, the complex nature of MI, which can encompass various experiences and their consequences, becomes evident in the diversity of available MI scales. These scales may emphasise the assessment of events that lead to MI, the measurement of MI sequelae, or a combination of both. Consequently, they manifest different approaches to capturing various facets of MI. Thus, the limitations imposed by the diversity in MI measures and the usage of scales developed for veterans, inherent to our meta-analysis, underscores a broader limitation in the assessment of the current body of evidence when investigating MI among HCWs.

In summary, we found statistically significant associations between moral injury and symptoms of PTSD, anxiety, depression, burnout, and suicidal ideation among active health-care workers during the

COVID-19 pandemic. The magnitude of this association was moderate for all investigated mental health problems. There was evidence for publication bias in studies measuring PTSD. After correcting for bias, the magnitude of the association remained moderate. Contrary to our expectation, we found MI's effect on depression and anxiety was negatively moderated by the percentage of HCWs caring directly for patients with COVID-19. Perhaps active HCWs during the pandemic, whether in COVID-19 units or other units and regardless of practice area, have been at significant risk for MI experiences and the detrimental mental health consequences that may follow. The strength of the association between MI and anxiety and depressive symptoms was more pronounced in samples with more nurses than in other HCWs. Our findings suggest the need for more mental health professionals to care for fellow HCWs, particularly nurses, and the need to develop more interventions targeting moral injury.

Note

1. We used '*n*' to represent the number of individuals and '*k*' to represent the number of categories.

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Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

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