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REVIEW ARTICLE

The Psychological Impact of the COVID-19 Pandemic on Frontline Healthcare Workers.

A Systematic Review and a Meta-Analysis

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Introduction: The COVID-19 pandemic has created a chronically stressful work environment for healthcare workers, increasing the negative psychological effects experienced.
Aims: The authors of this systematic review and meta-analysis aimed to assess the impact of COVID-19 on frontline healthcare workers' mental health, using various psychological outcomes.
Methods: A systematic literature search was conducted up until June 30th, 2022 on MEDLINE, EMBASE, CINAHL, Cochrane Library, Web of Science, ClinicalTrials.gov, and Dissertations and Theses.
Results: This meta-analysis includes 22 cross-sectional studies with a total of 32,690 participants. Anxiety (ES = 0.23, CI: [0.18, 0.28]), depression (ES = 0.17, CI: [0.10, 0.24]), PTSD (ES = 0.28, CI: [0.08, 0.48]), and stress (ES = 0.35, CI: [0.17, 0.53]) was significantly prevalent among frontline healthcare workers.
Conclusions: Our results suggested that European healthcare workers were experiencing high psychological symptoms associated with the COVID-19 pandemic. The monitoring of their psychological symptoms, preventative interventions, and treatments should be implemented to prevent, reduce, and treat the worsening of their mental health.

Keywords: COVID-19, healthcare workers, meta-analysis, systematic review, psychological impact

Introduction

At the end of December 2019, a cluster of pneumonia cases was found to be associated with a novel coronavirus, COVID-19, in Wuhan, China. After spreading at an alarming speed, Europe had become the epicenter of disease spread by late February 2020 (Allam, 2020), and afterwards the World Health Organization (WHO) would declare COVID-19 to be a global pandemic on March 11th, 2020 (WHO, 2020). As of June 28th, 2020, the number of confirmed global cases has exceeded 10 million (WHO, n.d.).

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Since the pandemic's beginning, healthcare workers (HCWs) have been working tirelessly to protect the population despite a daily risk of contracting COVID-19, which produces a chronically stressful work environment. This risk also impacts the daily life of HCWs, as HCWs continually face negative psychological effects of chronic work stress, social isolation due to quarantine (Robertson et al., 2004), as well as fear of illness and fear of infecting family, friends, and colleagues (Adams & Walls, 2020). As spreading waves of COVID-19 infection cyclically arrive and subside in countries all around the world, HCWs must also deal with an ever-increasing workload, while potentially also facing shortages of personal protective equipment or intensive care beds (Saglietto et al., 2020; Shaukat et al., 2020; Walton et al., 2020). Furthermore, an increasing proportion of the European population faces economic insecurity due to downturns in numerous European nations and fear of infecting family, friends, and colleagues; this could impact the prevalence of psychological symptoms in European HCWs, including conditions such as anxiety, depression, insomnia, post-traumatic stress disorder, and many others (Koçak et al., 2021; Witteveen & Velthorst, 2020).

The accumulation of these challenges can cause short-term and long-term psychological distress and produce negative mental health symptoms in European HCWs. Therefore, it is important to track and measure the psychological impact of this pandemic on HCWs, as it could indicate the need for future changes or for maintaining the currently available mental health support services needed for all HCWs. Our systematic review and meta-analysis aims to assess the impact of COVID-19 on the mental health of frontline healthcare workers, employing the measurement of various psychological outcomes.

Methods

Search Strategy

A literature search was conducted in the following five databases: MEDLINE, EMBASE, CINAHL, Cochrane Library, and Web of Science. A gray literature search was conducted in ClinicalTrials.gov, and Dissertations and Theses. The search was conducted till June 30th, 2022. Sets of keywords relating to COVID-19 (i.e. coronavirus, SARS-CoV-2, nCoV-2019), mental health (i.e. depression, anxiety, post-traumatic stress disorder, stress, insomnia), healthcare workers (i.e. healthcare provider, health personnel), and Europe (i.e. Europe, Eastern Europe) were used with restrictions placed on human and English-published literature. All articles were imported into Covidence, which is a web-based systematic review screening tool it was used to remove duplicates and to organize two levels of screening: title and abstract screening and full text screening.

After all articles had been imported into Covidence (Veritas Health Innovation, n.d.), two reviewers independently screened titles and abstracts for healthcare workers! mental health outcomes related to COVID-19. Articles that were accepted past the first level of screening then proceeded through a second level of screening where independent full texts were reviewed. The second screening question used for the full-text review was "Does the study focus on the impact of COVID-19 on the mental health of healthcare workers in Europe?" Conflicts at both levels of screening were resolved through consensus and discussion between the reviewers (SS and TQW). After each screening level, chance-corrected kappa statistic was used to assess interobserver agreement for the inclusion of studies.

Inclusion and Exclusion criteria

The population of interest consisted of frontline healthcare professionals who are working in a setting with a COVID-19 exposure risk. Inclusion criteria for this study were that the evidence presented must be related to the impact of COVID-19 on healthcare workers' mental health, using a validated assessment instrument for mental illnesses. Studies included were cross sectional studies. Exclusion criteria were nonhuman and non-English studies as well as mental health studies that do not pertain specifically to healthcare workers in Europe. No limits were placed via study design.

Risk of Bias Assessment

The quality of each study was assessed using the CLARITY risk of bias instrument for cross-sectional surveys of attitudes and practices (Agarwal et al., 2011). This assessment tool measures the risk of bias based on five factors: 1) selection of representative population, 2) survey response rate, 3) missing data within completed questionnaires, 4) sensibility of the clinical survey, and 5) established validity of survey instrument. Table 1 describes in detail the assessment done for each included article.

Data Extraction

For each included study, quantitative and qualitative information related to healthcare workers' mental health outcomes was collected independently (Table 1). The following data were extracted: study information (i.e., author and year), study characteristics (i.e., mean age of participants, location of study, percentage of females, and participants' mental health outcomes (i.e., scores of anxiety, depression, insomnia, PTSD, stress). Data entry was abstracted manually from studies into an Excel sheet and organized according to the type of mental health outcome (Table 2.1-2.5).

Table 1. Study characteristics of included studies

Author	Year	Study Design	Study Location	Total number of participants, *N* (%)	Age Mean *(SD)*; Range; *N* (%), etc.	Female, *n* (%)	Non-Binary *n* (%)
Aisa et al.	July 2021	Cross-sectional multicenter, international study	Europe	557	–	–	–
Büntzel et al.	January 2021	Survey study	Germany	167	–	–	–
De Pasquale et al.	April 2022	Cross-sectional multicenter, national study	Italy	107	26.75(3.86)	78 (73)	–
Erquicia et al.	November 2020	Cross-sectional study	Spain	395	40.20(11.46)	291 (75.6)	–
Failla et al.	October 2021	Cross-sectional web-based, international study	France, Italy, Portugal, Spain	443	Median (IQR): 29 (25-33)	–	–
Goberna-Tricas et al.	June 2021	Qualitative descriptive study	Spain	10	Range: 29-50	10 (100)	–
Hummel et al.	January 2021	Cross-sectional multicenter, international study	Germany, UK, Spain, France, Portugal, Austria, Italy, Switzerland	354	Median (range): 41 (18-84)	–	–
Morawa et al.	May 2021	Cross-sectional web-based, international study	Germany	3678	18-30: 812 (22.1) 31-40: 974 (26.5) 41-50: 820 (22.3) 51-60: 899 (24.4) 61-70: 167 (4.5) >70: 6 (0.2)	2751 (74.8)	15 (0.4)
Mortier et al.	May 2021	Observational prospective cohort multicenter study	Spain	5169	Range: n (% ± SE) 18-29: 881 (15.3 ± 1.6) 30-49: 2553 (47.7 ± 1.1) >50: 1730 (37.0 ± 2.1)	n (% ± SE) 4172 77.3 (1.3)	–
Sharif et al.	March 2021	Cross-sectional web-based, international study	Europe, Africa, Asia, South America, North America	207	–	–	–
Skoda et al.	November 2020	Cross-sectional web-based, nation-wide study	Germany	2224	–	1690 (75.99)	5 (0.22)
van Hout et al.	February 2022	Cross-sectional multicenter, international study	40 European countries	2289	42 (11)	1509 (66)	–
Vindrola-Padros et al.	November 2020	Cross-Sectional Rapid Appraisal Study	UK	30	–	17 (56.67)	–
Abdessater et al.	April 2020	Cross-sectional web-based, national study	France	275	29.5 (0.47)	91 (33.33)	–

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Table 1, continued

Author	Year	Study Design	Study Location	Total number of participants, *N* (%)	Age Mean *(SD)*; Range; *N* (%), etc.	Female, *n* (%)	Non-Binary *n* (%)
Antonijevic et al.	December 2020	Cross-sectional web-based study	Serbia	684	–	572 (83.62)	–
Babore et al.	November 2020	Cross-sectional web-based, national study	Italy	595	40.69 (11.48) Range: 21-72	478 (80.3)	–
Collantoni et al.	April 2021	Cross-sectional web-based, hospital-based study	Padua, Italy	996	–	755 (75.8)	–
Davico et al.	March 2021	Cross-sectional web-based, national study	Italy	380	18-29: 84 (22.1) 30-49: 216 (56.8) 50-69: 77 (20.3) >70: 3 (0.8)	296 (77.9)	–
Denning et al.	April 2021	Cross-sectional web-based, international study	UK, Poland	UK: 765 Poland: 232	–	UK: 535 (69.9) Poland: 210 (90.5)	Undisclosed UK: 9 (1.2) Poland: 2 (0.9)
Gorini et al.	October 2020	Cross-sectional web-based multicenter	Italy	650	44.59 (11.1)	439 (67.5)	–
Man et al.	July 2020	Cross-sectional study	Romania	115	40.78 (9.58)	102 (88.7)	–
Rossi et al.	May 2020	Cross-sectional web-based, national study	Italy	1379	39.0 (16.0)	1064 (77.2)	–

Table 2.1. Anxiety scores of healthcare workers in the included studies

Author	*N*	Measurement Scale	Mean*(SD)*, [95% CI]	Prevalence; *N* (%)
Erquicia et al.	395	DASS-21	–	59 (14.5)
Antonijevic et al.	684	GAD-7	7.18(5.94)	–
Antonijevic et al.	Frontline doctors: 75	GAD-7	7.37(5.68)	Frontline doctors and nurses minimal: 44 (28.39) mild: 52 (33.55) moderate: 25 (16.13) severe: 34 (21.94)
Antonijevic et al.	Frontline nurses: 102	GAD-7	9.58(6.57)	Frontline doctors and nurses minimal: 44 (28.39) mild: 52 (33.55) moderate: 25 (16.13) severe: 34 (21.94)
Antonijevic et al.	Second-line physicians: 245	GAD-7	5.31(4.93)	Second-line doctors and nurses minimal: 208 (44.26) mild: 135 (28.72) moderate: 68 (14.47) severe: 59 (12.55)
Antonijevic et al.	Second-line nurses: 262	GAD-7	8.05(6.16)	Second-line doctors and nurses minimal: 208 (44.26) mild: 135 (28.72) moderate: 68 (14.47) severe: 59 (12.55)
Büntzel et al.	Physicians: 86	Self-perception of anxiety related to patients*	–	64 (74.4)
Büntzel et al.	Physicians: 85	Self-perception of anxiety related to COVID-19 risk*	–	31 (40.7)

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Table 2.1, continued

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Büntzel et al.	Other medical staff: 69	Self-perception of anxiety related to COVID-19 risk*	–	36 (52.2)
Collantoni et al.	996	GAD-7	–	Any anxiety: 597 (59.9) Severe: 97 (9.7)
Collantoni et al.	Physicians: 215	GAD-7	5.35(4.50)	–
Collantoni et al.	Nurses and other professionals: 635	GAD-7	7.27(5.50)	–
Collantoni et al.	Healthcare assistants: 146	GAD-7	6.12(4.54)	–
Denning et al.	UK: 765	HADS	–	Prevalence % [95% CI]: 27% [24, 30]
Denning et al.	Poland: 232	HADS	–	Prevalence % [95% CI]: 28% [22, 33]
Erquicia et al.	395	DASS-21	3.38(3.78)	126 (31.4)
Erquicia et al.	395	HARS	11.92(8.63)	–
Failla et al.	443	DASS-21	8.13(7.79)	43.10%
Gorini et al.	Total: 650	GAD-2	–	None: 457 (70.3) Mild: 116 (17.8) Severe: 77 (11.8)
Gorini et al.	Physicians: 177	GAD-2	–	None: 137 (77.4) Mild: 27 (15.3) Severe: 13 (7.3)
Gorini et al.	Nurses: 214	GAD-2	–	None: 136 (63.6) Mild: 50 (23.4) Severe: 28 (13.1)
Gorini et al.	Other HCWs: 217	GAD-2	–	None: 157 (72.4) Mild: 30 (13.8) Severe: 30 (13.8)
Gorini et al.	Admin: 42	GAD-2	–	None: 27 (64.3) Mild: 9 (21.4) Severe: 9 (21.4)
Hummel et al.	354	DASS-21	7.90(8.36)	Normal/mild: 240 (67.80) Moderate: 49 (13.84) Severe/very severe: 65 (18.36)
Morawa et al.	3678	GAD-2	–	702 (19.1)
Morawa et al.	Physicians: 1061	GAD-2	1.45(1.41)	189 (17.8)
Morawa et al.	Nurses: 1275	GAD-2	1.48(1.48)	242 (19.0)
Morawa et al.	Medical Technical Assistants: 1342	GAD-2	1.66(1.50)	270 (20.1)
Rossi et al.	1379	GAD-7	Mean (range): 9 (4-13)	273 (19.80)
Skoda et al.	Physicians: 492	GAD-7	–	29 (5.89)
Skoda et al.	Nursing staff: 1511	GAD-7	–	172 (11.41)
Skoda et al.	Paramedics: 221	GAD-7	–	10 (4.55)

-: data unavailable; *: uses unvalidated measurement tool; DASS-21: Anxiety and Stress Scale; GAD-2: 2-items Generalized Anxiety Disorder; GAD-7: 7-items Generalized Anxiety Disorder; HADS: Hospital Anxiety and Depression Scale; HARS: Hamilton Anxiety Rating Scale, PHQ-4: 4-items Patient Health Questionnaire

Table 2.2. Depression scores of healthcare workers in the included studies

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Antonijevic et al.	684	BDI-IA	7.84(7.57)	–
Antonijevic et al.	Frontline doctors: 75	BDI-IA	7.73(6.97)	Frontline doctors and nurses minimal: 101 (68.24) mild: 27 (18.24) moderate: 15 (10.14) severe: 5 (3.38)
Antonijevic et al.	Frontline nurses: 102	BDI-IA	10.65(9.12)	Frontline doctors and nurses minimal: 101 (68.24) mild: 27 (18.24) moderate: 15 (10.14) severe: 5 (3.38)
Antonijevic et al.	Second-line doctors: 245	BDI-IA	6.35(6.45)	Second-line doctors and nurses minimal: 332 (75.28) mild: 73 (16.55) moderate: 25 (5.67) severe: 11 (2.49)
Antonijevic et al.	Second-line nurses: 262	BDI-IA	8.34(7.89)	Second-line doctors and nurses minimal: 332 (75.28) mild: 73 (16.55) moderate: 25 (5.67) severe: 11 (2.49)
Collantoni et al.	996	PHQ-9	–	Any depression: 421 (42.3%) Severe: 37 (3.7%)
Collantoni et al.	Physicians: 215	PHQ-9	4.00(3.94)	–
Collantoni et al.	Nurses and other professionals: 635	PHQ-9	4.10(4.04)	–
Collantoni et al.	Healthcare assistants: 146	PHQ-9	5.43(4.81)	–
De Pasquale et al.	107	POMS	15.50(11.90)	–
Denning et al.	UK: 765	HADS		Prevalence % [95% CI]: 12% [9, 14]
Denning et al.	Poland: 232	HADS		Prevalence % [95% CI]: 14% [10-19]
Erquicia et al.	395	DASS-21	3.05(3.5)	49 (12.2)
Erquicia et al.	395	MADRS	9.93(7.37)	–
Failla et al.	443	DASS-21	13.3(10.27)	60.50%
Gorini et al.	Total: 650	PHQ-2	–	None: 502 (77.2) Mild: 104 (16.0) Severe: 44 (6.8)
Gorini et al.	Physicians: 177	PHQ-2	–	None: 144 (81.4), Mild: 26 (14.7) Severe: 7 (4.0)
Gorini et al.	Nurses: 214	PHQ-2	–	None: 148 (69.2) Mild: 43 (20.1) Severe: 23 (10.7)

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Table 2.2, continued

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Gorini et al.	Other HCWs: 217	PHQ-2	–	None: 178 (82.0), Mild: 28 (12.9), Severe: 11 (5.1)
Gorini et al.	Admin: 42	PHQ-2	–	None: 32 (76.2) Mild: 7 (16.7) Severe: 3 (7.1)
Hummel et al.	354	DASS-21	10.39(9.12)	Normal/mild: 246 (69.49) Moderate: 60 (16.95) Severe/very severe: 48 (13.56)
Morawa et al.	3678	PHQ-2		769 (20.9)
Morawa et al.	Physicians: 1061	PHQ-2	1.48(1.35)	185 (17.4)
Morawa et al.	Nurses: 1275	PHQ-2	1.70(1.44)	275 (21.6)
Morawa et al.	Medical Technical Assistants: 1342	PHQ-2	1.86(1.45)	309 (23.0)
Rossi et al.	1379	PHQ-9	Median (IQR): 10 (5–14)	341 (24.73)
Sharif et al.	207	SRQ-20	–	34 (16.4)
van Hout et al.	Junior nurse: 240	WHO-5	54.0(18.2)	–
van Hout et al.	Senior nurse: 657	WHO-5	57.5(19.3)	–
van Hout et al.	Senior medical doctor: 803	WHO-5	56.9(19.8)	–
van Hout et al.	Junior medical doctor: 269	WHO-5	54.8(17.8)	–
van Hout et al.	Junior allied health professional: 31	WHO-5	57.5(17.2)	–
van Hout et al.	Senior allied health professional: 66	WHO-5	51.0(21.2)	–
van Hout et al.	Other: 223	WHO-5	55.7(19.8)	–

–: data unavailable; BDI-IA: Beck Depression Inventory IA; HADS: Hospital Anxiety and Depression Scale; PHQ-2: Patient Health Questionnaire-2; PHQ-9: Patient Health Questionnaire-9; MADRS: Montgomery-Asberg Depression Rating Scale; DASS-21: Depression Anxiety Stress Scales-21; POMS: Profile of Mood States; SRQ-20: Self-Reporting Questionnaire-20; WHO-5: World Health Organization-5 Well-Being Index

Table 2.3. Insomnia scores of healthcare workers in the included studies

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Collantoni et al.	996	ISI-7	–	Any insomnia: 424 (42.6%) Severe: 34 (3.4%)
Collantoni et al.	Physicians: 215	ISI-7	6.49(5.37)	–
Collantoni et al.	Nurses and other professionals: 635	ISI-7	8.29(6.54)	–
Collantoni et al.	Healthcare assistants: 146	ISI-7	6.62(5.62)	–
Rossi et al.	1379	ISI-7	Median (IQR): 10 (4-16)	114 (8.27)

–: data unavailable; ISI-7: Insomnia Severity Index-7

Table 2.4. PTSD scores of healthcare workers in the included studies

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Collantoni et al.	996	IES-R	–	Any PTSD: 652 (65.5%) Severe: 97 (9.7%)
Collantoni et al.	Physicians: 215	IES-R	15.27(14.93)	–
Collantoni et al.	Nurses and other professionals: 635	IES-R	20.05(16.92)	–
Collantoni et al.	Healthcare assistants: 146	IES-R	17.95(15.26)	–
Davico et al.	380	IES-R	Median (IQR): 29.0 (21.0-40.0)	29.7%
Gorini et al.	650	IES-R	–	None: 356 (55.1) Mild: 104 (16.1) Moderate: 36 (5.6) Severe: 150 (23.2)
Gorini et al.	Physicians: 177	IES-R	–	None: 120 (67.8) Mild: 21 (11.9), Moderate: 9 (5.1) Severe: 27 (15.3)
Gorini et al.	Nurses: 214	IES-R	–	None: 87 (41.0), Mild: 43 (20.3), Moderate: 13 (6.1), Severe: 69 (32.5)
Gorini et al.	Other HCWs: 217	IES-R	–	None: 127 (59.1), Mild: 31 (14.4) Moderate: 10 (4.7), Severe: 47 (21.9)
Gorini et al.	Admin: 42	IES-R	–	None: 22 (52.4), Mild: 9 (21.4), Moderate: 4 (9.5), Severe: 7 (16.7)
Rossi et al.	1379	GPS	Median (IQR): 9 (6-12)	681 (49.38)
De Pasquale et al.	107	COVID-19-PTSD	26.18(14.60)	–

–: data unavailable; COVID-19-PTSD: COVID-19 PTSD Checklist for DSM-5; GPS: Global Psychotrauma Screen; IES-R: Impact of Event Scale-Revised

Table 2.5. Stress scores of healthcare workers in the included studies

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Abdessater et al.	275	Original survey	Univariable logistic regression OR [95% CI], p-value Medical history: 2.96 [1.23, 7.12], 0.01 Experience (Senior): 1.76 [1.05, 2.97], 0.04 COVID-19 patients: 2.39 [1.30, 4.39], 0.006 Severe COVID-impacted location: 1.71 [1.06–2.78], 0.029 Multivariable logistic regression OR [95% CI], p-value Medical history: 2.57 [1.31, 5.98], 0.013	–
Aisa et al.	557	PSS-10	23.66(5.2)	–
Antonijevic et al.	684	PSS-10	17.94(5.73)	–
Antonijevic et al.	Frontline doctors: 75	PSS-10	18.40(5.60)	Frontline doctors and nurses Low: 41 (25.15) Moderate: 68 (41.72) High: 54 (33.13)

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Table 2.5, continued

Author	*N*	Measurement Scale	Mean *(SD)*, [95% CI]	Prevalence; *N* (%)
Antonijevic et al.	Frontline nurses: 102	PSS-10	16.26(5.77)	Frontline doctors and nurses Low: 41 (25.15) Moderate: 68 (41.72) High: 54 (33.13)
Antonijevic et al.	Second-line doctors: 245	PSS-10	19.69(5.68)	Second-line doctors and nurses Low: 168 (35.29) Moderate: 195 (40.97) High: 113 (23.70)
Antonijevic et al.	Second-line nurses: 262	PSS-10	18.73(5.39)	Second-line doctors and nurses Low: 168 (35.29) Moderate: 195 (40.97) High: 113 (23.70)
Babore et al.	Female: 478	PSS-10	19.56(7.06)	–
Babore et al.	Male: 117	PSS-10	15.38(6.65)	–
Buntzel et al.	Physicians: 94	Self-perception of very high stress*	–	34 (36.5)
Büntzel et al.	Other medical staff: 73	Self-perception of very high stress*	–	31 (42.5)
Erquicia et al.	395	DASS-21	6.29(4.60)	–
Failla et al.	443	DASS-21	19.06(9.71)	61.20%
Hummel et al.	354	DASS-21	17.10(10.51)	Normal/mild: 208 (58.76) Moderate: 55 (15.54) Severe/very severe: 91 (25.71)
Man et al.	COVID-19 patients: 67	PSS-10	16	–
Man et al.	Non-COVID-19 patients: 48	PSS-10	15	–
Rossi et al.	1379	PSS-10	Median (IQR): 24 (18-29)	302 (21.90)

–: data unavailable; *: validated by author's group, available on request; DASS-21: Depression Anxiety Stress Scales-21; PSS-10: Perceived Stress Scale-10

Statistical Analysis

Meta-analysis was completed using STATA v. 15.0 (StataCorp, 2017). The main outcomes of interest were prevalence of anxiety, depression, insomnia, PTSD, and stress.

For prevalence, effect size (ES) was calculated as the treatment effect. The raw prevalence rates in the meta-analysis were transformed to logit scale and re-transformed back to original measured units. ES for each study was then aggregated using the fixed or random-effect model based on the presence of heterogeneity to estimate the summary effect.

To test heterogeneity, statistics, *Z*-value, and χ^2 statistics were computed. An value of less than 50% implies low heterogeneity, and in these cases, a fixed-effect model was computed. An statistics of 50% or more represents high heterogeneity, and in these cases a random-effect model was calculated. Additionally, a high *Z*-value, a low p-value (< 0.01) and a large value implies significant heterogeneity and, therefore, a random-effect model using DerSimonian and Laird methods was computed. Forest plots were also generated for each case. Funnel plots were generated to check publication bias. Causes of heterogeneity were also explored.

Results

Search Results

Database searches resulted in 201 published and 24 gray literature records. The 201 records were imported into the Covidence systematic review software and 15 duplicates were removed. At the end of the first screening, 44 articles remained that moved onto the full-text screening. After the full-text screening, 22 cross-sectional studies were included. The Kappa statistic for the first and second levels of screening came to 0.644 and 0.706, respectively. The systematic review study retrieval process is detailed in a Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram (Figure 1) (Moher et al., 2009). The included cross-sectional studies, contained nine high quality articles, and thirteen medium quality articles (Figure 2).

Figure 1. PRISMA Flow Diagram for the impact of COVID-19 on the mental health of healthcare workers in Europe

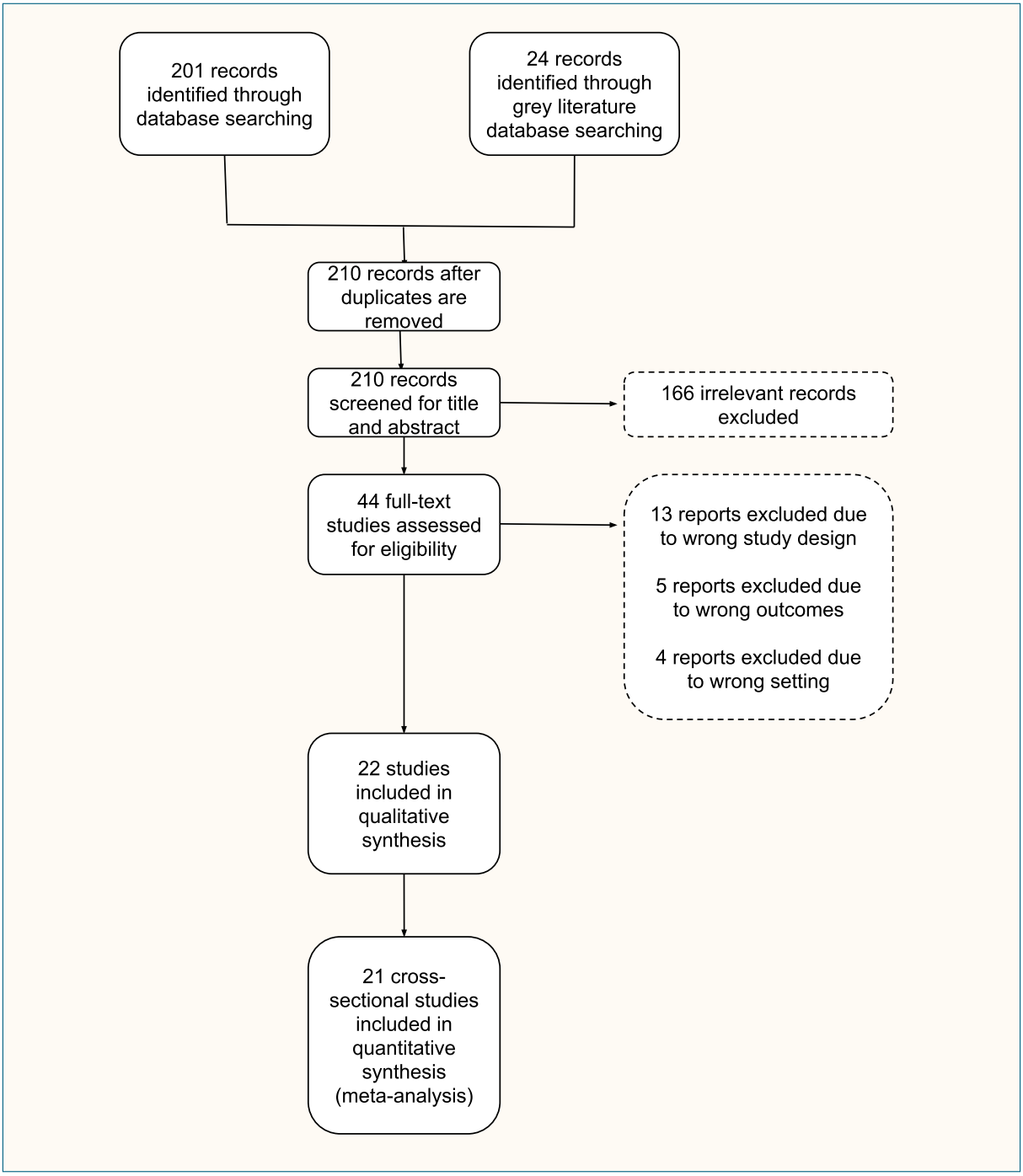


Figure 2.1. Results of risk of bias assessment for studies included

Figure 2.2. Summary plot of risk of bias assessment for studies included

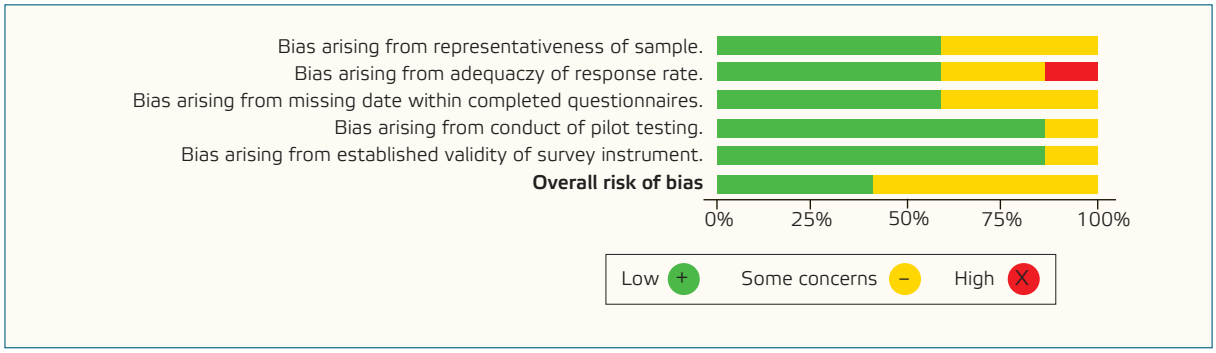


Table 3. Measurement of the included studies

Mental Health Outcome	Measurement Scale	Abbreviation	References
Anxiety	Anxiety and Stress Scale	DASS-21	(Osman et al., 2012)
	7-items Generalized Anxiety Disorder	GAD-7	(Spitzer et al., 2006)
	2-items Generalized Anxiety Disorder*	GAD-2	(Kroenke et al., 2009; Spitzer et al., 2006)
	Hospital Anxiety and Depression Scale	HADS	(Zigmond & Snaith, 1983)
	Hamilton Anxiety Rating Scale	HARS	(Lobo et al., 2002)
Depression	Beck's Depression Inventory	BDI-IA	(Beck et al., 1988)
	Anxiety and Stress Scale	DASS-21	(Osman et al., 2012)
	Hospital Anxiety and Depression Scale	HADS	(Zigmond & Snaith, 1983)
	2-items Patient Health Questionnaire*	PHQ-2	(Kroenke et al., 2001, 2009)
	9-items Patient Health Questionnaire	PHQ-9	(Kroenke et al., 2001)
	Profile of Mood States	POMS	(Douglas M. McNair, 1992)
	Self-Reporting Questionnaire-20	SRQ-20	(Beusenberg et al., 1994)
	Montgomery-Asberg Depression Rating Scale	MADRS	(Lobo et al., 2002)
Emotional Well-being	World Health Organization- 5 Well-Being Index	WHO-5	(Bech, 2004)
Insomnia	Insomnia Severity Index	ISI	(Morin, 1993)
Post-traumatic Stress Disorder	Global Psychotrauma Screen	GPS	(Olff et al., 2020)
	Impact of Event Scale-Revised	IES-R	(Weiss & Marmar, 1997)
	COVID-19 PTSD Checklist for DSM-5	Modified PCL-5	(Weathers et al., 2013)
Stress	Anxiety and Stress Scale	DASS-21	(Osman et al., 2012)
	Perceived Stress Scale	PSS-10	(Cohen et al., 1994)

a: the GAD-2 and PHQ-2 are components of the Patient Health Questionnaire-4 (PHQ-4)

Study Characteristics

This systematic review includes 22 cross-sectional studies with a total of 32,690 participants (Table 1). Out of all the cross-sectional studies, six studies were undertaken in Italy (Babore et al., 2020; Collantoni et al., 2021; Davico et al., 2021; De Pasquale et al., 2022; Gorini et al., 2020; Rossi et al., 2020), three in Spain (Erquicia et al., 2020; Goberna-Tricas et al., 2021; Mortier et al., 2021), three in Germany (Büntzel et al., 2021; Morawa et al., 2021; Skoda et al., 2020), one in Romania (Man et al., 2020), one in the United Kingdom and Poland (Denning et al., 2021), one in France (Abdessater et al., 2020), one in Serbia (Antonijevic et al., 2020), one in the United Kingdom (Vindrola-Padros et al., 2020), and five in a combination of European countries (Aisa et al., 2022; Failla et al., 2021; Hummel et al., 2021; Sharif et al., 2022; van Hout et al., 2022).

Publication Bias

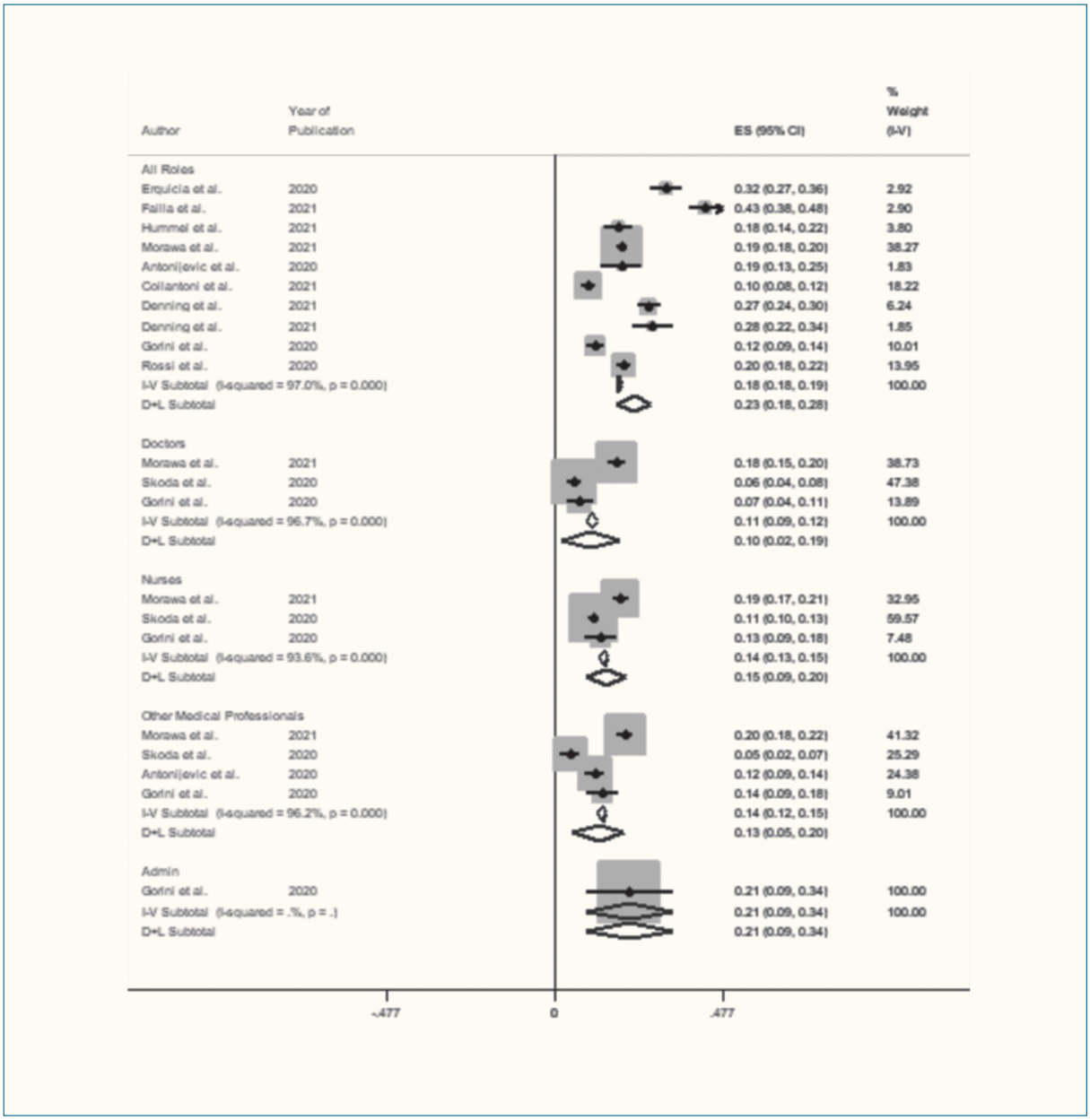
Each study measured different sets of mental health outcomes and their severity, via different psychological symptom scales (Table 3). Throughout the articles, anxiety was graded on five different scales. HCWs' depression symptoms were analyzed using eight different measurement scales. Emotional well-being and insomnia were each graded using one scale. Post-traumatic stress disorder (PTSD) was measured using three different scales. HCWs' stress symptoms were analyzed using two different scales.

Figure 3.2, 3.4, 3.6, and 3.8 showed funnel plots for the prevalence of anxiety, depression, PTSD, and stress, respectively. The visual inspection of funnel plots did not reveal any asymmetry. Additionally, publication bias remains only one of the numerous possible explanations for funnel plot asymmetry.

Main Outcomes

The main outcome of the study serves to analyze and quantify the impact of COVID-19 on the prevalence of anxiety, depression, PTSD, and stress in frontline health care workers.

Figure 3.1. Forest plot for studies examining anxiety prevalence among healthcare workers during COVID-19 pandemic in Europe



Prevalence of Anxiety

Figure 3.1 summarizes the results gained from the outcome measure, that is: anxiety prevalence in frontline healthcare workers during the COVID-19 pandemic. Ten studies focused on the impact of COVID-19 on the mental health of frontline health care workers and all the studies showed a significant impact on anxiety. Heterogeneity between studies that investigated the impact (I^2 = 97.0%) stood significantly (high. In studies examining the impact (ES = 0.23, CI: [0.18, 0.28]), anxiety registered significantly prevalent among frontline healthcare workers.

Prevalence of Depression

Figure 3.3 summarizes the results for the prevalence of depression among frontline health care workers during the COVID-19 pandemic. Ten studies existed evaluating the prevalence of depression. There appeared significant

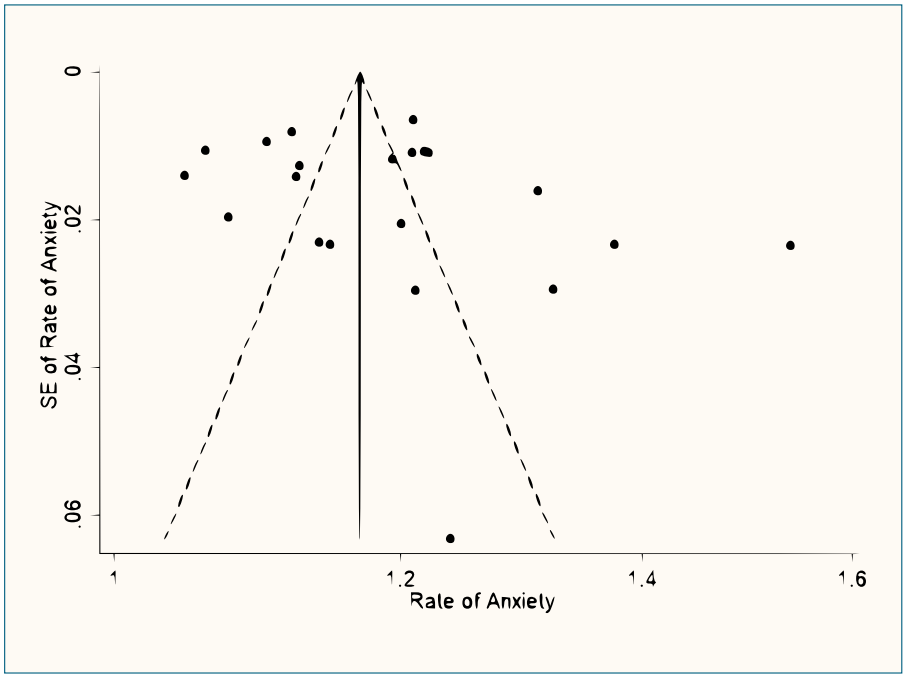


Figure 3.2. Funnel plot for studies examining anxiety prevalence among healthcare workers during COVID-19 pandemic in Europe

heterogeneity between studies (I^2 = 99.1%,). Figure 3.3 suggests that depression was significantly prevalent (ES = 0.17, CI: [0.10, 0.24]) among frontline healthcare workers.

Prevalence of PTSD

Figure 3.5 illustrates a forest plot of ES of PTSD prevalence among frontline health care workers during the COVID-19 pandemic. Four studies examining the impact of PTSD among frontline healthcare workers showed a significant prevalence (ES = 0.28, CI: [0.08, 0.48]). Further, all four studies had a significant () amount of between study heterogeneity (I^2 = 99.5%). Our results indicated a significant PTSD prevalence during the COVID-19 pandemic among frontline healthcare workers.

Prevalence of Stress

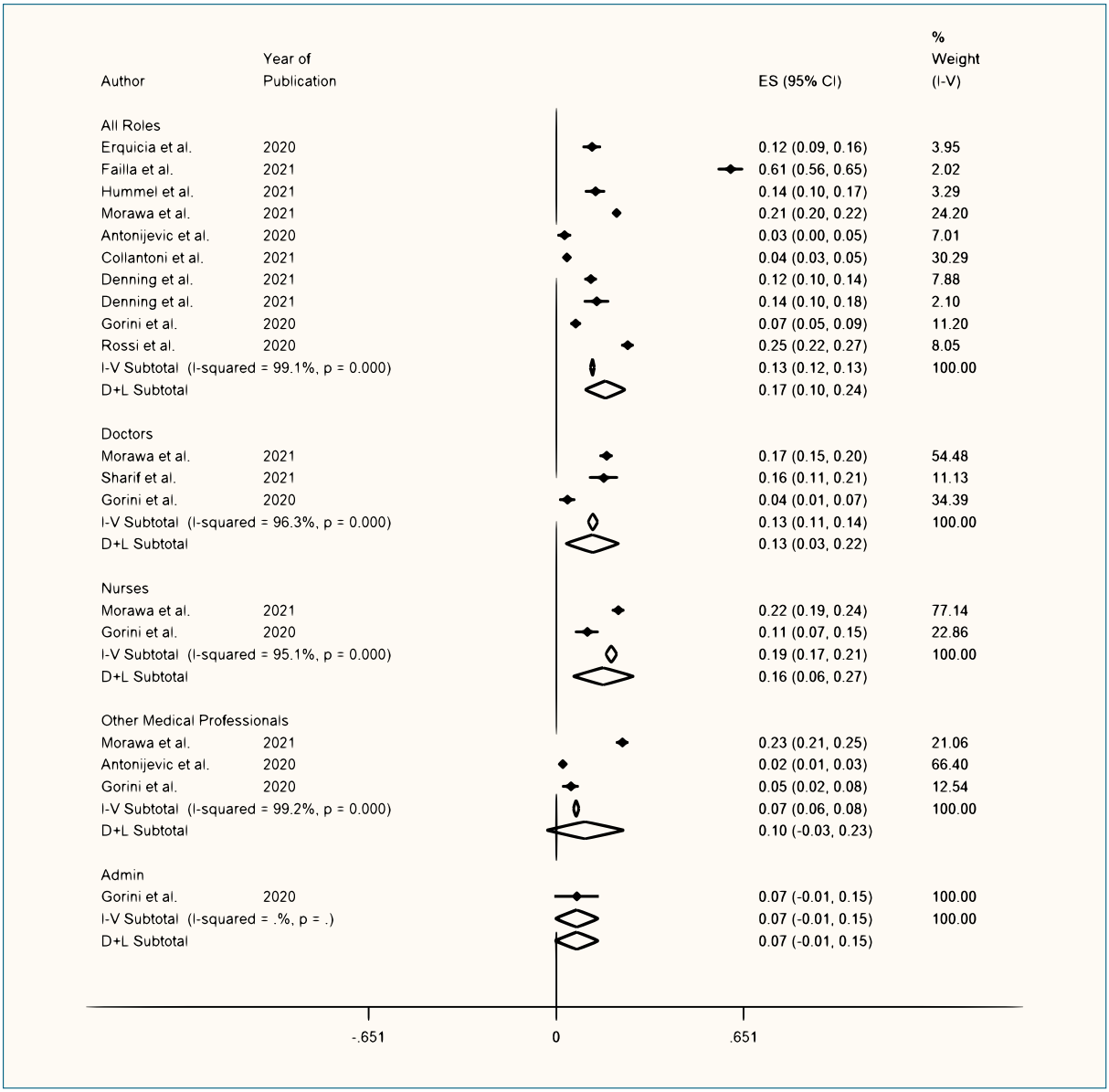
Figure 3.7 displays a forest plot for ES prevalence of stress among frontline healthcare workers. We found four studies examining the impact of COVID-19 among frontline healthcare workers. Heterogeneity between the four studies (I^2 = 98.7%,) stood significantly high and thus, a random-effects model was computed. Results showed significant prevalence of stress among frontline healthcare workers (ES = 0.35, CI: [0.17, 0.53]).

Discussion

We conducted a systematic review and meta-analysis to evaluate mental health outcomes of European HCWs during the COVID-19 pandemic. Through various database searches, cross-sectional studies from various European nations measured the impact of the COVID-19 pandemic on psychological symptoms such as anxiety, depression, PTSD, stress, and others. Aside from the prevalence data that were used for statistical analyses in this study, some studies also reported risk factors for certain psychological symptoms, relationships between physical and psychological symptoms, and suggested urgently needed interventions to prevent negative mental health outcomes in European HCWs.

Female sex (Collantoni et al., 2021; Denning et al., 2021; Gorini et al., 2020; Rossi et al., 2020), young age (Rossi et al., 2020), high alcohol consumption (Morawa et al., 2021), living with elderly family members (Col-

Figure 3.3. Forest plot for studies examining depression prevalence among healthcare workers during COVID-19 pandemic in Europe



lantoni et al., 2021), transferring to a different unit (Collantoni et al., 2021), and fear of COVID-19 infection (Gorini et al., 2020; Morawa et al., 2021) were independently associated with enhanced anxiety symptoms. Man et al. (2020) found that problem-focused coping significantly predicted anxiety, sadness, and fear compared to emotion-focused coping. Healthcare professionals working in a high risk exposure environment were associated with higher anxiety compared to those working in a low or no risk exposure environment (Antonijevic et al., 2020). Morawa et al. (2021) and Skoda et al. (2020) found that healthcare workers have lower anxiety symptoms than the general population, whereas Antonijevic et al. (2020) reported the opposite. Medical assistants reported having significantly higher anxiety and depression symptoms than physicians and nurses (Morawa et al., 2021) while nurses have higher anxiety symptoms than physicians (Collantoni et al., 2021; Morawa et al., 2021; Skoda et al., 2020).

Similarly, the following HCW characteristics were independently associated with increased depression symptoms: female sex (Collantoni et al., 2021; Gorini et al., 2020; Rossi et al., 2020), young age (Rossi et al., 2020), high alcohol consumption (Morawa et al., 2021), death of a colleague (Rossi et al., 2020), nursing job role (Collantoni et al., 2021; Morawa et al., 2021; Skoda et al., 2020), not being vaccinated (Sharif et al., 2022), and working in the frontline (Antonijevic et al., 2020; Collantoni et al., 2021; Rossi et al., 2020). Positive infection status is positively associated with depression symptoms (Collantoni et al., 2021; Sharif et al., 2022). Being a physician (Denning et al., 2021) is significantly associated with decreased depression symptoms. However, medical assistants appear to

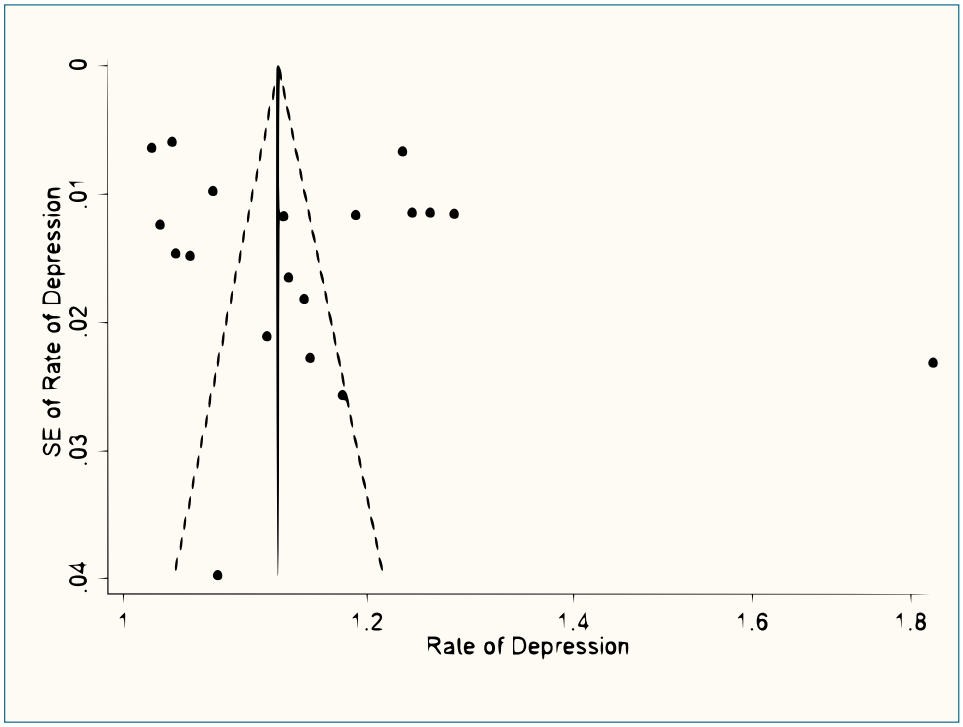


Figure 3.4. Funnel plot for studies examining depression prevalence among healthcare workers during COVID-19 pandemic in Europe

have significantly greater depression symptoms than physicians and nurses, while HCWs have significantly lower symptoms than the general population (Morawa et al., 2021). Redeployment during the pandemic also significantly increased depression symptoms (Collantoni et al., 2021; Denning et al., 2021; Sharif et al., 2022).

Nurses (Collantoni et al., 2021; Rossi et al., 2020) and HCWS who were redeployed to different settings (Collantoni et al., 2021) independently reported significantly higher insomnia symptoms than other HCWs. Overall, HCWs have significantly lower emotional disturbances compared to the general population (De Pasquale et al., 2022).

Experiencing the death of a colleague (Rossi et al., 2020), working in the frontline (Collantoni et al., 2021; Davico et al., 2021; Rossi et al., 2020), working as a nurse (Collantoni et al., 2021; Gorini et al., 2020), being redeployed (Collantoni et al., 2021), and being female (Collantoni et al., 2021; Davico et al., 2021; Gorini et al., 2020) all appeared as independent PTSD risk factors for healthcare workers. However, HCWs have lower PTSD symptom scores in comparison to the general population (Davico et al., 2021).

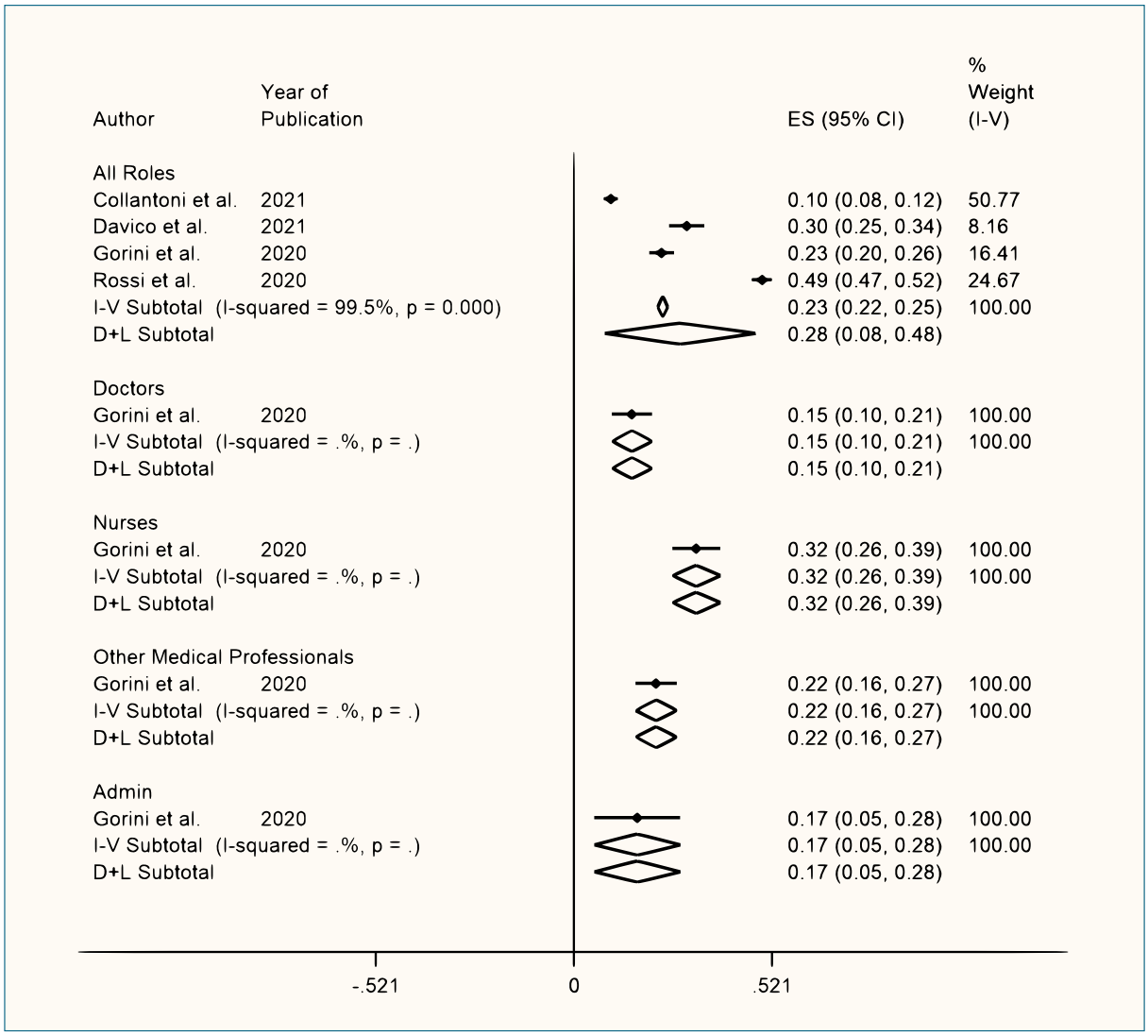
Female sex (Aisa et al., 2022; Babore et al., 2020; Erquicia et al., 2020; Rossi et al., 2020), young age (Aisa et al., 2022; Rossi et al., 2020), being a nurse (Aisa et al., 2022), and working in the frontline (Abdessater et al., 2020; Antonijevic et al., 2020; Babore et al., 2020) were independently associated with increased stress symptoms, while having a child (Babore et al., 2020) was associated with fewer stress symptoms. Aisa et al. (2022) reported a strong association between high intensive care unit bed occupancy and stress due to the greater workload. Abdessater et al. (2020) found that a respiratory illness history in HCWs is significantly associated with more stress. Greater stress symptoms in healthcare workers compared to the general population were discovered by Aisa et al. (2022).

The mental comorbidity of anxiety and burnout was positively associated with depression in healthcare workers (Denning et al., 2021). Compared to other healthcare workers in other European countries, anxiety, depression, and stress symptoms stood at the highest for healthcare workers in the United Kingdom and France, which may be a result of high case-fatality rates (Hummel et al., 2021). Stress symptoms stood significantly higher in healthcare workers compared to other workers in various European countries, due to unprepared facilities and personal protective materials shortage at the beginning of the pandemic (Aisa et al., 2022).

From the overall outcomes reported in the included studies, the characteristics of the most vulnerable healthcare worker would be a young woman working in the frontline in France or the United Kingdom, specifically as a redeployed nurse or medical assistant with a prior history of respiratory and mental illness. On the other hand, the characteristic of the least vulnerable healthcare worker would be an older male physician who has no respiratory and mental illness history.

Excessive workload was associated with psychological symptoms (Aisa et al., 2022). With limited personal protective equipment and COVID information, healthcare workers often did not eat, drink, or relieve them-

Figure 3.5. Forest plot for studies examining PTSD prevalence among healthcare workers during COVID-19 pandemic in Europe



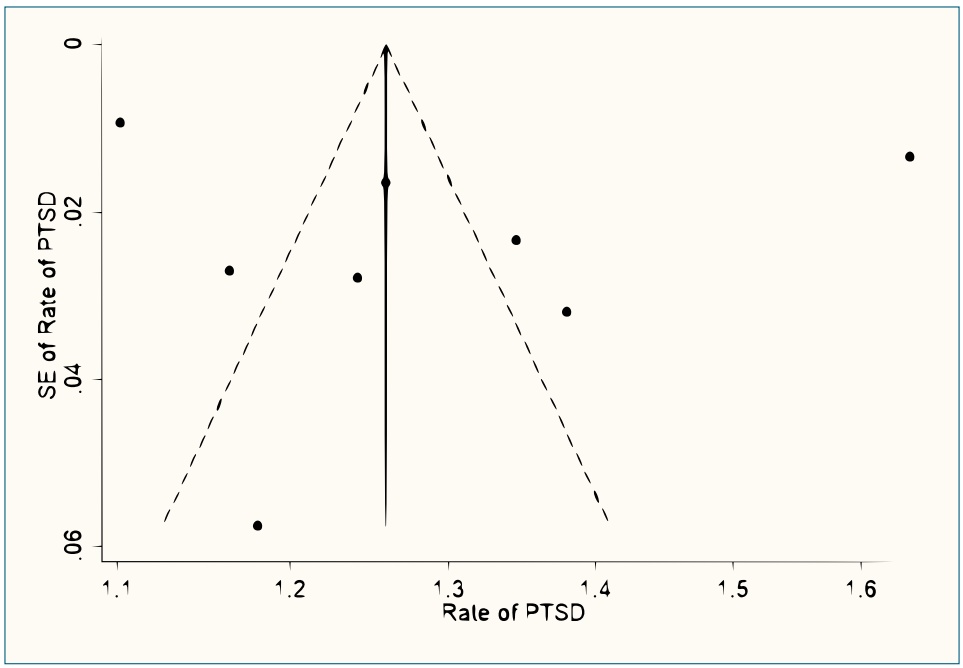
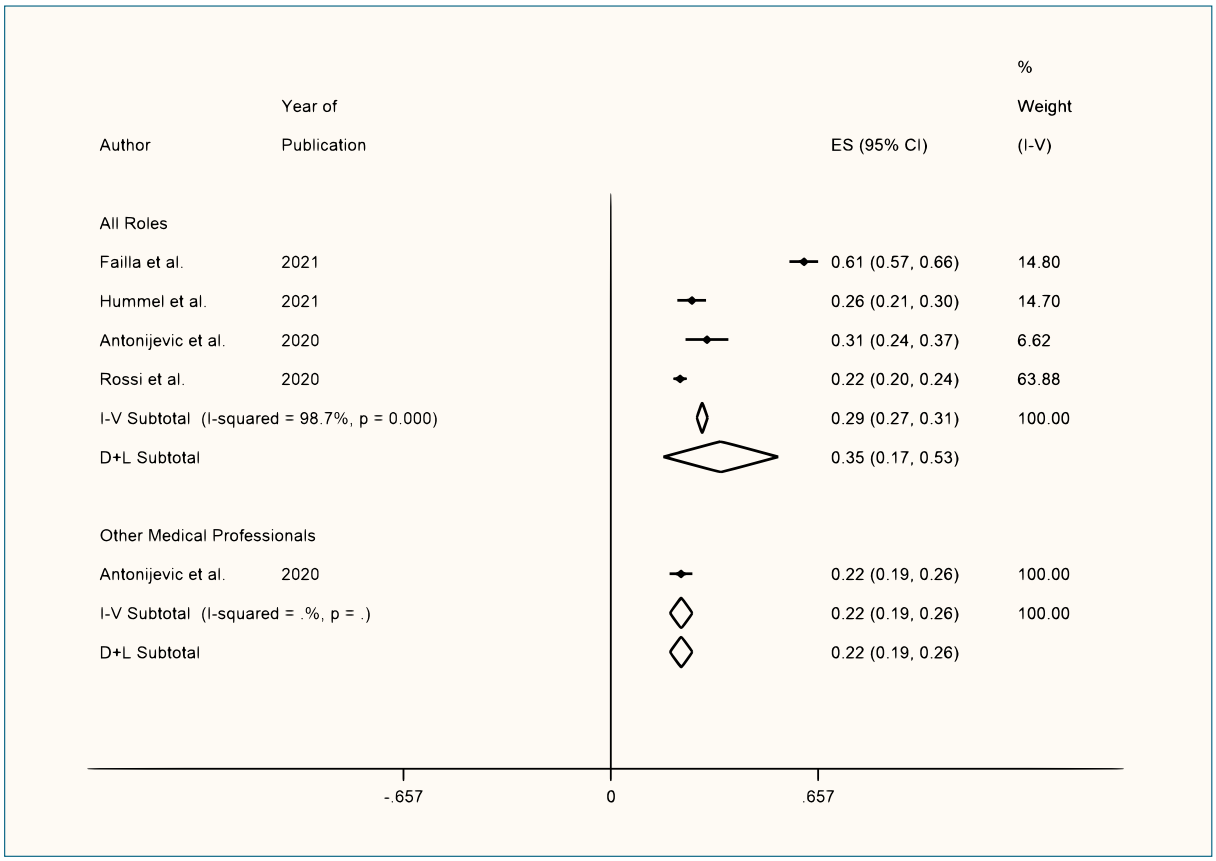


Figure 3.6. Funnel plot for studies examining PTSD prevalence among healthcare workers during COVID-19 pandemic in Europe

Figure 3.7. Forest plot for studies examining stress prevalence among healthcare workers during COVID-19 pandemic in Europe.



selves during shifts while simultaneously working long shifts in high temperatures and negative pressure environments, and thus became mentally and physically exhausted (Aisa et al., 2022; Büntzel et al., 2021; De Pasquale et al., 2022; Erquicia et al., 2020; Gorini et al., 2020; Hummel et al., 2021; Morawa et al., 2021; Sharif et al., 2022; van Hout et al., 2022; Vindrola-Padros et al., 2020). All these factors increased the risk of psychological distress for healthcare workers. Moreover, medical professionals were overworked due to the shortage of medical

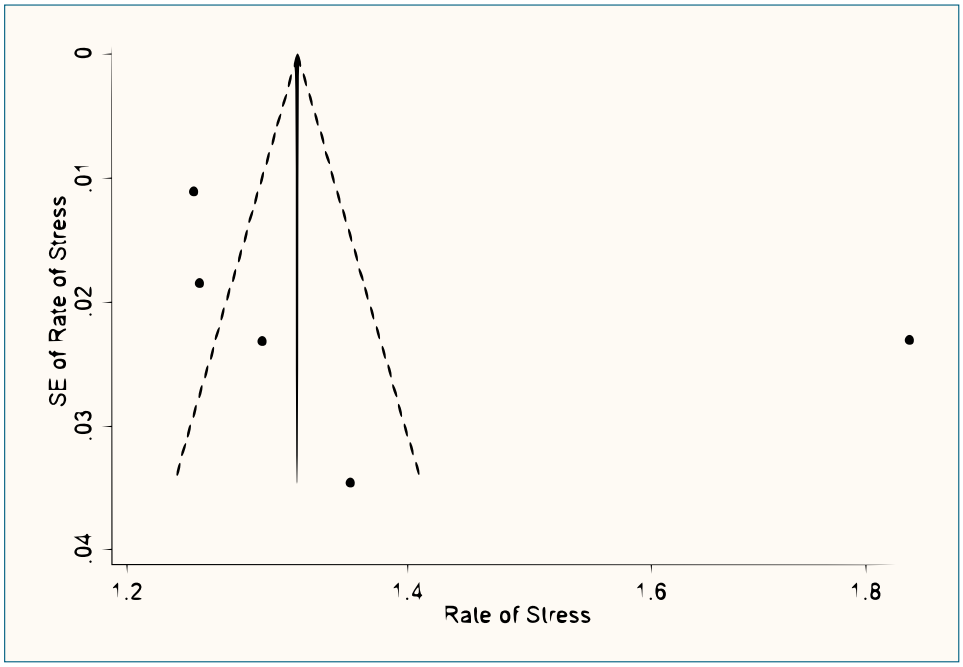


Figure 3.8. Funnel plot for studies examining stress prevalence among healthcare workers during COVID-19 pandemic in Europe.

staff and resources such as PPEs, COVID-19 PCR testing services, and guidelines for COVID-19 treatment (Abdessater et al., 2020; Aisa et al., 2022), leading to the increased intensity of their work requiring excessive physical and mental energy.

Studies suggested that monitoring healthcare workers' physical and psychological symptoms and needs was important in terms of adjusting their work schedule and tailoring specific psychological interventions and treatments (Rossi et al., 2020). In order to decrease stress and increase occupational confidence, healthcare workers should be well prepared through pre-job training of new treatment and sterilization protocols, have adequate education on preventing disease spread, and be equipped with adequate PPE (Sharif et al., 2022). Aisa et al. (2022) suggest that healthcare workers should receive psychiatric team counseling and motivational virtual messages to reduce stress. Additionally, Babore et al. (2020) found that those with severe mental health symptoms preferred seeking services directly from professionals than from close family and friends. The data included in this meta-analysis emphasized the urgent need for mental health services to minimize the psychological impact of the COVID-19 pandemic on healthcare workers that may persist even years after the pandemic.

All of the studies included were cross-sectional in nature, which inherently lack longitudinal follow-up due to the short data collection time during these acute phases of the pandemic. However, these studies met the inclusion criteria, were published, and shared vital insights and therefore, were included. Substantial heterogeneity between the studies was demonstrated, which could reflect different study participants from different countries, different self-reported questionnaires, different levels of severity cut-offs to calculate the prevalence for each mental health outcome, demographics, inclusion/exclusion criteria, study location, and year the study was conducted. The results drawn from this quantitative synthesis of the currently available literature suggest that more studies need to be reported to better understand the psychological effects of COVID-19 on healthcare workers.

Strengths and Limitations

One of the strengths of this systematic review involves the wide variety of studies included from different European nations spanning most of Europe's regions. Covering a wide selection of European nations and healthcare institutions generates a current view of the overall state of European HCWs in general, highlighting the factors that uniquely influence the work of HCWs in Europe, as opposed to HCWs residing in other continents. Additionally, most included studies had large sample sizes, which can provide a more accurate picture regarding the true state of European HCWs' mental health than studies with lower power.

The study limitations for meta-analyses such as this are necessary to understand, and aid in understanding the context of the results. First, it is necessary to consider the quality of the included studies. This revealed a significant variation in quality scoring with high-, medium-, and poor-quality studies having been reported. Nevertheless, as only few studies were available for analysis, all were included, irrespective of their quality. This is a recognized, but necessary, limitation due to the few clinical studies currently available. The poor quality can be seen in the missing data that were not reported in studies, such as sample percentage of genders and mean age (Table 1). Second, the meta-analysis of observational studies is influenced by inherent biases in the included articles. For example, a multitude of other factors such as the level of education, ethnicity, income status, socioeconomic status, and family could influence the estimates in the original studies. Lastly, it should be noted that although almost all included studies measured mental health outcomes through validated scales, these consisted not of clinical diagnoses but rather interviews or surveys that may carry a bias due to self-reporting.

Conclusion, Implications, and Future Directions

Healthcare workers in Europe were at greater risk of various mental health disorders due to the fear of transmitting COVID-19 to loved ones, strenuous working conditions, and lack of knowledge about COVID-19 in general and its treatment in particular. Healthcare workers' mental health is essential for providing patients with the best care and averting the collapse of the healthcare system. Preventative interventions and treatments as well as social support should be implemented to prevent, reduce, and treat healthcare workers' psychological symptoms. Furthermore, their mental and physical health should be closely monitored to ensure the effectiveness of these preventative measures over an extended period of time. Future studies should focus on longitudinally following the long-term psychological impact of this pandemic on the mental health of healthcare workers and explore the effectiveness of these interventions in preventing and reducing these negative psychological symptoms of healthcare workers.

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Brian Edward YU: conceptualization, investigation, project administration, data management, interpretation, writing review and editing.
Monali S. MALVANKAR-MEHTA: conceptualization, design, methodology, project administration, data management, formal analysis, interpretation, supervision, writing review and editing.
All authors gave their final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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The authors have no conflicts of interest to disclose.

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This manuscript is the authors' original work.
The study was pre-registered on PROSPERO with the registration number CRD42022343054.

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References

Abdessater, M., Rouprêt, M., Misrai, V., Matillon, X., Gondran-Tellier, B., Freton, L., Vallée, M., Dominique, I., Felber, M., Khene, Z., Fortier, E., Lannes, F., Michiels, C., Grevez, T., Szabla, N., Boustany, J., Bardet, F., Kaulanjan, K., Mazancourt, E. S. de, … Pradere, B. (2020). COVID19 pandemic impacts on anxiety of French urologist in training: Outcomes from a national survey. *Progrès En Urologie, 30*(8–9), 448–455. https://doi.org/10.1016/j.purol.2020.04.015

Adams, J. G., & Walls, R. M. (2020). Supporting the Health Care Workforce During the COVID-19 Global Epidemic. *JAMA, 323*(15), 1439–1440. https://doi.org/10.1001/jama.2020.3972

Agarwal, A., Guyatt, G., & Busse, J. (2011). Risk of Bias Instrument for Cross-Sectional Surveys of Attitudes and Practices. https://www.distillersr.com/wp-content/uploads/2021/03/Risk-of-Bias-Instrument-for-Cross-Sectional-Surveys-of-Attitudes-and-Practices-DistillerSR.pdf

Aisa, T., Diviney, D., Thomas, J., Al Qadheeb, N., Abdelbaky, M., Afify, H., Yasawy, M., Mahmoud, M., Abdallah, A., Bashir, A., Algrni, K., & Elgammal, B. (2022). Stress level assessment among health care workers involved in the management of critically ill COVID-19 patients. *Irish Journal of Medical Science, 191*, 1067–1073. https://doi.org/10.1007/s11845-021-02721-0

Allam, Z. (2020). The Second 50 days: A Detailed Chronological Timeline and Extensive Review of Literature Documenting the COVID-19 Pandemic From Day 50 to Day 100. *Surveying the Covid-19 Pandemic and Its Implications*, 9–39. https://doi.org/10.1016/B978-0-12-824313-8.00002-4

Antonijevic, J., Binic, I., Zikic, O., Manojlovic, S., Tosic-Golubovic, S., & Popovic, N. (2020). Mental health of medical personnel during the COVID-19 pandemic. *Brain and Behavior, 10*(12), e01881. https://doi.org/10.1002/brb3.1881

Babore, A., Lombardi, L., Viceconti, M. L., Pignataro, S., Marino, V., Crudele, M., Candelori, C., Bramanti, S. M., & Trumello, C. (2020). Psychological effects of the COVID-2019 pandemic: Perceived stress and coping strategies among healthcare professionals. *Psychiatry Research, 293*, Article 113366. https://doi.org/10.1016/j.psychres.2020.113366

Bech, P. (2004). Measuring the dimension of psychological general well-being by the WHO-5. *Quality of Life Newsletter, 32*, 15–16.

Beck, A. T., Steer, R. A., & Carbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review, 8*(1), 77–100. https://doi.org/10.1016/0272-7358(88)90050-5

Beusenberg, M., Orley, J. H., & World Health. Division of Mental Health. (1994). *A User's guide to the self reporting questionnaire (SRQ)*. World Health Organization. https://apps.who.int/iris/handle/10665/61113

Büntzel, J., Micke, O., Klein, M., Büntzel, J., Walter, S., Keinki, C., & Huebner, J. (2021). Take care or "German Angst"? Lessons from cancer care during COVID-19 pandemic in spring 2020. *Journal of Cancer Research and Clinical Oncology, 147*, 2093–2105. https://doi.org/10.1007/s00432-020-03492-4

Cohen, S., Kamarck, T., & Mermelstein, R. (1994). Perceived stress scale. Measuring Stress: A Guide for Health and Social Scientists, 10(*2*), 1–2. https://www.mindgarden.com/documents/PerceivedStressScale.pdf

Collantoni, E., Saieva, A. M., Meregalli, V., Girotto, C., Carretta, G., Boemo, D. G., Bordignon, G., Capizzi, A., Contessa, C., Nesoti, M. V., Donato, D., Flesia, L., & Favaro, A. (2021). Psychological Distress, Fear of COVID-19, and Resilient Coping Abilities among Healthcare Workers in a Tertiary First-Line Hospital during the Coronavirus Pandemic. *Journal of Clinical Medicine, 10*(7), Article 1465. https://doi.org/10.3390/jcm10071465

Davico, C., Ghiggia, A., Marcotulli, D., Ricci, F., Amianto, F., & Vitiello, B. (2021). Psychological Impact of the COVID-19 Pandemic on Adults and Their Children in Italy. *Frontiers in Psychiatry, 12*, Article 572997. https://doi.org/10.3389/fpsyt.2021.572997

De Pasquale, C., Conti, D., Dinaro, C., D'Antoni, R. A., La Delfa, E., & Di Nuovo, S. (2022). The COVID-19 Pandemic and Posttraumatic Stress Disorder: Emotional Impact on Healthcare Professions. *Frontiers in Psychiatry, 13*, Article 832843. https://doi.org/10.3389/fpsyt.2022.832843

Denning, M., Goh, E. T., Tan, B., Kanneganti, A., Almonte, M., Scott, A., Martin, G., Clarke, J., Sounderajah, V., Markar, S., Przybylowicz, J., Chan, Y. H., Sia, C.-H., Chua, Y. X., Sim, K., Lim, L., Tan, L., Tan, M., Sharma, V., … & Kinross, J. (2021). Determinants of burnout and other aspects of psychological well-being in healthcare workers during the Covid-19 pandemic: A multinational cross-sectional study. *PloS One, 16*(4), e0238666. https://doi.org/10.1371/journal.pone.0238666

Douglas M. M., Lorr, M., Droppleman, L. F. (1992). *Profile of mood states*. Educational and Industrial Testing Service. https://www.statisticssolutions.com/free-resources/directory-of-survey-instruments/profile-of-mood-states-poms/

Erquicia, J., Valls, L., Barja, A., Gil, S., Miquel, J., Leal-Blanquet, J., Schmidt, C., Checa, J., & Vega, D. (2020). Emotional impact of the Covid-19 pandemic on healthcare workers in one of the most important infection outbreaks in Europe. *Medicina Clínica (English Edition), 155*(10), 434–440. https://doi.org/10.1016/j.medcle.2020.07.010

Failla, G., Peyre-Costa, D., Croci, R., Lo Moro, G., Chen-Xu, J., Ferreira, M. C., Jaquete, A., Malcata, F., Vasiliu, A., & ERG EuroNet-MRPH Research Group. (2021). Assessing COVID-19-related depression, anxiety and stress among European public health residents. *European Journal of Public Health, 31(Issue Supplement_3)*, ckab164.534. https://doi.org/10.1093/eurpub/ckab164.534

Goberna-Tricas, J., Biurrun-Garrido, A., Perelló-Iñiguez, C., & Rodríguez-Garrido, P. (2021). The COVID-19 Pandemic in Spain: Experiences of Midwives on the Healthcare Frontline. *International Journal of Environmental Research and Public Health, 18*(12), Article 6516. https://doi.org/10.3390/ijerph18126516

Gorini, A., Fiabane, E., Sommaruga, M., Barbieri, S., Sottotetti, F., La Rovere, M. T., Tremoli, E., & Gabanelli, P. (2020). Mental health and risk perception among Italian healthcare workers during the second month of the Covid-19 pandemic. *Archives of Psychiatric Nursing, 34*(6), 537–544. https://doi.org/10.1016/j.apnu.2020.10.007

Hummel, S., Oetjen, N., Du, J., Posenato, E., Resende de Almeida, R. M., Losada, R., Ribeiro, O., Frisardi, V., Hopper, L., Rashid, A., Nasser, H., König, A., Rudofsky, G., Weidt, S., Zafar, A., Gronewold, N., Mayer, G., & Schultz, J.-H. (2021). Mental Health Among Medical Professionals During the COVID-19 Pandemic in Eight European Countries: Cross-sectional Survey Study. *Journal of Medical Internet Research, 23*(1), e24983. https://doi.org/10.2196/24983

Koçak, O., Koçak, Ö. E., & Younis, M. Z. (2021). The Psychological Consequences of COVID-19 Fear and the Moderator Effects of Individuals' Underlying Illness and Witnessing Infected Friends and Family. *International Journal of Environmental Research and Public Health, 18*(4), Article 1846. https://doi.org/10.3390/ijerph18041836

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9. *Journal of General Internal Medicine, 16*, 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kroenke, K., Spitzer, R. L., Williams, J. B. W., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: The PHQ-4. *Psychosomatics, 50*(6), 613–621. https://doi.org/10.1176/appi.psy.50.6.613

Lobo, A., Chamorro, L., Luque, A., Dal-Ré, R., Badia, X., Baró, E., & Grupo de Validación en Español de Escalas Psicométricas (GVEEP). (2002). Validación de las versiones en español de la Montgomery-Asberg Depression Rating Scale y la Hamilton Anxiety Rating Scale para la evaluación de la depresión y de la ansiedad [Validation of the Spanish versions of the Montgomery-Asberg depression and Hamilton anxiety rating scales]. *Medicina Clínica, 118*(13), 493–499. https://doi.org/10.1016/s0025-7753(02)72429-9

Man, M. A., Toma, C., Motoc, N. S., Necrelescu, O. L., Bondor, C. I., Chis, A. F., Lesan, A., Pop, C. M., Todea, D. A., Dantes, E., Puiu, R., & Rajnoveanu, R.-M. (2020). Disease Perception and Coping with Emotional Distress During COVID-19 Pandemic: A Survey Among Medical Staff. *International Journal of Environmental Research and Public Health, 17*(13), Article 4899. https://doi.org/10.3390/ijerph17134899

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine, 6*(7), e1000097–e1000097. https://doi.org/10.1371/journal.pmed.1000097

Morawa, E., Schug, C., Geiser, F., Beschoner, P., Jerg-Bretzke, L., Albus, C., Weidner, K., Hiebel, N., Borho, A., & Erim, Y. (2021). Psychosocial burden and working conditions during the COVID-19 pandemic in Germany: The VOICE survey among 3678 health care workers in hospitals. *Journal of Psychosomatic Research, 144*, Article 110415. https://doi.org/10.1016/j.jpsychores.2021.110415

Morin, C. M. (1993). *Insomnia Severity Index (ISI)* [Database record]. APA PsycTest. https://psycnet.apa.org/doi/10.1037/t07115-000

Mortier, P., Vilagut, G., Ferrer, M., Serra, C., Molina, J. D., López-Fresneña, N., Puig, T., Pelayo-Terán, J. M., Pijoan, J. I., Emparanza, J. I., Espuga, M., Plana, N., González-Pinto, A., Ortí-Lucas, R. M., de Salázar, A. M., Rius, C., Aragonès, E., Del Cura-González, I., Aragón-Peña, A., … the MINDCOVID Working Group. (2021). Thirty-day suicidal thoughts and behaviors among hospital workers during the first wave of the Spain COVID-19 outbreak. *Depression and Anxiety, 38*(5), 528–544. https://doi.org/10.1002/da.23129

Olff, M., Bakker, A., Frewen, P., Aakvaag, H., Ajdukovic, D., Brewer, D., Elmore Borbon, D. L., Cloitre, M., Hyland, P., Kassam-Adams, N., Knefel, M., Lanza, J. A., Lueger-Schuster, B., Nickerson, A., Oe, M., Pfaltz, M. C., Salgado, C., Seedat, S., Wagner, A., … Global Collaboration on Traumatic Stress (GC-TS). (2020). Screening for consequences of trauma–an update on the global collaboration on traumatic stress. *European Journal of Psychotraumatology, 11*(1), Article 1752504. https://psycnet.apa.org/doi/10.1080/20008198.2020.1752504

Osman, A., Wong, J. L., Bagge, C. L., Freedenthal, S., Gutierrez, P. M., & Lozano, G. (2012). The Depression Anxiety Stress Scales—21 (DASS-21): Further examination of dimensions, scale reliability, and correlates. *Journal of Clinical Psychology, 68*(12), 1322–1338. https://doi.org/10.1002/jclp.21908

Robertson, E., Hershenfield, K., Grace, S. L., & Stewart, D. E. (2004). The psychosocial effects of being quarantined following exposure to SARS: A qualitative study of Toronto health care workers. *Canadian Journal of Psychiatry, 49*(6), 403–407. https://doi.org/10.1177/070674370404900612

Rossi, R., Socci, V., Pacitti, F., Di Lorenzo, G., Di Marco, A., Siracusano, A., & Rossi, A. (2020). Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. *JAMA Network Open, 3*(5), e2010185. https://doi.org/10.1001/jamanetworkopen.2020.10185

Saglietto, A., D'Ascenzo, F., Zoccai, G. B., & Ferrari, G. M. D. (2020). COVID-19 in Europe: The Italian lesson. *The Lancet, 395*(10230), 1110–1111. https://doi.org/10.1016/S0140-6736(20)30690-5

Sharif, S., Amin, F., Hafiz, M., Costa, F., Dahlan, R. H., Vaishya, S., Peev, N., Benzel, E., & World Spinal Column Society Executive Board. (2022). A Year of Pandemic-Comparison of Depression Among Neurosurgeons After the Advent of the COVID-19 Vaccine. *World Neurosurgery, 159*, e466–e478. https://doi.org/10.1016/j.wneu.2021.12.076

Shaukat, N., Ali, D. M., & Razzak, J. (2020). Physical and mental health impacts of COVID-19 on healthcare workers: A scoping review. *International Journal of Emergency Medicine, 13*, Article 40. https://doi.org/10.1186/s12245-020-00299-5

Skoda, E.-M., Teufel, M., Stang, A., Jöckel, K.-H., Junne, F., Weismüller, B., Hetkamp, M., Musche, V., Kohler, H., Dörrie, N., Schweda, A., & Bäuerle, A. (2020). Psychological burden of healthcare professionals in Germany during the acute phase of the COVID-19 pandemic: Differences and similarities in the international context. *Journal of Public Health, 42*(4), 688–695. https://doi.org/10.1093/pubmed/fdaa124

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

StataCorp. (2017). *Stata* (Release 15) [Statistical Software]. StataCorp LLC. https://www.stata.com/

van Hout, D., Hutchinson, P., Wanat, M., Pilbeam, C., Goossens, H., Anthierens, S., Tonkin-Crine, S., & Gobat, N. (2022). The experience of European hospital-based health care workers on following infection prevention and control procedures and their wellbeing during the first wave of the COVID-19 pandemic. *PLOS One, 17*(2), Article e0245182. https://doi.org/10.1371/journal.pone.0245182

Veritas Health Innovation. (n.d.). *Covidence* [Systematic Review Software]. www.covidence.org

Vindrola-Padros, C., Andrews, L., Dowrick, A., Djellouli, N., Fillmore, H., Bautista Gonzalez, E. B., Javadi, D., Lewis-Jackson, S., Manby, L., Mitchinson, L., Mulcahy Symmons, S., Martin, S., Regenold, N., Robinson, H., Sumray, K., Singleton, G., Syversen, A., Vanderslott, S., & Johnson, G. (2020). Perceptions and experiences of healthcare workers during the COVID-19 pandemic in the UK. *BMJ Open, 10*(11), e040503. https://doi.org/10.1136/bmjopen-2020-040503

Walton, M., Murray, E., & Christian, M. D. (2020). Mental health care for medical staff and affiliated healthcare workers during the COVID-19 pandemic. European Heart Journal. *Acute Cardiovascular Care, 9*(3), 241–247. https://doi.org/10.1177/2048872620922795

Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD Checklist for DSM-5 (PCL-5) – Standard [Measurement instrument]. https://www.ptsd.va.gov/

Weiss, D. S., & Marmar, C. R. (1997). The Impact of Event Scale–Revised. In J. P. Wilson & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399–411). The Guilford Press.

World Health Organization. (2020, June 29). *Listings of WHO's response to COVID-19.* https://www.who.int/news-room/detail/29-06-2020-covidtimeline

World Health Organisation. (n.d.). *WHO Coronavirus Disease (COVID-19) Dashboard.* https://covid19.who.int/

Witteveen, D., & Velthorst, E. (2020). Economic hardship and mental health complaints during COVID-19. *Proceedings of the National Academy of Sciences, 117*(44), 27277–27284. https://doi.org/10.1073/pnas.2009609117

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica, 67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x