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Indicators associated with job morale of physicians in low- and middle-income countries during the COVID- 19 pandemic: a systematic review and meta-analysis

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Abstract

Background The COVID- 19 pandemic has placed immense strain on healthcare systems around the globe, with low- and middle-income countries facing unique challenges due to limited resources and fragile healthcare infrastructures. This systematic review and meta-analysis aims to define the levels of four indicators of job morale (job motivation, job satisfaction, burnout, and depression symptoms) among physicians working in public healthcare settings in low- and middle-income countries.

Methods A comprehensive search of Scopus, PubMed, Embase, Web of Science, the Cochrane Library, and grey literature was performed. Studies were eligible if at least one job morale indicator (job motivation, job satisfaction, burnout, or depression symptoms) was assessed using quantitative methods, and at least 50% of the sample were qualified physicians working in low- and middle-income countries during the COVID- 19 pandemic. Random effects meta-analyses, planned sub-group analyses, and meta-regression were performed.

Results Overall, 82 studies involving 65,431 participants across 26 middle-income countries met the inclusion criteria for the review. The pooled random effect estimates of the prevalence of burnout suggest that 49% of physicians working in middle-income countries during the COVID- 19 pandemic suffered from professional burnout. The overall estimate of the mean was 24.64, which also indicated a high level of burnout. The pooled random effect estimates of the prevalence of depression symptoms varied from 41 to 58%, depending on the adopted scale. Sufficient data were not available for meta-analyses of job motivation and job satisfaction.

Conclusions The findings suggest that job morale among physicians working in middle-income countries was generally low during the COVID- 19 pandemic. However, due to substantial variation and limited methodological quality among the studies included, any conclusions offered should be approached with caution. Future research should focus on assessing job morale in low-income regions and identifying effective resilience strategies to support interventions aimed at improving job morale.

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Keywords Job morale, Burnout, Low- and middle-income countries, Systematic review, COVID-19 pandemic

Introduction

Job morale does not have a universally recognized and accepted definition [1]. In the context of healthcare research, job morale has been defined as a multidimensional construct encompassing a set of job-related concepts and influencing job-related outcomes [1]. In line with Warr's theoretical framework of affective well-being [2, 3], it has been suggested that job morale is encompassed by the interplay among job-related concepts, such as job motivation, job satisfaction, burnout and depression symptoms [1]. These concepts, in turn, are influenced by a range of factors categorized broadly as job demands and job resources, consistent with the Job Demands-Resources (JD-R) Model [4]. The primary hypothesis of the JD-R model is that a combination of excessive job demands and insufficient job resources results in job strain, burnout, and depression symptoms, leading to negative job morale [4]. Conversely, high levels of job motivation and job satisfaction– and thus positive job morale– are most likely when job resources are high, even in situations of high demands [4]. Job morale among healthcare workers has been described as a vital factor influencing the quality of provided care [5, 6], recruitment and retention [7], and overall health system performance [8]. Maintaining positive job morale ensures the sustainability and effectiveness of the healthcare workforce, which are crucial for managing crises such as the Coronavirus Disease 2019 (COVID- 19) pandemic.

The COVID- 19 pandemic has exerted extraordinary pressure on healthcare systems worldwide, particularly affecting low- and middle-income countries (LMICs), which encounter distinct obstacles attributable to constrained resources and vulnerable healthcare infrastructures [9]. Frontline healthcare workers in these regions, including physicians, faced a number of unique challenges during the COVID- 19 pandemic, which were rooted in structural, financial and social disparities that intensified the pandemic's impact on healthcare delivery and personal well-being. Firstly, healthcare workers in LMICs faced an increased risk of contracting COVID- 19 due to shortages of personal protective equipment, insufficient testing and tracing, and delayed access to vaccines and treatment [10–12]. Secondly, chronic shortages of healthcare professionals in LMICs became even more pronounced in the context of overwhelming patient flow during the pandemic, leading to extreme working hours and physical and mental exhaustion [10, 13]. Thirdly, the lack of adequate medical supplies and facilities hindered the ability of healthcare staff to provide adequate care for critically ill patients [14, 15]. Fourthly, poorly implemented or inconsistently enforced public health measures in LMICs facilitated the rapid dissemination of misinformation about the virus's origin, diagnosis and treatment. Healthcare workers faced stigma from communities that regarded them as potential transmitters of the virus [16]. Finally, healthcare workers in LMICs experienced severe emotional stress from high patient mortality and limited mental health support. Feelings of helplessness and moral distress from inadequate resources contributed to symptoms of anxiety and depression symptoms, while fears of infecting family members or contracting the virus themselves further amplified the psychological strain [16, 17]. It is also important to note that while both private and public healthcare systems were pivotal in patient care in LMICs, public healthcare facilities, frequently strained by resource limitations, primarily managed the majority of COVID- 19 patients, particularly in government-designated isolation centers.

To our knowledge, there is a lack of comprehensive research that synthesizes findings from various LMICs while simultaneously addressing the complex dimensions of healthcare worker's job morale during the COVID- 19 pandemic. Therefore, we conducted a systematic review and meta-analysis with the aim of defining the levels of four indicators of job morale (job motivation, job satisfaction, burnout and depression symptoms) among physicians working in public healthcare settings in LMICs during the COVID- 19 pandemic.

Methods

This review protocol was registered on PROSPERO (*CRD42022340195*) in advance. The present study followed the Meta-analysis of Observational Studies in Epidemiology (MOOSE) reporting guidelines [18] and the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines [19].

Search strategy

The search was conducted across five electronic databases: Scopus, PubMed, Embase, Web of Science, and the Cochrane Library on June 13, 2022 and updated on June 28, 2024. Search terms focused on three overlapping areas, including *morale OR job motivation OR job satisfaction OR burnout OR depression AND physicians AND LMICs* (Appendix 1 and Appendix 2). To minimize publication bias, the search included conference proceedings and unpublished literature via Google Scholar and OpenGrey using different combinations of key words indicated above.

Selection criteria

Studies were included if they met the following criteria: (1) assessed at least one job morale indicator (job motivation, job satisfaction, burnout, or depression symptoms) using quantitative methods after March 11, 2020

– the date when the World Health Organization declared COVID- 19 to be a global pandemic [20]; and (2) at least 50% of the participants were qualified physicians from LMICs as defined by the World Bank classification [21]. Studies were excluded if they met any of the following criteria: (1) 50% or more of the participants were physicians undertaking in training at the time of the study (medical students, residents, trainees or registrars); (2) 50% or more of the participants were employed in private healthcare settings; (3) physicians' qualifications or years of experience were not reported; or (4) studies were only available in languages other than Latin script, Russian, or Kazakh. For the purposes of the current review, dentists were regarded as physicians.

Identification and data extraction

Titles and abstracts were imported into EndNote X8 for initial screening by AK. All titles and abstracts were independently reviewed by second and third authors (NT and MD) to ensure the accuracy of selection. Full-text articles were inspected for relevance by five reviewers (AK, MD, RM, MS, and AT). Data from the included studies were extracted by AK, whereas a sub-sample of 40% was cross-checked by TS and DS. Discrepancies were resolved by involving a fourth reviewer (MT). The level of agreement between AK and NT was 85%, and between AK and MD was 90%. In the case of a mixed sample, only data focusing on the sample of interest was extracted [22]. A random sub-sample of 30% of meta-analyses results was independently verified by NT.

Quality assessment

The risk of bias was assessed using the 8-item Joanna Briggs Institute (JBI) Critical Appraisal Cheklist for Analytical Cross Sectional Studies [23]. AK conducted a full quality assessment. NT and MD ensured the accuracy at this stage by independently evaluating all included records.

Data synthesis and statistical analysis

Meta-analyses were performed using STATA version 18 (StataCorp, College Station, TX). A summary of all meta-analysis commands used is provided in Appendix 3. Studies which were not included in the meta-analyses were described narratively.

Separate analyses were conducted for dichotomous and continuous data. For dichotomous data, the pooled prevalence of burnout dimensions (emotional exhaustion, depersonalization, and personal accomplishment) and depression symptoms among physicians working in LMICs during the COVID- 19 pandemic was estimated from raw proportions reported in the included studies using the 'metaprop' command [24]. The exact method was applied to compute a 95% Confidence Interval (CI) [24]. For continuous data, the pooled mean scores for burnout dimensions and depression symptoms were estimated from means and standard deviations extracted from the included studies and by utilizing the 'metan' command [25].

As large methodological and clinical variability was expected [26], variances of raw proportions and means were pooled using a random-effects model [27]. Heterogeneity between studies was assessed using the I^2 test (values above 75% indicated a substantial level of heterogeneity). Publication bias was evaluated by examining funnel plots [28] and performing Egger's Test [29]. P-values less than 0.05 were considered to be statistically significant.

Sources of heterogeneity were investigated through exploratory sub-group analyses for meta-analyses that included at least ten included studies [27, 30]. The following covariates were examined: the country's income group categorized as upper-middle, lower-middle, and low-income according to the World Bank classification [21]; physicians' specialties; and geographical regions based on the United Nations classification [31]. Sub-group analyses examined the effects within each sub-group individually. Univariate random-effects meta-regression was conducted using the 'metareg' command [32] to explore residual heterogeneity for studies that indicated a difference in a sub-group analysis and contained more than ten studies per covariate.

Sensitivity analyses were performed by excluding studies with a high risk of bias (those rated unclear or no on five or more quality criteria), those including non-physician participants, and those without specified healthcare settings.

Results

The original search was conducted in June 2022, with an update in June 2024. A total of 1,142 studies were evaluated for eligibility, with 1,060 excluded for various reasons, including an irrelevant sample group or timeframe, lack of outcomes of interest, review papers, studies conducted outside the target countries, unavailability of full text, qualitative study design, absence of physician qualifications or years of experience, focus on private healthcare settings, non-relevant language, and studies limited to protocols or abstracts (Appendix 4). Ultimately, 82 studies met the eligibility criteria and were included in the review. The detailed selection process is outlined in the PRISMA flow diagram (Fig. 1).

Studies were published between 2020 and 2024, all in English ($n = 82$). Two studies used data from more than one country [33, 34]. Included studies assessed 65,431 participants from 26 LMICs (geographical distribution of included studies is summarized in Appendix 4). Overall, 27 studies were from lower-middle-income countries,

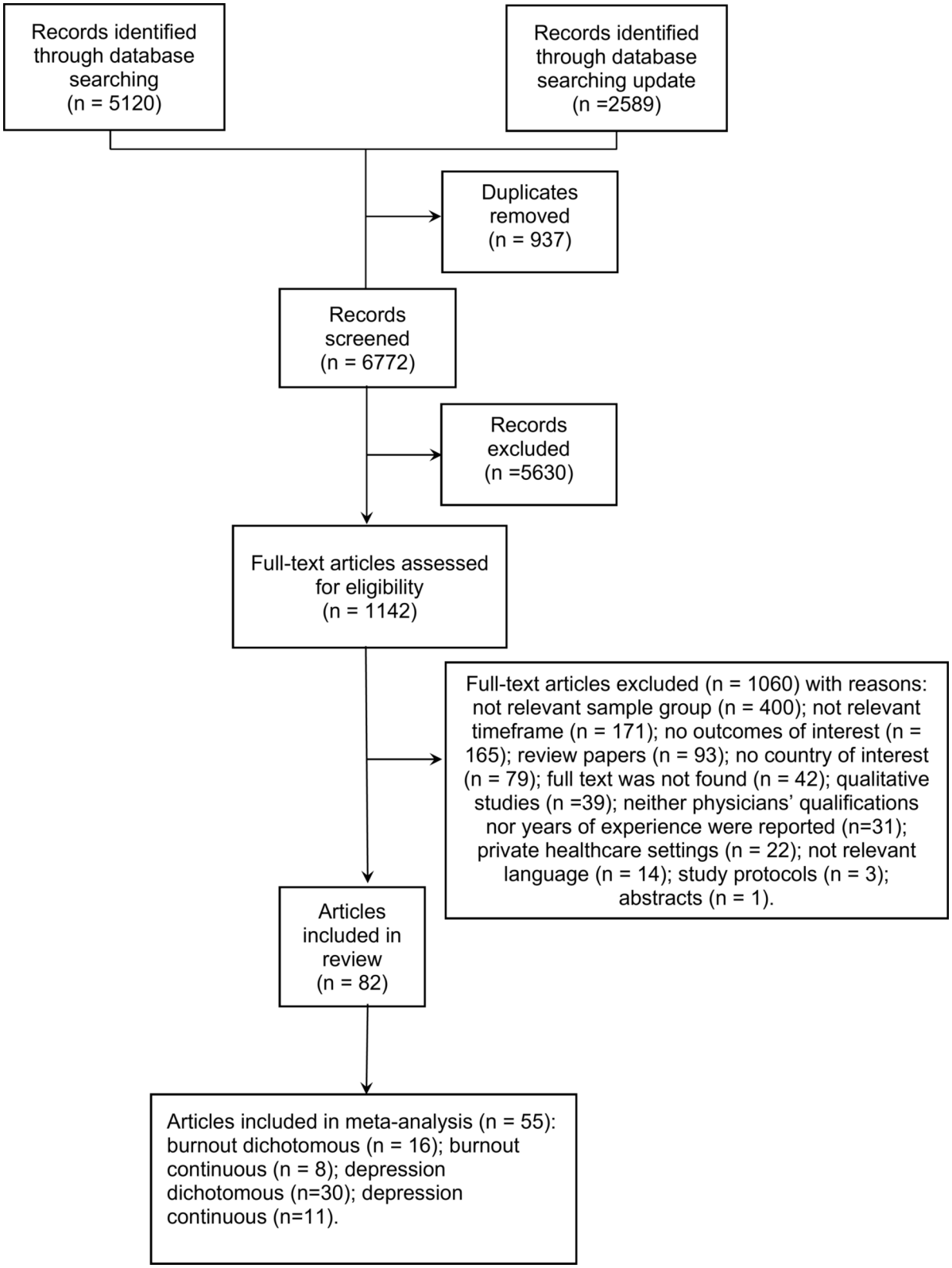

Fig. 1 PRISMA flow diagram

and 55 were from upper-middle-income countries. As regards the study design, 81 were cross-sectional surveys, and one study adopted mixed methods [22]. Sample sizes varied from between 37 [35] to 10,516 [36] participants, with a median sample size of 332 participants. The response rate across studies ranged from 16.9% [37] to 100% [38]. Detailed study characteristics are presented in Table 1.

Job motivation findings

Of all included studies, only one study was measured job motivation [64]. This study included a total sample of 939 participants and used an author-developed questionnaire. It was defined that 49.6% of participants experienced a decreased sense of job motivation during the outbreak of the COVID- 19 pandemic [64].

Job satisfaction findings

Of all the studies measuring job satisfaction (n = 11), the Minnesota Satisfaction Questionnaire (MSQ) was adopted in four studies [50, 57, 63, 97], whilst three studies [46, 64, 68] utilized author-developed questionnaires, and four others [22, 38, 67, 106] employed various scales to measure job satisfaction. Overall, four studies found moderate levels of job satisfaction [22, 38, 46, 50], three studies showed low levels of job satisfaction [57, 63, 68], and one study [64] reported a decline in job satisfaction levels. Another three studies [67, 97, 106] did not present quantifiable results.

Burnout findings

Burnout reported as dichotomous data

Among the 31 studies that reported burnout as dichotomous data, 16 studies [33, 41, 42, 50, 59, 61, 67, 69, 71, 74, 78, 79, 86, 96, 102, 110] adopted similar scales (Maslach Burnout Inventory-Human Services Survey, Maslach Burnout Inventory-General Survey, and Maslach Burnout Inventory for Educators) and provided sufficient data for inclusion in the meta-analyses for each dimension of burnout (emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA)), with a total sample size of 10,368 participants. The pooled random effect estimates of the prevalence indicated that 49% (n = 16; 95% CI 38%– 60%; I^2 = 99.28%; p < 0.001) of physicians exceeded the 'high' threshold for EE (Fig. 2); 39% (n = 15; 95% CI 24%– 53%; I^2 = 99.72%; p < 0.001) were above the 'high' threshold for DP (Fig. 3) and 50% (n = 15; 95% CI 41%– 59%; I^2 = 98.88%; p < 0.001) were below the 'low' threshold for PA (Fig. 4).

Heterogeneity was substantial in all analyses. It was explored via sub-group analyses, which revealed that the prevalence of burnout varied depending on country's income group for PA (P for heterogeneity < 0.001), geographical region (P for heterogeneity < 0.001) and physicians' various specialties (P for heterogeneity < 0.001) (Appendix 5). However, significant within-group heterogeneity and uneven covariate distribution suggested that sub-groups alone could not explain the variance between studies. Further, the meta-regression showed that physicians in upper-middle-income countries had significantly lower levels of PA compared to those in lower-middle-income countries (coefficient = 0.262, 95% CI 0.012 to 0.512, p = 0.041). The study from Bulgaria [61] was excluded due to the collinearity of the results.

Burnout reported as continuous data

Of 18 studies that reported burnout results as continuous data, eight studies [40, 41, 56, 71, 92, 105, 110, 111] used the Maslach Burnout Inventory and provided sufficient data to be included in the meta-analyses for the EE, DP, and PA dimensions with a total sample of 4,719 participants. The random-effects estimates of the weighted mean scores were: EE = 24.64 (n = 8; 95% CI 24.31–24.97; I^2 = 98.2%, P < 0.001) (Fig. 5); DP = 9.18 (n = 8; 95% CI 8.99–9.36; I^2 = 97.3%, P < 0.001) (Fig. 6); and PA = 27.84 (n = 8; 95% CI 27.52–28.15; I^2 = 99.8%; P < 0.001) (Fig. 7). These scores indicated a high level of emotional exhaustion, a moderate level of depersonalization and a relatively high level of personal accomplishment.

Sub-group analyses for burnout dimensions reported as continuous data were not conducted due to there being an insufficient number of studies to do so.

Depression symptoms findings

Depression symptoms reported as dichotomous data

Of 43 studies that reported depression symptoms levels as dichotomous data, 30 studies were included in separate meta-analyses depending on the measurement scales used with a total sample of 32,772 participants. The pooled random-effects meta-analysis of 19 studies [36, 37, 39, 43, 45, 53, 58, 65, 70, 76, 81, 87, 90, 98, 101, 103, 107, 108, 114] involving 21,953 participants and using the Patient Health Questionnaire (PHQ- 9) indicated that 58% of physicians exhibited symptoms of depression (n = 19; 95% CI 46%–70%; I^2 = 99.71%; p < 0.001) (Fig. 8). The pooled random-effects meta-analysis of seven studies [42, 50, 66, 72, 75, 89, 93] employing the Depression Anxiety and Stress Scale (DASS- 21) and encompassing 9881 participants revealed that 49% of physicians experienced symptoms of depression (n = 7; 95% CI 33%– 65%; I^2 = 99.67%; p < 0.001) (Fig. 9). The pooled random-effects meta-analysis of four studies that adopted the Hospital Anxiety and Depression Scale (HADS- 14) and that included 938 participants [54, 80, 100, 104] defined that 41% of physicians as having symptoms of depression (n = 4; 95% CI 26%– 56%; I^2 = 95.25%; p < 0.001) (Fig. 10).

Table 1 Overall characteristics of included studies

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Abd-Ellatif et al. [38] / Egypt (lower-middle income)	Convenience	physicians from different specialities	411 females 74.7% males 25.3% 20-50+/not stated	100%	job satisfaction (JS)	The Satisfaction with Life Scale	55% were satisfied. Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Abdeen et al. [39] / Egypt (lower-middle income)	Convenience	physicians from different specialities	124 females 64.5% males 35.5% not stated/not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	12.3±5.8
Abdelhafiz et al. [40] / Egypt (lower-middle income)	Convenience	physicians from different specialities	220 females 49.55% males 50.45% not stated/33.42±5.28	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE= 20.67±13.34 DP=7.20±6.14; PA=18.53±10.19
Ahmad et al. [41] / Pakistan (lower-middle income)	Purposive	physicians from different specialities	282 females 58.9% males 41.1 % 18-54/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE= 25.68±10.2/47.5% DP=8.61±5.96;/23.05% PA=35.31±9/29.4%
Akova et al. [42] / Turkey (upper-middle income)	Convenience	physicians from different specialities	569 females 47.5% males 52.5% not stated/not stated	reached saturation	burnout (B) and depression (D)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS), Depression Anxiety Stress Scale-21 (DASS-21)	EE=30.4% DP=21.1%; PA=63.3% D=37.1%.
Ali, et al. [43] / Pakistan (lower-middle income)	convenience	physicians from different specialities	400 females 43.2% males 56.8% 20-60/not stated	80%	depression (D)	Patient Health Questionnaire (PHQ-9)	10.4 ± 9.8 21.8%
Almhdawi et al. [44] / Jordan (upper-middle income)	convenience	emergency physicians	326 not stated not stated/not stated	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	not stated
Alrawashdeh et al. [22] / Jordan (upper-middle income)	convenience	physicians from different specialities	937 females 69,8% males 30.2% 24-77/34.6± 9.9	not stated	job satisfaction (JS) and burnout (B)	10-item Burnout Measure-Short version (BMS) by Malach-Pines 5-Item Short Index of Job Satisfaction (SIJS).	Not pooled for meta-analysis due to an insufficient number of studies for these assessment instruments.

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Aly et al. [45] / Egypt (lower-middle income)	convenience	healthcare workers	316 females 70.3% males 29.7% not stated / 33.4±5.9	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	93.99%
Anand et al. [46] / India (lower-middle income)	nonprobability sampling	physicians from different specialities	115 females 53% males 47% 25–56 / 38.28 ± 7.37	not stated	job satisfaction (JS)	self-administered questionnaire	59.1% were satisfied. Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Araç et al. [47] / Turkey (upper-middle income)	convenience	physicians from different specialities	64 females 21.9% males 78.1% not stated/34.81 ± 7.66	not stated	depression (D)	Hospital Anxiety and Depression Scale (HADS)	7.2±4.1
Arenliu et al. [48] / Kosovo (upper-middle income)	not stated	physicians from different specialities	545 females 47% males 53% not stated/not stated	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	4.19±4.65
Arslan et al. [49] / Turkey (upper-middle income)	convenience	physicians from different specialities	671 females 55.4% males 44.6% 44.0 ± 9.0	not stated	depression (D)	Hospital Anxiety and Depression Scale (HADS)	8.2±3.4
Bahadirli et al. [50] / Turkey (upper-middle income)	convenience	physicians from different specialities	331 females 42.9% males 57.1% not stated/not stated	58.02%	burnout (B) and depression (D)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS), Depression Anxiety Stress Scale-21 (DASS-21)	EE=71.3% DP=55.3% PA=47.4% D=89.1%
Bahadirli et al. [51] / Turkey (upper-middle income)	convenience	physicians from different specialities	787 females 46.6% males 53.4% not stated/not stated	53.77%	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	Not pooled for meta-analysis due to unclear results
Böckelmann et al. [52] / Ukraine (upper-middle income)	not stated	oncology physicians	37 females 54.05% males 45.95% not stated/ 46.5±13.6 years	not stated	burnout (B)	The Maslach Burnout Inventory (MBI-GS)	Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Brito-Marques et al. [53] / Brazil (upper-middle income)	not stated	physicians from different specialities	332 females 67.8% males 32.2% not stated/not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	73.1%

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Caliskan et al. [54] / Turkey (upper-middle income)	not stated	physicians from different specialities	290 females 38.3% males 61.7% not stated/31.8 ± 6.9	not stated	depression (D)	Hospital Anxiety and Depression Scale (HADS)	62%
Castañeda et al. [55] / Mexico (upper-middle income)	census	physicians from different specialities	540 females 56% males 44% not stated/44.0 ± 7.1	90%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	Not pooled for meta-analysis due to unclear results
Chalhub et al. [56] / Brazil (upper-middle income)	not stated	physicians from different specialities	223 females 6.2% males 53.8% not stated/not stated	49.6%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=27.53±11.59 DP=9.02±5.62 PA=32.13±8.16
Chen et al. [57] / China (upper-middle income)	not stated	family physicians (	1105 females 53.2% males 46.8% <25->46/not stated	not stated	job satisfaction (JS)	short Chinese version of the Minnesota Satisfaction Questionnaire (20-MSQ short version items)	Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Chen et al. [58] / China (upper-middle income)	not stated	emergency dental staff	800 not stated not stated/36.20±8.213	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	46.4%
Ciğerim et al. [59] / Turkey (upper-middle income)	not stated	physicians from different specialities	290 females 40.7% males 59.3%, 21-49/26.98±5.6	not stated	burnout (B) and depression (D)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS), Beck Depression Inventory (BDI) sections.	EE=91.72% DP=66.21% PA=75.87% D=73.11% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Civantos et al. [60] / Brazil (upper-middle income)	not stated	head and neck surgeons	163 females 25.8% males 74.2% 25-74/not stated	23.3%	burnout (B) and depression (D)	single-item Mini-Z burnout assessment;. The 2-item Patient Health Questionnaire (PHQ2;	B=14.7% D=16.0% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Deneva et al. [61] / Bulgaria (upper-middle income)	not stated	physicians from different specialities	95 females 43.2% males 47.5% not stated/46.5±4.3	not stated	burnout (B) and depression (D)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS), the Zung Self-Rating Depression Scale (SDS)	EE=95.6% DP= 0% PA = 0% D=40% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Dinibutun et al. [62] / Turkey (upper-middle income)	convenience	physicians from different specialities	200 females 59% males 41% not stated/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	Not pooled for meta-analysis due to unclear results
Dinibutun et al. [63] / Turkey (upper-middle income)	simple random sampling	physicians from different specialities	160 females 51.3% and males 48.7% 21-41/not stated	not stated	burnout (B) and job satisfaction (JS)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS) and Minnesota Job Satisfaction Scale.	Not pooled for meta-analysis due to unclear results
Doan et al. [64] / Vietnam (lower-middle income)	snowball sampling	physicians from different specialities	939 females 56.5% males 43.5%, 21-41/not stated	not stated	job motivation (JM) and job satisfaction (JS)	Fifteen questions were adapted from the work motivation scale for health workers	Decreased JS=39.4% Decreased JM=49.6% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Dong et al. [65] / China (upper-middle income)	convenience	psychiatrists	564 females 67.9%, males 32.1% 23-65 /not stated	not stated	depression (D) and burnout (B)	Patient Health Questionnaire-9 (PHQ-9), Maslach Burnout Inventory-General Survey (MBI-GS)	D=33.6% Not pooled for meta-analysis due to unclear results
Durmaz et al. [66] / Turkey (upper-middle income)	not stated	ophthalmologists	360 females 48.9% males 51.1% 35-55/38.6±10.2	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	65.0%

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Ebrahimpour et al. [67] / Iran (upper-middle income)	not stated	orthopedic surgeons	456 females 4.2% males 95.8% 35-55/not reported	41%	job satisfaction (JS) and burnout (B)	Job Descriptive Index (JDI) questionnaire, Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=30.9% DP=47.4% PA=60.75% Not pooled for meta- analysis due to unclear results
El Dabbah et al. [34] / Egypt, Sudan (lower-middle income)	non-probability convenience sampling	physicians from different specialities	362 females 60% males 40% not stated/ 37.0±7.55 years for Egypt and 26.67±5.31 years for Sudan	not stated	burnout (B)	Oldenburg Burnout Inventory	B=98.6% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
El-Mazahy et al. [68] / Egypt (lower-middle income)	not stated	physicians from different specialities	959 females 39.9% males 60.1% not stated/ 23-50+	not stated	job satisfaction (JS)	self-administered questionnaire	Not pooled for meta- analysis due to unclear results and type of questionnaire
Elghazally et al. [69] / Egypt (lower-middle income)	convenience	physicians from different specialities	201 females 34.8% males 65.2% not stated/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=35.5%, DP=70.6%, PA=26.4%
Elkholy et al. [70] / Egypt (lower-middle income)	probability	physicians from different specialities	457 females 50% males 50% 18-40</not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	77.2%
Elsaie et al. [71] / Egypt (lower-middle income)	not stated	physicians from different specialities	144 females 72.2% males 27.8% not stated/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=29.24±12.73 PA=29.14±9.24 DP=10.07±6.46 EE=57.6% DP=34.72% PA=20.83%
Elsaie et al. [72] / Egypt (lower-middle income)	not stated	dermatologists	415 females 76.6% males 23.4% not stated/not stated	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	18.98 ± 9.56 72.2%
Enea et al. [73] / Romania (upper-middle income)	not stated	physicians from different specialities physicians from different specialities	not stated	not stated	burnout (B)	The Copenhagen Burnout Inventory	38.39±14.09 Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Faria et al. [74] / Brazil (upper-middle income)	not stated	physicians from different specialities	126 not stated/33.77 years in group 1 and 38.02 in group 2.	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=38.89% DP=25.40% PA=58.73%
Fauzi et al. [75] / Malaysia (upper-middle income)	not stated	physicians from different specialities	1050 females 71.5% males 28.5% 24-59/33.08 (6.965)	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	31%
Fernandez-Arana et al. [76] / Peru (upper-middle income)	not stated	physicians from different specialities	542 females 63.5% males 36.5% 24-87/49.2	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	44.5%
Fu et al. [77] / China (upper-middle income)	not stated	physicians in tertiary hospitals	656 females 45.5% males 54.5% not stated/37.24 (9.47)	not stated	depression (D)	10-item Center for Epidemiologic Studies Depression Scale	8.97 ± 5.40 42.2% Not pooled for meta-analysis due to an insufficient number of studies for this assessment instrument.
Fumis et al. [78] / Brazil (upper-middle income)	not stated	ICU physicians	51 females 39.2% males 60.8% not stated/not stated	82%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=51% DP=51% PA=96.1%
Hamdan et al. [79] / Jordan (upper-middle income)	convenience	orthopedic surgeons	84 not stated not stated/39.10±11.26 years	75%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=26.19% DP=3.57% PA=89.29%
Haznedaroğlu et al. [80] / Turkey (upper-middle income)	not stated	pulmonologists	179 female 70.4% males 29.6% 25–65/42	not stated	depression (D)	Hospital Anxiety and Depression Scale (HADS)	38.5%
Hossain et al. [81] / Bangladesh (lower-middle income)	not stated	physicians from different specialities	203 females 47.78% males 52.22% not stated/33.12±9.14	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	71.92%
Iyer et al. [82] / Tanzania (lower-middle income)	not stated	physicians from different specialities	67 females 32.84% males 67.16% not stated/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	Not pooled for meta- analysis due to unclear results

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Kadivar et al. [83] / Iran (upper-middle income)	not stated	pathologists	350 females 32.3% males 67.7% 25-55</not stated	not stated	burnout (B)	not stated	15.4% Not pooled for meta-analysis due to unclear assessment instrument.
Kalantarion et al. [37] / Iran (upper-middle income)	not stated	ophthalmologists	228 females 32.9% males 67.1% 31-85/49.0±15.61	16.9%	depression (D)	Patient Health Questionnaire (PHQ-9)	73.68%
Kasemy et al. [84] / Egypt (lower-middle income)	convenience	critical care specialists	144 females 36.8% males 63.2% 24-45/30.11±4.3	92.90%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	29.39±7.07 63.9% Not pooled for meta- analysis due to unclear results
Kashif et al. [85] / Pakistan (lower-middle income)	not stated	physicians from different specialities	102 females 96.1% males 3.9% not stated/not stated	71.8%	burnout (B)	25-item Oldenburg Burnout Inventory.	B=39.2% EE=81.4% DP=43.1% Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Kashtanov et al. [86] / Russia (upper-middle income)	not stated	ICU physicians	1259 females 45.7% males 54.3% 21-73/36.28±12.03	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=54.6% DP=71.9% PA=36.2%
Khatun et al. [87] / Bangladesh (lower-middle income)	convenience	physicians from different specialities	114 females 33.7% male 66.7% not stated/not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	34.2%
Khursheed et al. [33] / Pakistan, India (lower-middle income)	convenience	rheumatologists	146 females 48.6% males 51.4% not stated/not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=28.8% DP=29.5% PA=52.1%
Li et al. [88] / China (upper-middle income)	not stated	dentists	256 females 69.9% male 30.1% 21-51</ not stated	not stated	depression (D)	Depression Anxiety Stress Scale-42 (DASS-42)	Not pooled for meta-analysis due to an insufficient number of studies for this assessment

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Li et al. [89] / China (upper-middle income)	not stated	psychiatrists	3783 females 59.8% males 40.2%, <29-50</not stated	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	13.43±7.76
Mei, Q [90] / China (upper-middle income)	convenience	physicians from different specialities	9433 females 41.2% male 58.8 % Not stated/30.9±8.3	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	5.9 ± 5.8 21.4%
Mijić Marić et al. [91] / Bosnia and Herzegovina (upper-middle income)	snowball	physicians from different specialities	840 females 76.2% males 23.8%, <30-60</not stated	not stated	burnout (B)	Copenhagen Burnout Inventory	49.5 ± 17.8 Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Mohd Fauzi et al. [75]/ Malaysia (upper-middle income)	not stated	physicians from different specialities	1050 females 71.5% males 28.5%, 24-59/33.08±6.965	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	31%
Na Nakorn et al. [92] / Thailand (upper-middle income)	not stated	dentists (74% - professionals and senior professionals/experts)	423 females 72.3% males27.7% 25–59/34.6±7.6	55.7%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=16.91±9.78 DP=7.04±4.96 PA=12.90±8.72
Ning et al. [93] /China (upper-middle income	stratified sampling	physicians from different specialities	3373 females 69.2% males 30.2%, 18-45</not stated	not stated	depression (D)	Depression Anxiety Stress Scale-21 (DASS-21)	23.6%
Okour et al. [94] / Jordan (lower-middle income)	not stated	physicians from different specialities	295 females 50.5% males were 49.5% 20-40</ 33.1	88.3%	depression (D)	10-item short form of the Center for Epidemiological Studies Depression Scale Revised	59.3% Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Oliveira et al. [95] / Brazil (upper-middle income	convenience	physicians from different specialities	769 females 100% not stated/not stated	61.6%	burnout (B)	13 statements from the Brazilian Portuguese version of the Oldenburg Burnout Inventory (OLBI)	Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Oluwadiya et al. [96] / Nigeria (lower-middle income)	not stated	physicians from different specialities	155 80.7% males and 19.3% females not stated/ 51.1±7.4	60.5%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=18.5% DP=0.7% PA=33.1%

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Pehlivanoglu et al. [97] / Turkey (upper-middle income)	not stated	surgical pathologists	321 females 75% males 25% not stated/not stated	24%	job satisfaction (JS)	self-administered questionnaire	Not pooled for meta- analysis due to unclear results and type of questionnaire
Pérez-Herrera et al. [98] / Colombia (lower-middle income)	not stated	physicians from different specialities	133 females 54.14% males 45.86% not stated/50.07±12.54	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	33.83%
Şahin et al. [99] / Turkey (upper-middle income)	not stated	physicians from different specialties	939 females 66% males 34% 18-40/not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	77.6%
Sarkar et al. [100] / Pakistan (lower-middle income)	not stated	gastroenterologists	63 females 3.20% males 96.80% 36–67/49.77	38%	depression (D)	Hospital Anxiety and Depression Scale (HADS)	20.7%
Silva et al. [101] / Brazil (upper-middle income)	non-probabilistic convenience	surgeons	119 females 5.9% males 94.1% not stated/43.9	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	26.7%
Somboonviboon et al. [102] / Thailand (upper-middle income)	snowball	physicians from different specialties	3173 females 71.45% males 27.83% others 0.9% <30-60</not stated	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=50.46% DP=25.53% PA=49.20%
Tran et al. [103] / Vietnam (lower-middle income)	snowball	physicians from different specialties	503 females 53.3% males 46.7% 21-40</not stated	98.6%	depression (D)	Patient Health Questionnaire (PHQ-9)	67.6%
Tuna et al. [104] / Turkey (upper-middle income)	convenience	physicians from different specialties	406 females 46.6% males 53.4% not stated/42.9±10.1	not stated	depression (D)	Hospital Anxiety and Depression Scale (HADS)	42.1%
Turan et al. [105] / Turkey (upper-middle income)	convenience	physicians from different specialties	40 females 32.5% males 67.5% not stated/40±6.35	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=18.23 ±8.28 DP=6.15 ±4.56 PA=5.35±5.2

Table 1 (continued)

Study/ Country (income group)	Sampling	Study population	Sample size (n) and characteristics (gender and age range/mean)	Response rate	Outcome(s) of interest	Measure/ assessment instrument	Prevalence Mean(SD)/% of high scores
Tutan et al. [106] / Turkey (upper-middle income)	convenience	physicians from different specialties	595 females 68.9% males 31.1% <30-40</not stated	not stated	job satisfaction (JS)	self-administered	3.17± 0.93 Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Villalba-Arias et al. [107] / Paraguay (upper-middle income)	intentional, non-probabilistic sampling	physicians from different specialties	432 females 71.06% males 28.94% 27–38/32	48.75%	depression (D)	Patient Health Questionnaire (PHQ-9)	41.90%
Visi et al. [108] / India (lower-middle income)	purposive sampling	physicians from different specialties (	200 females 75% males 25% not stated/31.43±6.24 years	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	15%
Wang et al. [109] / China (upper-middle income)	snowball sampling	physicians from different specialties	3006 females 65% males 35% 20-70/35.4±8.1	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	10.6±6.0
Wang et al. [110] / China (upper-middle income)	snowball sampling	physicians from different specialties	3006 females 65% males 35% 20-70/35.4±8.1	not stated	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=47.4% DP=42.1% PA=36.53 EE=26±11.7 DP=10.4±6.9 PA=30.3±14.1
Wannarit et al. [111] / Thailand (upper-middle income)	not stated	physicians from different specialties	682 females 65.1% males 34.9% <30-50</not stated	28.72%	burnout (B)	Maslach Burnout Inventory - Human Services Survey (MBI-HSS)	EE=25.28±13.27 DP=7.15±6.11 PA=36.83±8.13
Wijesinghe et al. [112] / Sri Lanka (lower-middle income)	not stated	physicians from different specialties	188 females 59.2% males 40.8% 22-59/not stated	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	12.8% Not pooled for meta-analysis due to an insufficient number of studies for this assessment
Zhang et al. [36] / China (upper-middle income)	not stated	psychiatric clinicians	10516 females 85.5% males 15.5% not stated/33.25±8.40	not stated	depression (D)	Patient Health Questionnaire (PHQ-9)	3.27±4.29 28.52%
Zhu et al. [113] / China (upper-middle income)	not stated	physicians from different specialties	79 not stated 38.70±8.13	79%	burnout (B)	Oldenburg Burnout Inventory (OLBI)	38.09± 4.55 Not pooled for meta-analysis due to an insufficient number of studies for this assessment

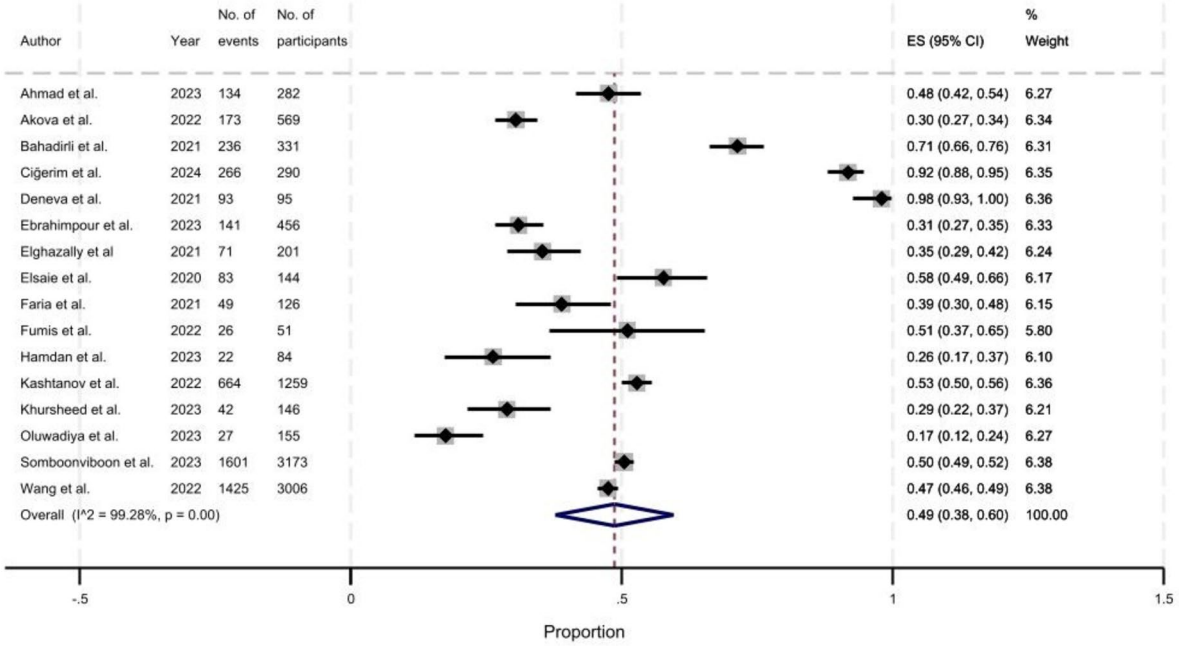

Fig. 2 Meta-analysis of the prevalence of 'high' emotional exhaustion among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data). *NB: ES = Proportion*

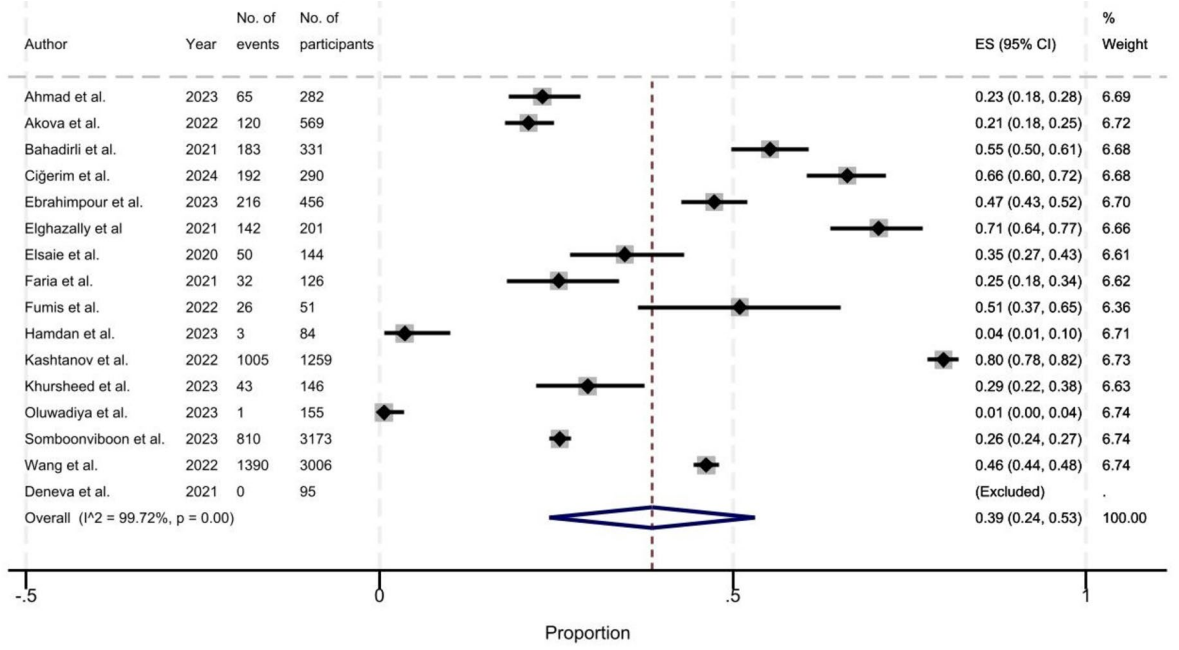

Fig. 3 Meta-analysis of the prevalence 'high' depersonalization among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data). *NB: ES = Proportion*

Sub-group analyses revealed that levels of depression among physicians varied significantly by geographical region and physicians' specialty ($p < 0.001$ for both) (Appendix 6). Further, the meta-regression analysis found no statistically significant pooled estimates among the covariates examined (Appendix 6), suggesting that none of the factors accounted for the heterogeneity observed in the overall analysis.

Depression symptoms reported as continuous data

Of 16 studies that presented the prevalence of symptoms of depression as continuous data, 11 studies (41, 48, 50, 56, 57, 67–72) were included in a meta-analysis with a

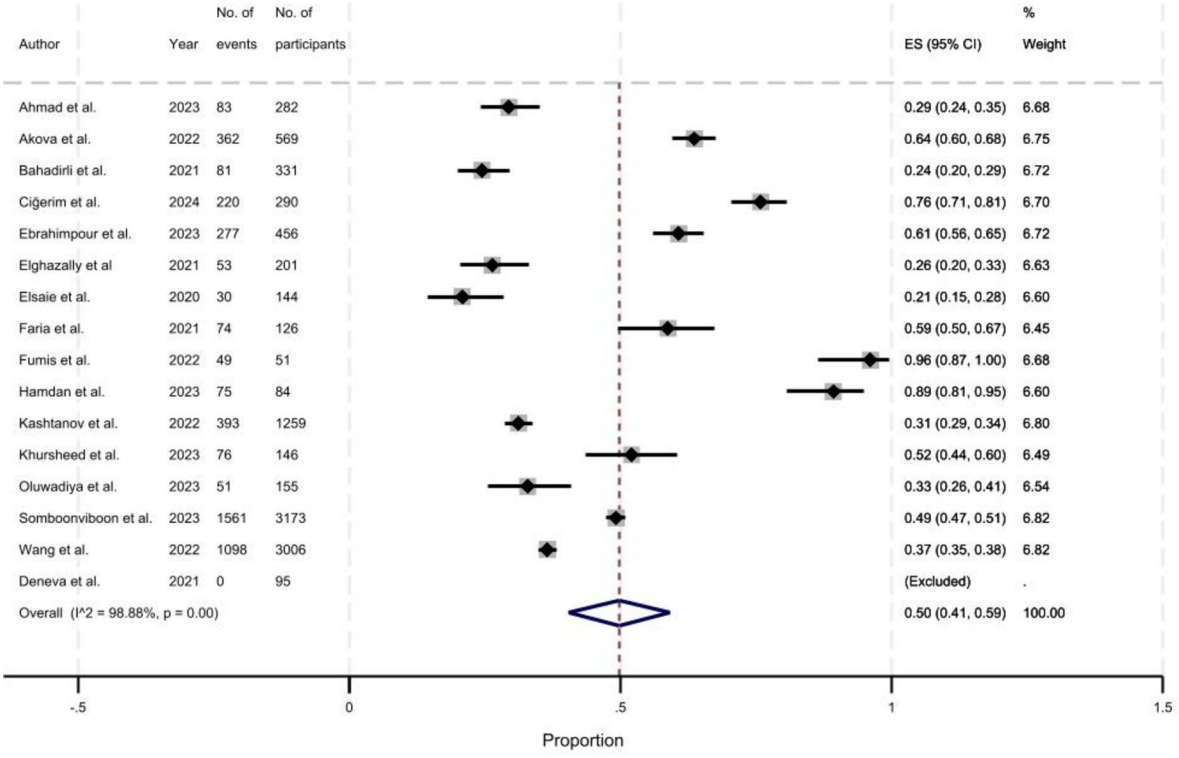

Fig. 4 Meta-analysis of the prevalence of 'low' personal accomplishment among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data) *NB: ES = Proportion*

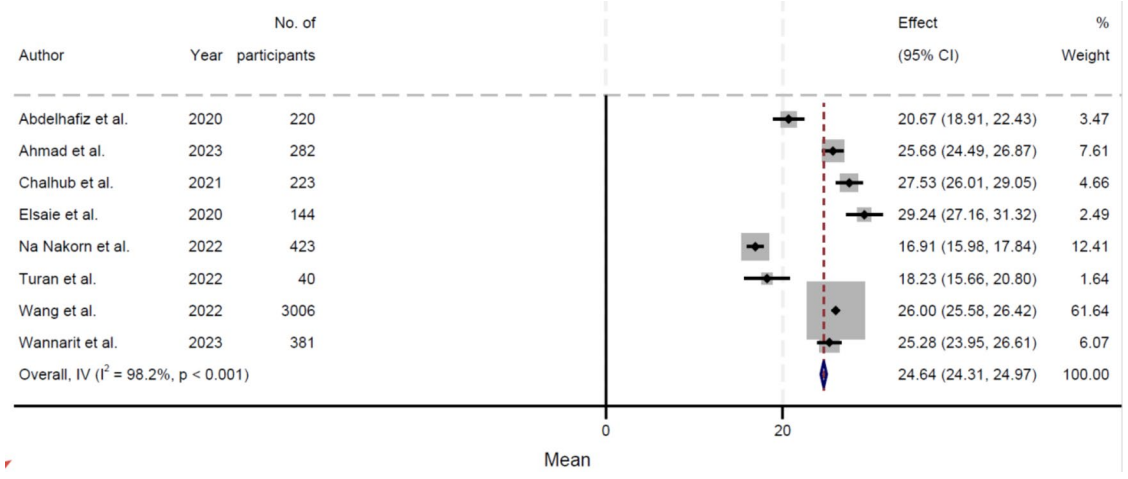

Fig. 5 Meta-analysis of the mean score for emotional exhaustion among physicians and dentists in LMICs during the COVID-19 pandemic (based on results provided as continuous data). *NB: ES = Mean score*

total sample of 24,975 participants. The random-effects estimate of the weighted mean scores were: depression symptoms measured by the PHQ- 9 was 4.57 ($n = 4$; 95% CI 4.50–4.64; $I^2 = 99.9\%$, $P < 0.001$), indicating a high level (Fig. 11); depression symptoms measured by the DASS-21 was 12.35 ($n = 5$; 95% CI 12.15–12.55; $I^2 = 99.8\%$, $P < 0.001$), suggesting a high level (Fig. 12); and depression symptoms measured by the HADS- 14 was 8.14 ($n = 2$; 95% CI 7.89–8.39; $I^2 = 72.0\%$; $P = 0.059$), indicating a moderate level (Fig. 13). Sub-group and meta-regression analyses were not performed due to an insufficient number of studies.

Sensitivity analyses

The sensitivity analyses assessed the robustness and stability of the meta-analyses regarding burnout and depression symptoms against the studies which included participants other than qualified physicians and where

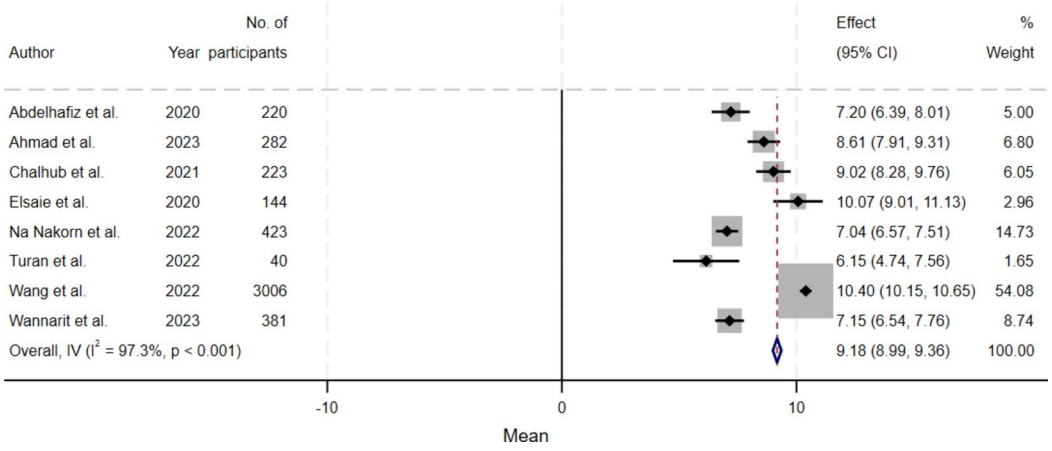

Fig. 6 Meta-analysis of the mean score for depersonalization among physicians in LMICs during the COVID-19 pandemic (based on results provided as continuous data).*NB: ES = Mean score*

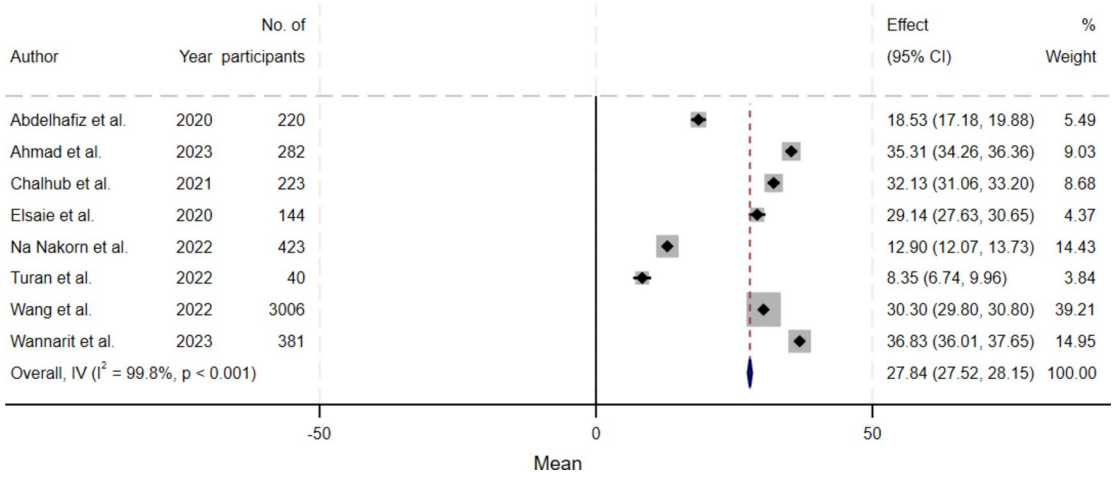

Fig. 7 Meta-analysis of the mean score for personal accomplishment among physicians in LMICs during the COVID-19 pandemic (the mean score for personal accomplishment is based on results provided as continuous data). *NB: ES = Mean score*

type of healthcare setting was not reported (Appendices 5 and 6). No studies identified were found to have a high risk of bias.

Excluding studies which included participants other than qualified physicians decreased the prevalence of depression symptoms reported as dichotomous data and measured using the PHQ- 9 to 46% (n = 8; 95% CI: 31–61%; I^2 = 99.20%; p < 0.001); decreased the mean depression symptoms score measured by the PHQ- 9 to 3.33 (n = 2; 95% CI: 3.25–3.41; I^2 = 99.7%; p < 0.001); and increased the mean depression symptoms score measured by the DASS- 21 to 14.34 (n = 4; 95% CI: 14.34–14.56; I^2 = 98.9%; p < 0.001). Excluding studies where the type of healthcare setting was not reported, the mean DP score decreased to 7.73 (n = 7; 95% CI: 7.47–8.00; I^2 = 89.1%; p < 0.001), and the mean depression symptoms score measured by the PHQ- 9 slightly decreased to 3.88 (n = 3; 95% CI: 3.81–3.95; I^2 = 99.8%; p < 0.001). In other instances, the pooled prevalence levels and the weighted mean scores remained stable and still showed substantial heterogeneity, suggesting that the meta-analyses' results are generally robust against these criteria. The results of the sub-group and sensitivity analyses are presented in Table 2.

Quality assessment

According to the JBI Critical Appraisal Checklist for Analytical Cross Sectional Studies [23], confounding factors were identified in 59 studies (72%), yet only 23 studies (28%) implemented strategies to address them. Furthermore, 87% of the studies utilized appropriate statistical analysis (Appendix 8). A visual review of the funnel plots indicated asymmetry across all distributions for burnout and depression symptom studies. However, Egger's tests suggested potential small-study effects in the meta-analyses for depression symptoms reported as dichotomous data, which were measured using the PHQ-9 (bias = 17.86; SE = 0.21; P < 0.001) and the DASS- 21

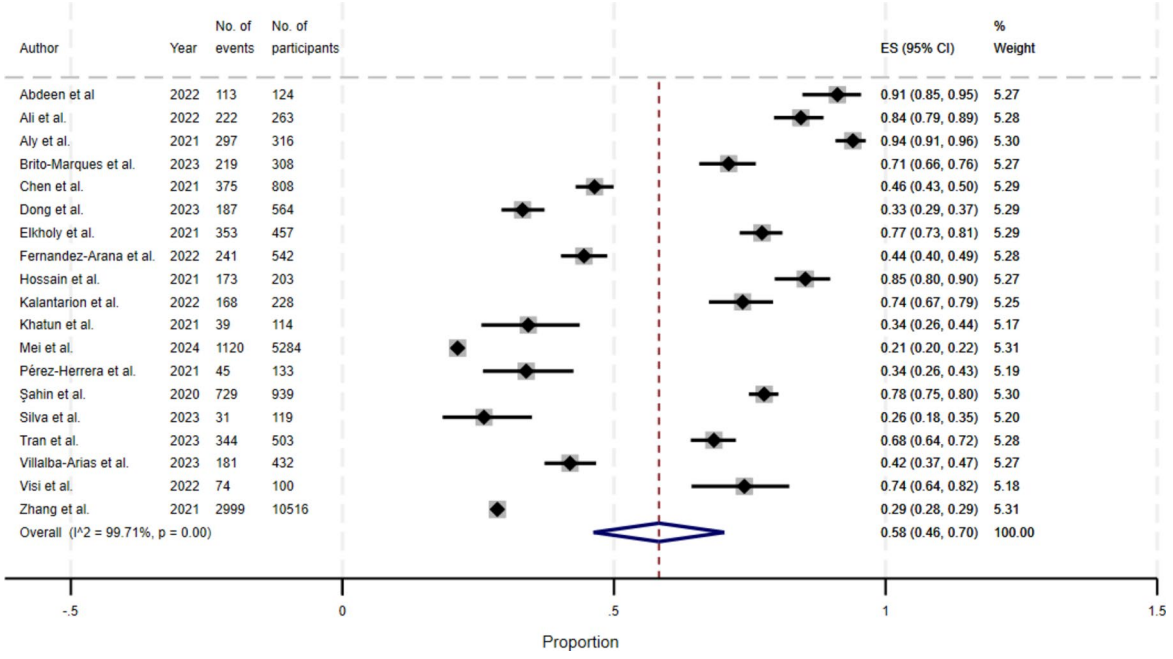

Fig. 8 Meta-analysis of depression symptoms among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data measured by the PHQ- 9). *NB: ES = Proportion*

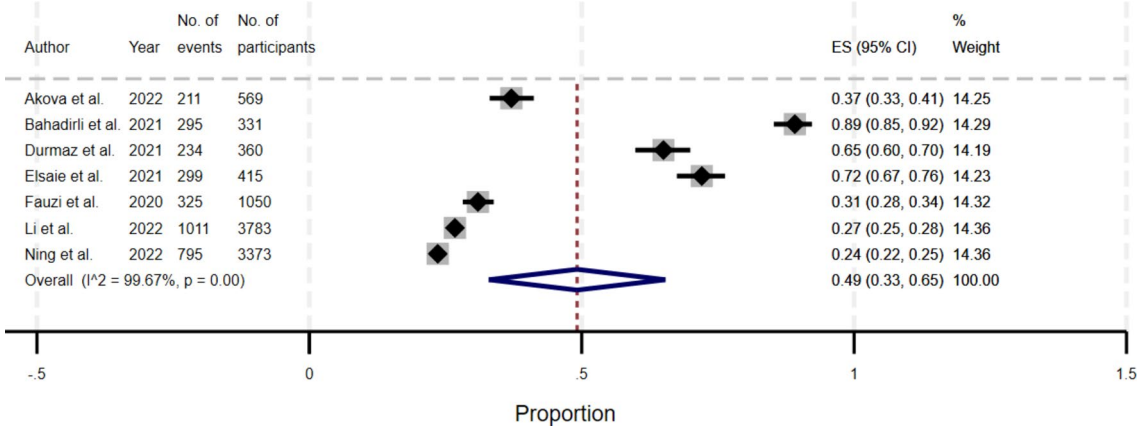

Fig. 9 Meta-analysis of depression among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data measured by the DASS- 21). *NB: ES = Proportion*

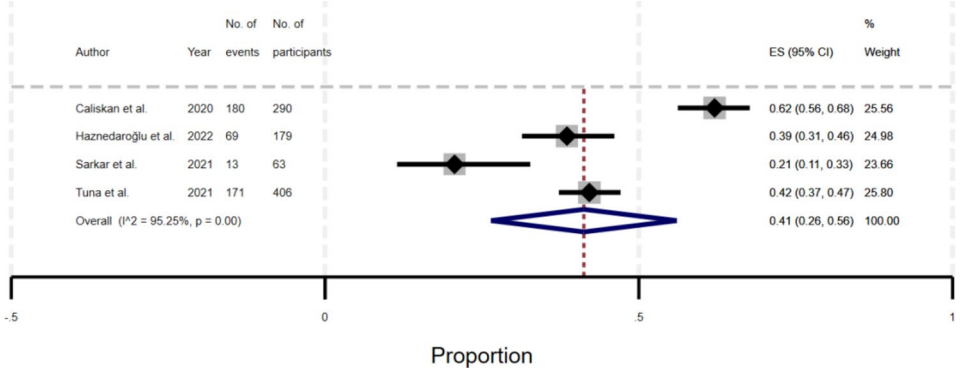

Fig. 10 Meta-analysis of depression among physicians in LMICs during the COVID-19 pandemic (based on results provided as dichotomous data measured by the HADS). *NB: ES = Proportion*

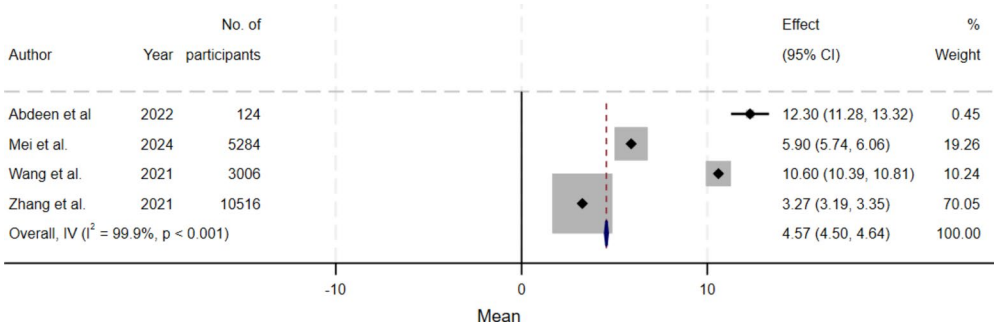

Fig. 11 Meta-analysis of depression symptoms among physicians in LMICs during the COVID-19 pandemic (based on results provided as continuous data measured by the PHQ- 9). *NB: Effect = Mean*

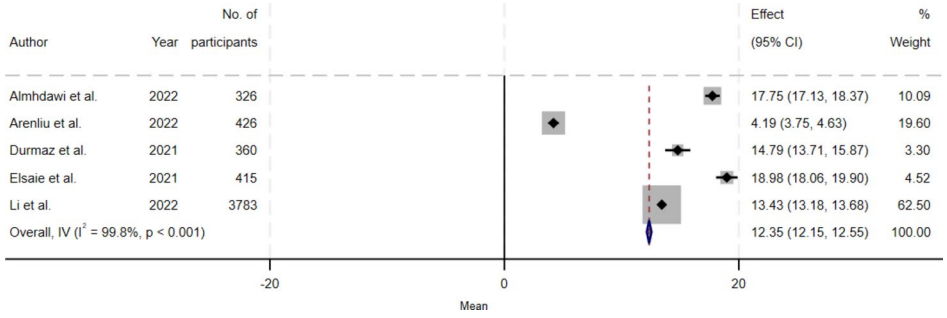

Fig. 12 Meta-analysis of depression symptoms among physicians in LMICs during the COVID-19 pandemic (based on results provided as continuous data measured by the DASS- 21). *NB: Effect = Mean*

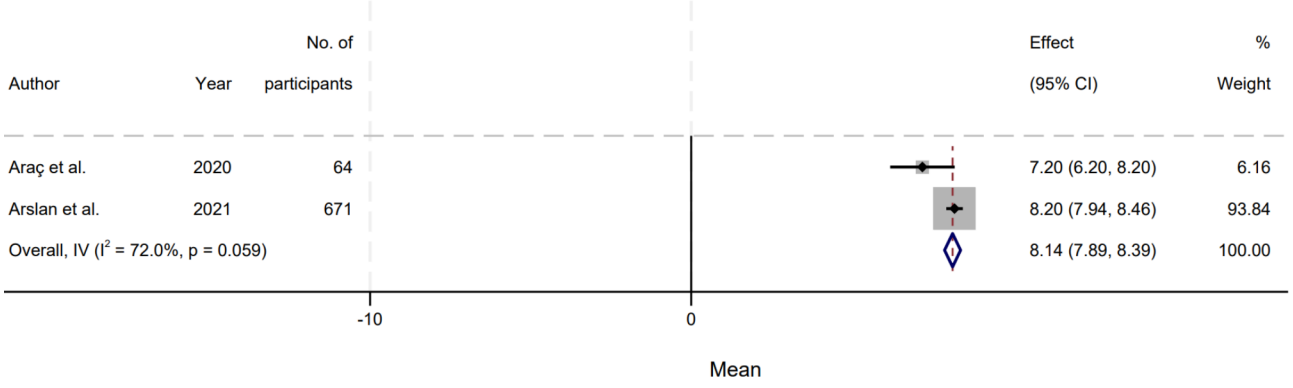

Fig. 13 Meta-analysis of depression symptoms among physicians in LMICs during the COVID-19 pandemic (based on results provided as continuous data measured by the HADS- 14). *NB: Effect = Mean*

(bias = 27.10; SE = 0.06; *P* = 0.042). In other cases, Egger's tests showed no significant findings, indicating minimal evidence of publication bias (Appendices 6 and 7).

Discussion

This review included findings from 82 studies with 65,431 participants from 26 LMICs. Although a comprehensive search strategy was used, all the included studies were from middle-income countries, indicating that the findings of the current review cannot be generalized to low-income countries. Therefore, the present review suggests that there was a decline in job motivation and that job satisfaction levels of physicians varied from moderate to low during the COVID- 19 pandemic. Considering the EE as a core dimension of burnout [115, 116] the present review suggests that 49% of physicians working in middle-income countries during the COVID- 19 pandemic suffered from professional burnout. The overall estimate of the mean was 24.64 for EE, which indicates a high level using the cut-off-scores presented in the MBI Manual [117]. The pooled random effect estimates of the prevalence of depression symptoms varied from 41 to 58% depending on the adopted scale; similarly, the

Table 2 Summary of sub-group and sensitivity analyses results

Analysis type	Dimension	Subgroup type/exclusion criteria	Number of studies	Pooled prevalence (95% CI)	Heterogeneity (I^2, *p*-value)
Sub-group analysis	EE (dichotomous data)	Region (Western Asia)	4	55% (21–89)	$I^2 = 99.55\%$, $p < 0.001$
		Income group (Lower-middle income)	5	32% (6–57)	$I^2 = 99.35\%$, $p < 0.001$
		Income group (Upper-middle income)	11	42% (24–53)	$I^2 = 99.60\%$, $p < 0.001$
		Specialties (mixed)	6	52% (34–69)	$I^2 = 99.56\%$, $p < 0.001$
		Overall	16	49% (38–60)	$I^2 = 99.28\%$, $p < 0.001$
	DP (dichotomous data)	Region (Western Asia)	4	36% (10–63)	$I^2 = 99.33\%$, $p < 0.001$
		Income group (Lower-middle income)	5	32% (6–57)	$I^2 = 99.35\%$, $p < 0.001$
		Income group (Upper-middle income)	11	42% (27–57)	$I^2 = 99.60\%$, $p < 0.001$
		Specialties (mixed)	5	37% (24–50)	$I^2 = 99.21\%$, $p < 0.001$
		Overall	15	39% (24–53)	$I^2 = 99.72\%$, $p < 0.001$
	PA (dichotomous data)	Region (Western Asia)	4	63% (37–89)	$I^2 = 99.13\%$, $p < 0.001$
		Income group (Lower-middle income)	5	32% (23–41)	$I^2 = 89.38\%$, $p < 0.001$
		Income group (Upper-middle income)	11	58% (47–70)	$I^2 = 99.19\%$, $p < 0.001$
		Specialties (mixed)	5	41% (31–51)	$I^2 = 98.47\%$, $p < 0.001$
		Overall	15	50% (41–59)	$I^2 = 98.88\%$, $p < 0.001$
	Depression - measured by PHQ- 9 (dichotomous data)	Region (South Asia)	5	71% (56–85)	$I^2 = 96.56\%$, $p < 0.001$
		Region (South America)	5	44% (30–58)	$I^2 = 96.94\%$, $p < 0.001$
		Region (East Asia)	5	39% (29–49)	$I^2 = 99.38\%$, $p < 0.001$
		Income group (Lower-middle income)	10	66% (41–91)	$I^2 = 99.80\%$, $p < 0.001$
		Income group (Upper-middle income)	9	49% (34–64)	$I^2 = 99.51\%$, $p < 0.001$
		Specialties (mixed)	15	63% (46–80)	$I^2 = 99.73\%$, $p < 0.001$
		Overall	21	58% (46–70)	$I^2 = 99.71\%$, $p < 0.001$

Table 2 (continued)

Analysis type	Dimension	Subgroup type/exclusion criteria	Number of studies	Pooled prevalence (95% CI)	Heterogeneity (I^2, *p*-value)
Sensitivity analysis	EE (dichotomous data)	exclusion of studies, where respondents were not only qualified physicians and/or dentists	12	48% (29–67)	$I^2 = 99.41\%$, $p < 0.001$
	DP (dichotomous data)		11	37% (20–53)	$I^2 = 99.39\%$, $p < 0.001$
	PA (dichotomous data)		11	55% (39–70)	$I^2 = 98.77\%$, $p < 0.001$
	EE (continuous data)		7	24.56% (24.22–24.90)	$I^2 = 98.4\%$, $p < 0.001$
	DP (continuous data)		7	9.22% (9.03–9.41)	$I^2 = 97.7\%$, $p < 0.001$
	PA (continuous data)		7	27.10% (26.77–27.43)	$I^2 = 99.8\%$, $p < 0.001$
	Depression - measured by PHQ- 9 (dichotomous data)		8	46% (31–61)	$I^2 = 99.2\%$, $p < 0.001$
	Depression - measured by DASS- 21 (dichotomous data)		6	53% (32–75)	$I^2 = 99.67\%$, $p < 0.001$
	Depression - measured by PHQ- 9 (continuous data)		2	3.33% (3.25–3.41)	$I^2 = 97.7\%$, $p < 0.001$
	Depression - measured by DASS- 21 (continuous data)		4	14.34% (14.12–14.56)	$I^2 = 98.9\%$, $p < 0.001$
	Depression - measured by PHQ- 9 (dichotomous data)	exclusion of studies, where the type of healthcare setting was not reported	16	61% (46–76)	$I^2 = 99.69\%$, $p < 0.001$
	Depression - measured by HADS- 14 (dichotomous data)		3	42% (22–62)	$I^2 = 96.69\%$, $p < 0.001$
	Depression - measured by PHQ- 9 (continuous data)		3	3.88% (3.81–3.95)	$I^2 = 99.8\%$, $p < 0.001$

weighted mean scores also indicated a high prevalence of such among physicians.

The findings of this review are consistent with the JD-R model [4], which asserts that employee job morale is shaped by the interplay between job demands (e.g., workload, emotional strain) and available job resources (e.g., support, infrastructure). In the context of physicians in middle-income countries during the COVID- 19 pandemic, the data reveals a significant imbalance between job demands and resources, which contributed to heightened burnout, diminished job motivation and satisfaction, and an increase in depression symptoms, resulting in overall negative job morale.

In particular, the pandemic substantially amplified job demands for physicians in middle-income countries, as evidenced by several factors. First, the mean EE score of 24.64 found in the current review indicates severe emotional strain, reflecting the overwhelming psychological burden of patient care under the pandemic's extraordinary conditions. Second, the pandemic caused an unprecedented increase in patient numbers, which overwhelmed an already limited healthcare infrastructure. Third, physicians faced the additional challenge of protecting themselves and their families from COVID- 19 while working on the frontlines [10–12]. Fourth, the scarcity of essential medical supplies and personal protective equipment further heightened stress and helplessness, intensifying the emotional toll on healthcare workers. Lastly, prolonged work hours exacerbated both physical and emotional exhaustion. These heightened demands far exceeded what could be reasonably managed, particularly within the systemic constraints of middle-income countries. In addition, the review identifies a significant shortage of job resources that could have mitigated the impact of these excessive demands. Many middle-income countries struggled with underfunded healthcare systems, which lacked sufficient hospital beds, ventilators, and critical care units. These preexisting deficits likely reduced physicians' resilience and motivation during the pandemic. The high prevalence of depression symptoms (41–58%) observed in this review highlights the inadequate provision of mental health resources for healthcare workers. The lack of comprehensive institutional frameworks to address physician well-being and job morale worsened burnout and mental health challenges. According to the JD-R model, the availability of sufficient resources—both tangible and intangible—is essential for buffering the effects of excessive demands. In middle-income countries, the pandemic exposed and exacerbated longstanding gaps in these resources, contributing to the negative outcomes observed.

Comparing levels of job morale among physicians working in LMICs before and during the COVID- 19 pandemic highlights significant shifts that were driven by the pandemic's pressures and healthcare system challenges. According to the systematic reviews [118, 119] published before the pandemic, physicians working in LMICs were generally motivated to do their jobs due to a strong sense of calling to medicine and the satisfaction gained from helping people recover. The findings of the current review, in contrast, suggest that physicians experienced a diminished sense of job motivation, which was somewhat expected considering increased patient flow and risk of infection. Based on the results of the meta-analysis [118], 60% of physicians, mainly working in middle-income countries, were satisfied with their jobs prior to the pandemic, whereas the present review defined that the prevalence of job satisfaction varied from moderate to low. Job satisfaction may not have shown significant change as many challenges contribute to such in LMICs – for instance, inadequate healthcare infrastructure, poor working conditions, inadequate financial compensation and limited career growth opportunities [119] were already entrenched prior to the pandemic and remained largely unchanged during its course. Furthermore, the present review found that almost half of physicians working in middle-income countries during the COVID- 19 pandemic suffered from professional burnout and experienced symptoms of depression compared to a 32% prevalence of burnout before the pandemic [118]. It can be assumed that the pandemic exacerbated existing burnout drivers and aggravated symptoms of depression.

The levels of burnout found in the present study (49%) were similar to those found in the reviews, focusing primarily on physicians working in high-income countries during the pandemic, which were estimated to be 51% by a meta-analysis focusing on healthcare workers in general [120], 41% among intensive care unit physicians [121], and 41% [122] and 54.6% [123] among physicians of all specialties. These informal comparisons indicate that physicians in high-income and middle-income countries may encounter similar triggers of burnout within their clinical practices during the COVID- 19 pandemic, despite the anticipated disparities in working conditions, rewards, and organizational frameworks that tend to be less favorable in middle-income countries. In contrast, the prevalence of depression symptoms defined in the current review (from 41 to 58%) was considerably higher than those reported in the systematic reviews and meta-analyses on all countries worldwide. In particular, the level of depression was estimated to be 20.5% among physicians [124], and 23.2% [125], 24% [126], 24.3% [127] and 36% [128] among healthcare workers in general. It is important to note that these findings may be affected by variations in threshold criteria and the inclusion of medical residents or other healthcare staff.

Implications for research and practice

To address the challenges identified, future research must fill several critical gaps to generate actionable directives for improvement. A key priority is the need for comprehensive data on job morale and its influencing factors within low-income settings, where such information is often scarce yet essential for informed decision-making. Equally important are longitudinal studies that examine the trajectory of physicians' mental health during crises like pandemics. Such research can illuminate how prolonged stress impacts job morale over time and inform the development of evidence-based policies to ensure adequate mental health support during and after such events. An important direction for future research is determining effective resilience strategies designed for resource-limited settings. These strategies can serve as the foundation for interventions aimed at preventing burnout and enhancing job satisfaction. Since intrinsic motivation often drives physicians to persevere in challenging conditions, further investigation is needed to uncover the factors that cultivate a sense of purpose and to explore how healthcare systems can nurture these motivators, even under adversity.

Building on these research findings, healthcare policies in LMICs must prioritize the mental well-being of physicians. Establishing regular mental health check-ins, confidential counseling services, mindfulness-based interventions, and peer support networks could significantly enhance job morale. Additionally, resilience training should become a core component of medical education, equipping physicians with skills in stress management, emotional regulation, and conflict resolution to better navigate the demands of their work. Healthcare institutions must also adopt crisis response plans that place physicians' well-being at the forefront. Such plans should include provisions for adequate protective equipment, hazard pay, structured rotation schedules to mitigate exhaustion, and access to emergency mental health resources. By integrating these measures, healthcare systems can create supportive environments that sustain the morale and resilience of physicians, ultimately improving the quality of care delivered to patients.

Strengths and limitations

The present review has a number of strengths. It employed a comprehensive methodology by examining four distinct indicators of job morale: job motivation, job satisfaction, burnout and depression symptoms, thereby addressing the current absence of a unified and standardized measure of job morale. A systematic and reproducible search of the available literature was performed, and rigorous statistical methods were applied.

This review is also subject to several limitations. Firstly, the available data on job motivation and job satisfaction was insufficient to perform meta-analyses; thus, the final interpretation of job morale was based primarily on the other two indicators, namely burnout and depression symptoms. Secondly, substantial heterogeneity was observed across the included studies, which could not be fully accounted for through sub-group analyses or meta-regression. Although key covariates—such as the country's income group, physicians' specialties, and geographical regions—were analysed to explain this variability, additional factors, including differences in COVID- 19 waves, frontline versus non-frontline roles, sample demographics, and other contextual factors, may have also contributed to the observed heterogeneity. The comparability of results across the included studies may be constrained by considerable variability in job characteristics, cultural factors and country-specific conditions. The impact of socio-cultural context might be lost when diverse studies are combined, although this limitation is unavoidable in a systematic review when synthesizing findings from multiple countries. Additionally, heterogeneity is an inherent and prominent feature of meta-analyses, and therefore, its high presence should be anticipated. Finally, despite employing a comprehensive search methodology, all the studies included in this review originated from middle-income countries, suggesting that the results of this review may not be applicable to low-income settings. This limitation aligns with observations from systematic reviews carried out in LMICs prior to the COVID- 19 pandemic [118, 119], highlighting the persistent lack of resources for conducting such research in low-income contexts.

Conclusion

This systematic review and meta-analysis identified a generally low level of job morale among physicians working in middle-income countries during the COVID- 19 pandemic. Given the considerable heterogeneity and limited methodological quality of the included studies, any conclusions drawn should be regarded as tentative. Future investigations should prioritize the examination of job morale within low-income regions and aim to identify effective resilience strategies, providing a foundation for interventions that enhance job morale. Improved job morale could contribute to higher quality care, better recruitment and retention of healthcare professionals, and greater preparedness for future pandemic preparedness and other serious potential healthcare challenges.

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
Conceptualization AK and MT; Supervision: AK and MT; Data curation: MD, NT, TS, DS, RM, MS and AT; Data analysis, validation, and interpretation: MD, NT, TS, DS and RM; Qualitative data analysis and interpretation: AK, RM, MS and AT; Original draft preparation: AK, MD, MT and NT. All authors have agreed to the order of authorship. All authors have approved the submission of this version and are accountable for the content of this manuscript.

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Data availability
All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

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References

1. Sabitova A, Hickling LM, Priebe S. Job morale: a scoping review of how the concept developed and is used in healthcare research. BMC Public Health. 2020;20(1):1166.
2. Warr P. AQThe measurement of Well-Being and other aspects of mental health. J Occup Organ Psychol. 1990;63(3):193–210.
3. Warr P. Work, happiness and unhappiness. NJ: Lawrence Erlbaum Associates; 2011. p. 1–548.
4. Bakker AB, Demerouti E. The job Demands-Resources model: state of the Art. J Managerial Psychol. 2007;22(3):309–28.
5. Dewa CS, et al. The relationship between physician burnout and quality of healthcare in terms of safety and acceptability: a systematic review. BMJ Open. 2017;7(6):e015141.
6. Hall LH, et al. Healthcare staff wellbeing, burnout, and patient safety: A systematic review. PLoS One. 2016;11(7):e0159015.
7. Reininghaus U, Priebe S. Assessing morale in community mental health professionals: a pooled analysis of data from four European countries. Soc Psychiatry Psychiatr Epidemiol. 2007;42(3):237–43.
8. Rowe AK, et al. How can we achieve and maintain high-quality performance of health workers in low-resource settings? Lancet. 2005;366(9490):1026–35.
9. World Health Organization. Pulse survey on continuity of essential health services during the COVID-19 pandemic interim report. Geneva: 2020. https://iris.who.int/bitstream/handle/10665/334048/WHO-2019-nCoV-EHS_continuity-survey-2020.1-eng.pdf?sequence=1.
10. Hamid H, et al. Current burden on healthcare systems in low- and middle-income countries: recommendations for emergency care of COVID-19. Drugs Ther Perspect. 2020;36(10):466–8.
11. Haileamlak A. The impact of COVID-19 on health and health systems. Ethiop J Health Sci. 2021;31(6):1073-4. https://doi.org/10.4314/ejhs.v31i6.1.
12. Pasquale S, et al. COVID-19 in Low- and Middle-Income Countries (LMICs): A Narrative Review from Prevention to Vaccination Strategy. Vaccines (Basel). 2021;9(12):1477. https://doi.org/10.3390/vaccines9121477.
13. World Health Organization. Global Health Workforce statistics database. Available from: https://www.who.int/data/gho/data/themes/topics/health-workforce. Accessed Jan 2024.
14. Marks IH, et al. Medical equipment donation in low-resource settings: a review of the literature and guidelines for surgery and anaesthesia in low-income and middle-income countries. BMJ Glob Health. 2019;4(5):e001785.
15. Nasir N, et al. Risk factors for mortality in hospitalized COVID-19 patients across five waves in Pakistan. Sci Rep. 2024;14(1):20205.
16. Kuandyk Sabitova A, et al. Impact of the COVID-19 pandemic on access to and delivery of maternal and child healthcare services in low-and middle-income countries: a systematic review of the literature. Front Public Health. 2024;12:1346268.
17. Moitra M, et al. Mental health consequences for healthcare workers during the COVID-19 pandemic: A scoping review to draw lessons for LMICs. Front Psychiatry. 2021;12:602614. https://doi.org/10.3389/fpsyt.2021.602614.
18. Stroup DF, BJ, Morton SC. Meta-analysis of Observational Studies in Epidemiology (MOOSE) Group. Meta-analysis of observational studies in epidemiology: a proposal for reporting. JAMA. 2000;283(15):2008-12. PMID: 10789670. https://doi.org/10.1001/jama.283.15.2008.
19. Moher D, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.
20. World Health Organization. Coronavirus (COVID-19) Dashboard. [cited 2023 June 5]; Available from: https://covid19.who.int/.
21. World Bank Open Data. Available from: https://data.worldbank.org. Accessed Mar 2023.
22. Alrawashdeh HM, et al. Occupational burnout and job satisfaction among physicians in times of COVID-19 crisis: a convergent parallel mixed-method study. BMC Public Health. 2021;21(1):811.
23. Moola S, et al. Chapter 7: Systematic reviews of etiology and risk. Joanna Briggs Institute Reviewer's Manual. In: Aromataris E, Munn Z, editor. The Joanna Briggs Institute; 2017. Available at: https://jbi.global/sites/default/files/2019-05/JBI_Critical_Appraisal-Checklist_for_Analytical_Cross_Sectional_Studies2017_0.pdf.
24. Nyaga VN, Arbyn M, Aerts M. Metaprop: a Stata command to perform meta-analysis of binomial data. Arch Public Health. 2014;72(1):39.
25. Harris R, et al. Metan: fixed- and random-effects meta-analysis. Stata J. 2008;8(1):3–28.
26. Gagnier JJ, et al. Investigating clinical heterogeneity in systematic reviews: a methodologic review of guidance in the literature. BMC Med Res Methodol. 2012;12:111.
27. Borenstein M, et al. Introduction to meta-analysis. West Sussex: Wiley; 2009.
28. Sedgwick P, Marston L. How to read a funnel plot in a meta-analysis. BMJ. 2015;351:4718.
29. Egger M, et al. Bias in meta-analysis detected by a simple, graphical test. BMJ. 1997;315(7109):629–34.
30. Richardson M, Garner P, Donegan S. Interpretation of subgroup analyses in systematic reviews: A tutorial. Clin Epidemiol Global Health. 2018;7(2):192–8.
31. United Nations. Statistic Division. Standard country or area codes for statistical use (M49). Available from: https://unstats.un.org/unsd/methodology/m49/. Accessed Mar 2023.
32. Harbord R, Higgins JPT. Meta-Regression in Stata. Stata J. 2008;8(4):493–519.
33. Khursheed T, et al. Burnout in South Asian rheumatologists in the COVID-19 pandemic: an online survey. Rheumatol Int. 2023;43(6):1143–50.
34. El Dabbah NA, Elhadi YAM. High levels of burnout among health professionals treating COVID-19 patients in two nile basin countries with limited resources. Sci Rep. 2023;13(1):6455.
35. Alnajdawi AM, Alsawalqa RO, Alrawashdeh MN. Suicidal ideation and their relationship with job satisfaction and job strain among Jordanian hospitals' healthcare professionals: a cross-sectional study. Front Public Health. 2024;12:1393867.
36. Zhang HH, et al. Depression and its relationship with quality of life in frontline psychiatric clinicians during the COVID-19 pandemic in China: a National survey. Int J Biol Sci. 2021;17(3):683–8.

37. Kalantarion M, et al. Psychological impact of COVID-19 on ophthalmologists in Iran. J Ophthalmic Vis Res. 2022;17(2):233–41.
38. Abd-Ellatif EE, et al. Fear of COVID-19 and its impact on job satisfaction and turnover intention among Egyptian physicians. Saf Health Work. 2021;12(4):490–5.
39. Abdeen MS, et al. Traumatic stress in Egyptian doctors during COVID-19 pandemic. Psychol Health Med. 2023;28(1):171-8. https://doi.org/10.1080/13548506.2022.2059096.
40. Abdelhafiz AS, et al. Prevalence, associated factors, and consequences of burnout among Egyptian physicians during COVID-19 pandemic. Front Public Health. 2020;8:590190.
41. Ahmad Z, et al. Burnout level in Pakistani dentists during COVID-19 pandemic: Cross-sectional National study. Heliyon. 2023;9(12):e23061.
42. Akova I, Kilic E, Ozdemir ME. Prevalence of burnout, depression, anxiety, stress, and hopelessness among healthcare workers in COVID-19 pandemic in Turkey. Inquiry. 2022;59:469580221079684. https://doi.org/10.1177/00469580221079684.
43. Ali SM, Nausheen S. Psychosocial impact of COVID-19 on healthcare workers: A cross-sectional survey from Pakistan. Sultan Qaboos Univ Med J. 2022;22(1):82–90.
44. Almhdawi KA, et al. Physicians' Health-Related quality of life and its associated factors during COVID-19 pandemic in Jordan: A Cross-Sectional study. Eval Health Prof. 2022;45(1):76–85.
45. Aly HM, et al. Stress, anxiety and depression among healthcare workers facing COVID-19 pandemic in Egypt: a cross-sectional online-based study. BMJ Open. 2021;11(4):e045281.
46. Anand T, et al. Job satisfaction among medical officers working in Delhi. J Family Med Prim Care. 2022;11(1):155–61.
47. Araç S, Dönmezdil S. Investigation of mental health among hospital workers in the COVID-19 pandemic: a cross-sectional study. Sao Paulo Med J. 2020;138(5):433–40.
48. Arenliu Qosaj F, et al. Prevalence of Perceived Stress, Anxiety, and Depression in HCW in Kosovo during the COVID-19 Pandemic: A Cross-Sectional Survey. Int J Environ Res Public Health. 2022;19(24):16667. https://doi.org/10.3390/ijerph192416667.
49. Arslan HN, et al. The effects of the COVID-19 outbreak on physicians' psychological resilience levels. Postgrad Med. 2021;133(2):223–30.
50. Bahadirli S, Sagaltici E. Burnout, job satisfaction, and psychological symptoms among emergency physicians during COVID-19 outbreak: A Cross-Sectional study. Psychiat Clin Psychopharm. 2021;31(1):67–76.
51. Bahadirli S. Post-traumatic stress disorder in healthcare workers of emergency departments during the pandemic: A cross-sectional study. Am J Emerg Med. 2021;50:251–5.
52. Böckelmann I, et al. Current incidence of professional burnout among Ukrainian oncologists in Kharkiv. Int J Occup Med Environ Health. 2023;36(6):717–31.
53. Brito-Marques J, et al. Impact of COVID-19 pandemic on the sleep quality of medical professionals in Brazil. Arq Neuropsiquiatr. 2021;79(2):149–55.
54. Caliskan F, Dost B. The evaluation of knowledge, attitudes, depression and anxiety levels among emergency physicians during the COVID-19 pandemic. Signa Vitae. 2020;16(1):163–71.
55. Castañeda Aguilera E, Garcí J. Prevalence of burnout syndrome and associated variables in Mexican medical specialists. Rev Colomb Psiquiatr (Engl Ed). 2022;51(1):41–50.
56. Chalhub R, et al. Anxiety, health-related quality of life, and symptoms of burnout in frontline physicians during the COVID-19 pandemic. Braz J Infect Dis. 2021;25(5):101618.
57. Chen J, et al. Analysis on the relationship between effort-reward imbalance and job satisfaction among family Doctors in China: a cross-sectional study. BMC Health Serv Res. 2022;22(1):992.
58. Chen Y, Li W. Influencing factors associated with mental health outcomes among dental medical staff in emergency exposed to coronavirus disease 2019: A multicenter Cross-Sectional study in China. Front Psychiatry. 2021;12:736172.
59. Ciğerim L, et al. Factors Influencing Burnout Syndrome and Depression in Dentists across Various Institutions. Med (Kaunas). 2024;60(3):517. https://doi.org/10.3390/medicina60030517.
60. Civantos AM, et al. Mental health among head and neck surgeons in Brazil during the COVID-19 pandemic: A National study. Am J Otolaryngol. 2020;41(6):102694. https://doi.org/10.1016/j.amjoto.2020.102694.
61. Deneva TI, Ianakiev YP. Evaluation of anxiety, depression, and biological markers in health professionals with burnout. Folia Med (Plovdiv). 2021;63(1):122–8.
62. Dinibutun SR. Factors associated with burnout among physicians: an evaluation during a period of COVID-19 pandemic. J Healthc Leadersh. 2020;12:85–94.
63. Dinibutun SR. Factors affecting burnout and job satisfaction of physicians at public and private hospitals: A comparative analysis. J Healthc Leadersh. 2023;15:387–401.
64. Doan LP, et al. A reverse pattern in work motivation among Vietnamese health care workers during the prolonged COVID-19 outbreak of 2021: determinants and implications. J Glob Health. 2023;13:06022.
65. Dong P, et al. Depression, anxiety, and burnout among psychiatrists during the COVID-19 pandemic: a cross-sectional study in Beijing, China. BMC Psychiatry. 2023;23(1):494.
66. Durmaz Engin C, et al. The impact of COVID-19 pandemic on practice patterns and psychological status of ophthalmologists in Turkey. Cureus. 2021;13(7):e16614.
67. Ebrahimpour A, et al. Job satisfaction, career burnout, and Work-Related Well-Being prevalence among orthopedic surgeons: A nationwide study. Arch Bone Jt Surg. 2023;11(4):293–300.
68. El-Mazahy H, Mekky J, Elshaer N. Medical professionals' job satisfaction and telemedicine readiness during the COVID-19 pandemic: solutions to improve medical practice in Egypt. J Egypt Public Health Assoc. 2023;98(1):5.
69. Elghazally SA, et al. Burnout Impact of COVID-19 Pandemic on Health-Care Professionals at Assiut University Hospitals, 2020. Int J Environ Res Public Health. 2021;18(10):5368. https://doi.org/10.3390/ijerph18105368.
70. Elkholy H, et al. Mental health of frontline healthcare workers exposed to COVID-19 in Egypt: A call for action. Int J Soc Psychiatry. 2021;67(5):522–31.
71. Elsaie ML, et al. Therapeutic implications of prevalence and predictor risk factors for burn out syndrome in Egyptian dermatologists: A cross sectional study. Dermatol Ther. 2020;33(6):e14327.
72. Elsaie ML, et al. Implication of COVID-19 on the mental health of Egyptian dermatologists: A cross-sectional study. J Cosmet Dermatol. 2021;20(10):3066–73.
73. Enea V, et al. Death anxiety and burnout in intensive care unit specialists facing the COVID-19 outbreak: The mediating role of obsession with COVID-19 and coronaphobia. Death Stud. 2022;46(10):2306–15. https://doi.org/10.1080/07481187.2021.1928331.
74. Faria A, et al. Impact of the COVID-19 pandemic on the development of burnout syndrome in frontline physicians: prevalence and associated factors. Rev Assoc Med Bras (1992). 2021;67(7):942–9.
75. Fauzi MFM, et al. Doctors' Mental Health in the Midst of COVID-19 Pandemic: The Roles of Work Demands and Recovery Experiences. Int J Environ Res Public Health. 2020;17(19):7340. https://doi.org/10.3390/ijerph17197340.
76. Fernández-Arana A, et al. Depression and anxiety symptoms and perceived stress in health professionals in the context of COVID-19: do adverse childhood experiences have a modulating effect? Brain Behav. 2022;12(1):e2452.
77. Fu C, et al. Social support and depressive symptoms among physicians in tertiary hospitals in China: a cross-sectional study. BMC Psychiatry. 2021;21(1):217.
78. Fumis RRL, et al. Burnout syndrome in intensive care physicians in time of the COVID-19: a cross-sectional study. BMJ Open. 2022;12(4):e057272.
79. Hamdan M, et al. Burnout, grit and resilience among Jordanian orthopedic surgeons: a cross-sectional study. BMC Med Educ. 2023;23(1):593.
80. Haznedaroğlu D, et al. Effect of COVID-19 pandemic on sleep quality and mental state of frontline pulmonologists. Noro Psikiyatr Ars. 2022;59(4):315–20.
81. Hossain MR, et al. Psychological distress among healthcare professionals during the early stages of the COVID-19 outbreak in low resource settings: A Cross-Sectional study in Bangladesh. Front Public Health. 2021;9:701920.
82. Iyer S, et al. Risk factors for physician burnout: a perspective from Tanzania. Pan Afr Med J. 2022;41:298.
83. Kadivar M, Kabir-Mokamelkhah E, Habibi-Shams Z. Work-related hazards among pathologists and residents of pathology:results of a Cross-sectional study in Iran. Iran J Pathol. 2021;16(3):274–83.
84. Kasemy ZA, et al. Emotional intelligence, workplace conflict and job burn-out among critical care physicians: a mediation analysis with a cross-sectional study design in Egypt. BMJ Open. 2023;13(10):e074645.
85. Kashif S, Foong CC. Occupational burnout among obstetrics and gynaecology healthcare professionals in A public hospital in Islamabad, Pakistan. J Pak Med Assoc. 2023;73(9):1837–42.

86. Kashtanov A, et al. A Comparative Cross-Sectional Study Assessing the Psycho-Emotional State of Intensive Care Units' Physicians and Nurses of COVID-19 Hospitals of a Russian Metropolis. Int J Environ Res Public Health. 2022;19(3):1828. https://doi.org/10.3390/ijerph19031828.
87. Khatun MF, et al. Mental health of physicians during COVID-19 outbreak in Bangladesh: A Web-Based Cross-Sectional survey. Front Public Health. 2021;9:592058.
88. Li J, et al. Influencing factors of mental health status of dentists under COVID-19 epidemic. Front Psychiatry. 2022;13:933514.
89. Li M, et al. Depression, anxiety, stress, and their associations with quality of life in a nationwide sample of psychiatrists in China during the COVID-19 pandemic. Front Psychol. 2022;13:881408.
90. Mei Q, et al. Chinese hospital staff in anxiety and depression: not only comfort patients but also should be comforted - A nationwide cross-sectional study. J Affect Disord. 2024;360:126–36.
91. Mijić Marić A, et al. Prevalence of burnout among health care workers in the federation of Bosnia and Herzegovina during the coronavirus disease-2019 pandemic: a cross-sectional study. Croat Med J. 2022;63(5):482–9.
92. Na Nakorn S, Srisintorn W, Youravong N. Factors associated with burnout among dentists in public hospitals, Southern Thailand. J Dent Sci. 2022;17(4):1656–64.
93. Ning L, et al. Mental health among healthcare workers during the prolonged COVID-19 pandemic: A cross-sectional survey in Jilin Province in China. Front Public Health. 2022;10:1030808.
94. Okour A, Amarneh B. Physical activity reduces depression among healthcare workers during the COVID-19 pandemic in Jordan. Clin Pract Epidemiol Ment Health. 2023;19:e174501792306220.
95. Oliveira GMM, et al. Women physicians: burnout during the COVID-19 pandemic in Brazil. Arq Bras Cardiol. 2022;119(2):307–16.
96. Oluwadiya KS, et al. The high cost of healing and teaching: a cross-sectional survey of burnout among academic physicians in Nigeria. BMC Health Serv Res. 2023;23(1):1357.
97. Pehlivanoglu B, et al. How does it feel to be a pathologist in Turkey? Results of a survey on job satisfaction and perception of pathology. Turk Patoloji Derg. 2021;37(1):39–50.
98. Pérez-Herrera LC, et al. Effect of the COVID-19 pandemic on the mental health, daily and occupational activities of otolaryngologists and allergists in Colombia: a National study. Int Forum Allergy Rhinol. 2021;11(11):1599–603.
99. Şahin MK, et al. Prevalence of depression, anxiety, distress and insomnia and related factors in healthcare workers during COVID-19 pandemic in Turkey. J Community Health. 2020;45(6):1168–77.
100. Sarkar MAM, et al. Anxiety and depression among gastroenterologists: an online survey in Bangladesh. Prz Gastroenterol. 2021;16(4):358–63.
101. Silva M, Trettim JP. Economic and professional impact of the Covid-19 pandemic and prevalence of depression and anxiety on shoulder and elbow surgeons in Brazil. Rev Bras Ortop (Sao Paulo). 2023;58(5):e727–33.
102. Somboonviboon D, Wittayawisawasakul Y, Wacharasint P. Prevalence and risk factors of burnout syndrome during COVID-19 pandemic among healthcare providers in Thailand. J Environ Public Health. 2023;2023:5719241.
103. Tran B, et al. Psychological impacts of COVID-19 on Vietnamese health workers over the prolonged restricted COVID-19 responses: a cross-sectional study. BMJ Open. 2023;13(8):e069239.
104. Tuna T, Özdin S. Levels and predictors of anxiety, depression, and burnout syndrome in physicians during the COVID-19 pandemic. Int J Ment Health Addict. 2021;19(6):2470–83.
105. Turan Ç, et al. Specialist physicians battle against the COVID-19 pandemic: the relationship between specialist physicians working conditions and levels of burnout during the COVID-19 pandemic. Eur Rev Med Pharmacol Sci. 2022;26(4):1403–13.
106. Tutan A, Kökalan Ö. The mediation role of work-family conflict in the effect of workplace violence on job satisfaction and intention to leave: a study on health care workers in Turkey. Front Psychol. 2024;15:1322503.
107. Villalba-Arias J, et al. Mental health issues and psychological risk factors among Paraguayan healthcare workers during the COVID-19 pandemic. J Ment Health. 2023;32(6):1065–72.
108. Visi V, et al. Psychological impact of Covid-19 pandemic among the healthcare workers in a North-Eastern state of India. J Family Med Prim Care. 2022;11(6):2756–62.
109. Wang Z, et al. Spirituality, moral injury and mental health among Chinese health professionals. BJPsych Open. 2021;7(4):e135.
110. Wang Z, et al. Moral injury in Chinese health professionals during the COVID-19 pandemic. Psychol Trauma. 2022;14(2):250–7.
111. Wannarit K, et al. Burnout study during the COVID-19 pandemic in Thailand: psychometric evaluation of the Maslach burnout Inventory-Human services survey for medical personnel. Health Psychol Behav Med. 2023;11(1):2268694.
112. Wijesinghe C, et al. Survey on the psychosocial impact of COVID-19 on the Sri Lankan mental healthcare system and the needs of frontline healthcare workers in the post-covid era. Ceylon Med J. 2023;68(S1):21–6.
113. Zhu X, Chen Y, Liao X. Factors underlying burnout among rural village physicians in Southwestern China. Health Care Sci. 2023;2(4):233–41.
114. Sahin SK, et al. Psychological impact of COVID-19 outbreak on health workers in a university hospital in Turkey. Psychol Health Med. 2022;27(1):81–90.
115. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. World Psychiatry. 2016;15(2):103–11.
116. Maslach C, Schaufeli WB, Leiter MP. Job Burnout. Annu Rev Psychol. 2001;52(1):397–422.
117. Maslach C, Jackson SE, Leiter MP. Maslach burnout inventory manual. Palo Alto: Consulting Psychologists; 1996.
118. Sabitova A, et al. Indicators associated with job morale among physicians and dentists in Low-Income and Middle-Income countries: A systematic review and Meta-analysis. JAMA Netw Open. 2020;3(1):e1913202.
119. Sabitova A, et al. Job morale of physicians in low-income and middle-income countries: A systematic literature review of qualitative studies. BMJ Open. 2019;9(12):e028657. https://doi.org/10.1136/bmjopen-2018-028657.
120. Ghahramani S, et al. A systematic review and Meta-Analysis of burnout among healthcare workers during COVID-19. Front Psychiatry. 2021;12:758849.
121. Papazian L, et al. High-level burnout in physicians and nurses working in adult ICUs: a systematic review and meta-analysis. Intensive Care Med. 2023;49(4):387–400.
122. Alkhamees AA, et al. Physician's Burnout during the COVID-19 Pandemic: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health. 2023;20(5):4598. https://doi.org/10.3390/ijerph20054598.
123. Macaron MM, et al. A systematic review and meta analysis on burnout in physicians during the COVID-19 pandemic: A hidden healthcare crisis. Front Psychiatry. 2022;13:1071397.
124. Johns G, et al. The global prevalence of depression and anxiety among doctors during the covid-19 pandemic: Systematic review and meta-analysis. J Affect Disord. 2022;298(Pt A):431–41.
125. Pappa S, et al. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain Behav Immun. 2020;88:901–7.
126. Olaya B, et al. Prevalence of depression among healthcare workers during the COVID-19 outbreak: A systematic review and Meta-Analysis. J Clin Med. 2021;10(15):3406. https://doi.org/10.3390/jcm10153406.
127. Salari N, et al. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. Hum Resour Health. 2020;18(1):100.
128. Sun P, et al. The Psychological Impact of COVID-19 Pandemic on Health Care Workers: A Systematic Review and Meta-Analysis. Front Psychol. 2021;12:626547. https://doi.org/10.3389/fpsyg.2021.626547.

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