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Review Article

The mental health of healthcare workers in GCC countries during the COVID-19 pandemic: A systematic review and meta-analysis

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الملخص

أهداف البحث: تهدف هذه المراجعة إلى تلخيص الدراسات العلمية حول مدى انتشار الكرب، والاحتراق النفسي، والقلق، والاكتئاب بين مقدمي الرعاية الصحية في دول مجلس التعاون الخليجي (المملكة العربية السعودية، البحرين، الكويت، سلطنة عمان، قطر، الإمارات العربية المتحدة) خلال جائحة كوفيد-١٩.

طرق البحث: قمنا بالبحث في قواعد البيانات بيميد، سايك إنفو، سكوبس، وقوقل سكولار للتعرف على الدراسات ذات الصلة المنشورة في الفترة ما بين يناير ٢٠٢٠ إلى أبريل ٢٠٢١، وقمنا بعمل مراجعة منهجية وتحليل تلوي.

النتائج: تم العثور على ١٨١٥ ورقة في قواعد البيانات، من بينها ٢٩ دراسة استوفت معايير الاشتمال، ومنها ١٩ دراسة قمنا بتضمينها في التحليل التلوي. التقدير المجمع للقلق المتوسط إلى الشديد باستخدام مقياس "جاد-7" كان ٣٤.٥٧٪ (فترة الثقة: ١٩.٧٣٪ إلى ٥١.١٢٪)، بينما للاكتئاب المتوسط إلى الشديد باستخدام مقياس "استبانة صحة المريض-9" كان٥٣.٢١٪ (فترة الثقة: ٣٢.٧٦٪ إلى ٧٢.٩٦٪)، وللكرب باستخدام " مقياس إدراك الكرب-10" كان ٨١.١٢٪ (فترة الثقة: ٧٢.١٥٪ إلى ٨٨.٧٠٪).

أما بالنسبة للاحتراق النفسي، فلم يتم عمل التحليل التلوي لقلة الدراسات التي تم العثور عليها، غير أن أعلى نسبة بين الدراسات كانت ٧٦٪ (فترة الثقة: ٦٤٪ إلى ٨٥٪).

وبشكل عام، فقد لوحظ وجود اتجاه موجب مع تقدم الوقت للجائحة بالنسبة للقلق والاكتئاب المتوسطين إلى شديدي الدرجة. مع ملاحظة بأن هناك عدم تجانس عال بين الدراسات، وكثير من الدراسات كانت منخفضة الجودة.

الاستنتاجات: معدل انتشار الاضطرابات النفسية بين العاملين في الرعاية الصحية في دول مجلس التعاون الخليجي خلال الجائحة الحالية عال. على الرغم من ذلك، قد تتأثر النتائج بعدم التجانس العالي بين الدراسات وانخفاض جودتها.

الكلمات المفتاحية: القلق؛ الخليج العربي؛ كوفيد -19؛ الاكتئاب؛ ممارس صحي؛ الصحة النفسية

Abstract

Objectives: The aim of this study was to summarize the available evidence on the prevalence of stress, burnout, anxiety and depression among healthcare providers in the Gulf Cooperation Council (GCC) countries (KSA, Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates) during the COVID-19 pandemic.

Methods: We searched PubMed, PsycINFO, Scopus, and Google scholar for related studies published between January 2020 and April 2021 and conducted a systematic review and meta-analysis.

Results: Of the 1815 identified studies, 29 met the inclusion criteria, and 19 studies were included in the meta-analysis. The pooled estimate of prevalence for moderate to severe anxiety as reported using GAD-7 was 34.57% (95% CI = 19.73%, 51.12%), that for moderate to severe depression using PHQ-9 was 53.12% (95% CI = 32.76%, 72.96%), and that for moderate to severe stress using the 10-item Perceived Stress Scales was 81.12% (95% CI = 72.15%, 88.70%). Meta-analysis was not performed for burnout due to the small number of identified studies and the different tools used; however, the highest prevalence was reported at 76% (95% CI = 64%, 85%). Overall, a positive trend was observed over time for moderate to severe anxiety and depression, p = 0.0059 and 0.0762, respectively. Of note, the

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heterogeneity was significant among the studies, and many studies were of poor quality.

Conclusion: The prevalence of mental health disorders during the current pandemic among healthcare workers in GCC countries is high. However, the results could be affected by the high heterogeneity and low quality studies.

Keywords: Anxiety; Arabian Gulf; COVID-19; Depression; Healthcare worker; Mental health

Introduction

Coronavirus disease (COVID-19) is an infectious disease that emerged in China in December 2019 and spread rapidly across the globe. The infection rate rose exponentially, forcing healthcare systems to operate beyond their capacity.[1] Healthcare workers (HCWs) were among the "front-liners" to battle this pandemic while exposed to many stressors, such as high workload and the unexpected growing number of cases and deaths. Furthermore, there was a shortage of personal protective equipment, ventilators and intensive care unit (ICU) beds. In addition, many of HCWs faced social stigmatization and some isolated themselves in fear of transmitting the infection to their families.[2,3]

The countries of the Gulf Cooperation Council (GCC), the KSA, United Arab Emirates, Kuwait, Oman, Qatar and Bahrain,[4] were no exception to the global pandemic, with the first case of COVID-19 identified on January 29, 2020.[5] These countries, classified as high-income countries, are located in southwest Asia, along the Arabian Gulf, and have a total population of 56,905,993.[6,7] In addition to geographical borders, they share common cultural, social, political and economic backgrounds, as well as language and religion.[8] For containment of the emergent pandemic, several public health measures were implemented in GCC countries, including but not limited to travel bans, partial or complete lockdowns and the prohibition of mass gathering events.[9] Despite these measures, the number of reported cases in GCC countries until January 2021 was as high as 20,759 per million compared to 13,135 per million worldwide.[10] HCWs faced several challenges, such as high risk of infection and transmission of the infection to their families, high workload and increasing working hours.[5]

The objective of this review is to summarize the available evidence on the prevalence of stress, burnout, anxiety, and depression among HCWs in GCC countries during the COVID-19 pandemic. The synthesized knowledge can help evaluate the local situation and draw the attention of national health authorities and policymakers to the need to implement interventions to improve the mental health of HCWs in the current and similar future situations. Furthermore, it can provide baseline data for further research on the long-term effects of this pandemic on the mental health of HCWs in GCC countries.

Materials and Methods

Information sources

PubMed, PsycINFO, Scopus and Google scholar were searched for studies published between January 2020 and mid-April 2021. Additionally, the reference lists of the included studies were screened for relevant literature.

Search strategy

A population/outcome question was formulated. The following question was addressed; "in adult HCWs in the GCC countries, what was the prevalence of moderate to severe mental health problems, including anxiety, depression, stress, or burnout, during the period of the COVID-19 pandemic from 29 January 2020 to 15 April 2021, in any healthcare setting?" Multiple terms were categorized into population or outcome (Supplementary Table 1) and used in the search strategy. The search strategy for each database is presented in Supplementary Table 2. For Google Scholar, the search terms were modified to the most sensitive ones; only the first 49 pages were retrievable due to limitations associated with the search engine. This protocol was not registered.

Eligibility criteria

Studies were considered eligible for inclusion if they fulfilled the following criteria: 1) reported the prevalence of depression, anxiety, stress or burnout; 2) included HCWs regardless of the setting; 3) were conducted in one or more GCC countries; 4) the data collection process was conducted after the identification of the first confirmed case of COVID-19 GCC countries (i.e., January 30, 2020),[5] and 5) outcome assessment (prevalence of mental health disorders) was performed using a valid tool. Studies for which the full text was not available, along with duplicate studies were excluded.

Selection process

All identified studies were imported to Covidence, a web-based software designed for systematic reviews (Veritas Health Innovation, Melbourne, Australia). First, the title and abstract of all studies were screened independently in a double-blind manner by two reviewers. Any conflict was resolved by discussion. Subsequently, the full text of the studies was reviewed, and the reason for exclusion of any study was recorded in the same software.

Data collection process and data items

A template for data extraction was designed in Covidence software and the following items were extracted: 1) journal, study title and author name; 2) country in which the study was conducted; 3) study aim; 4) study design; 5) start and end dates of data collection; 6) inclusion and exclusion criteria; 7) sampling technique and recruitment methods; 8) total

number of participants; 9) measurement tool for the study outcomes; 10) cutoff points for the outcomes; 11) reported the prevalence of depression, anxiety, stress and/or burnout in general and/or in each category (mild, moderate, severe, or as specified in each study report); 12) average score (mean or median) for the abovementioned mental health disorders, and 13) associated risk factors for each studied outcome.

Risk of bias assessment

Each study was assessed using the modified Newcastle-Ottawa Scale (NOS) for the quality assessment of cross-sectional studies. This tool has three domains: selection, comparability and outcome, and seven question items. The tool uses a star system ranging from 0 to 10, with the highest being the best.[11] Based on the final score, studies are classified as being of unsatisfactory (1−4), satisfactory (5−6), good (7−8) or very good (9−10) quality.

In addition, the Joanna Briggs Institute (JBI) checklist for prevalence studies was also used.[12] This checklist has nine item questions with three possible answers (yes, no or unclear); 1 point is given for each "yes" answer, and 0 for "no" or "unclear." The maximum final score is 9 points, with higher scores indicating higher-quality studies.

Synthesis methods

The extracted data for each study were presented in a table to facilitate comparison, and narrative synthesis was used to summarize the distribution of the studied mental health disorders. R software (version 4.1.2) (Vienna, Austria) with meta (version 5.2-0) and metaphor (version 3.4-0) packages was used for the meta-analysis, meta-regression and related plots. Due to differences between populations, analyses were performed using the random effects model. Double-arcsine transformation was used to stabilize the variance. Studies that reported data collection time were included in meta-regression. Mid-time point was considered in the model construction. Heterogeneity was assessed using the I^2 statistic and Cochran's Q test.

Reporting bias assessment

Funnel plots were generated and Eggar's test was performed to assess publication bias.

Results

Study selection

The literature search identified a total of 2162 studies. An additional four studies were identified from the reference lists of the included studies. After removing duplicates, 1815 studies were screened at the title and abstract level, of which 90 studies were included for full-text screening and assessment against the eligibility criteria. Finally, 29 studies were included for analysis (Figure 1).

Study characteristics

The characteristics of the included studies are presented in Table 1. The majority of the studies were conducted in the KSA (18 studies),[13−30] six in Oman,[31−36] two in Kuwait[37,38] and one study in Bahrain.[39] The remaining two included studies were conducted in multiple countries, including KSA.[40,41] The sample sizes ranged from 47 to 4,920.[28,30]

With regards to the outcomes of interest, nine studies assessed the prevalence of anxiety, depression and stress,[18,19,21,24,29,32,33,35,40] seven assessed anxiety and depression,[13,15,20,23,26,37,38] two assessed anxiety and stress,[34,36] four assessed anxiety only,[17,22,28,31] four assessed burnout,[16,25,30,41] two assessed stress,[27,39] and one study reported the prevalence of depression only.[14]

Risk of bias assessment

Based on NOS scores, the quality of the included studies ranged from unsatisfactory to very good with the majority of studies being rated as unsatisfactory. The mean score based on the JBI assessment tool was 4.6 (Table 1).

Meta-analysis results

Prevalence of anxiety

Of the 29 included studies, 22 reported the prevalence of anxiety (Table 2).[13,15,17−24,26,28,29,31−38,40] In general, regardless of the tool and cutoff points, the reported prevalence of moderate to severe anxiety ranged from 11% (22) to 81% (20).

The pooled estimate of moderate to severe anxiety as reported using GAD-7 was 34.57% (95% CI = 19.73%, 51.12%). By country, it was 31.54% (95% CI = 14.01%, 52.35%), 27.02% (95% CI = 24.38%, 29.74%), for KSA and Oman, respectively, with one study from Kuwait reporting prevalence of 80.50% (95% CI = 77.11%, 83.68%) (Figure 2). Moreover, subgroup analysis by population for studies on all HCWs showed a pooled prevalence of 35.26% (95% CI = 16.61%, 56.61%), while for physicians it was 40.38% (95% CI = 8.24%, 78.19), and for nurses it was reported by a single study at 18.50% (95% CI = 16.40%, 20.69%)[13] (Figure 3). The removal of studies with unsatisfactory quality did not improve heterogeneity.

For DASS-21, the pooled estimate was 37.00% (95% CI = 17.30%, 59.26%) with high heterogeneity ($p < 0.001$, $I^2 = 97\%$) (Figure 4).

Two studies used the Hospital Anxiety and Depression Scale (HADS); the prevalence of anxiety was reported at 56.8% and 44.2% in KSA and Oman, respectively.[21,32]

Prevalence of depression

A total of 17 studies reported the prevalence of depression[13−15,18−21,23,24,26,29,32,33,35,37,38,40] (Table 3). The prevalence of depression among all included studies ranged from 23% (23) to 95.9% (37).

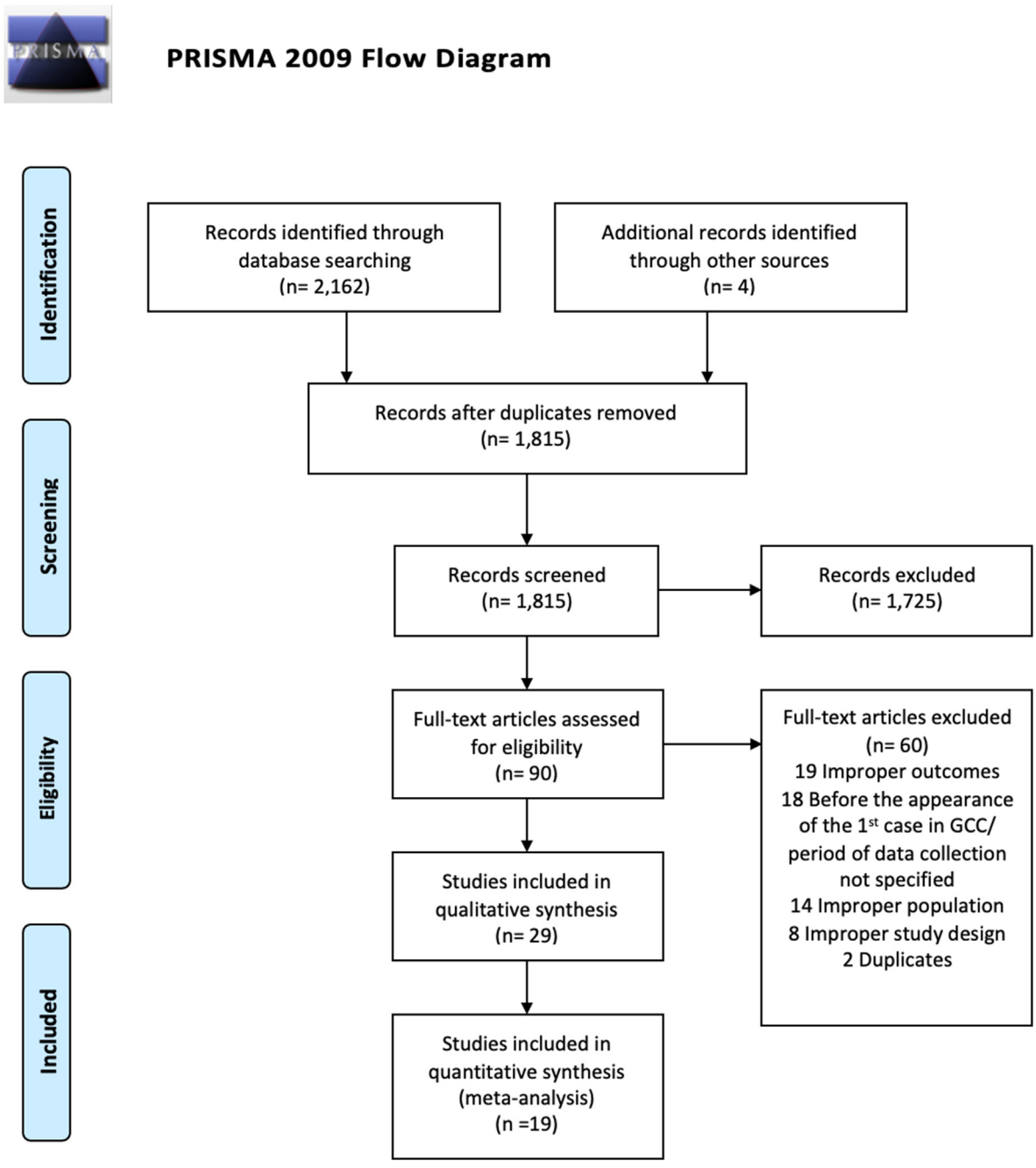

Figure 1: PRISMA flow diagram.

Using PHQ-9, studies in Kuwait showed a higher prevalence at 83.05% (95% CI = 42.92%,100%) as compared to KSA 43.71% (95% CI = 23.77%, 64.77%) (Figure 5). On the other hand, studies involving healthcare workers in general showed a higher prevalence at 61.52% (95% CI = 29.25%, 88.96%) than physicians alone at 48.48% (95% CI = 25.60%, 71.69%) (Figure 6). In both cases, high levels of heterogeneity were observed ($p < 0.001$, $I^2 = 100\%$). Overall, moderate to severe depression, as detected by PHQ-9, was pooled at 53.12% (95% CI = 32.76, 72.96). The pooling estimate from satisfactory to very good quality studies did not change the heterogeneity.

Moderate to severe depression, as reported by two studies using DASS-21, was pooled at 28.57% (95% CI = 25.02%, 32.25%) (Figure 7).

Prevalence of stress

As shown in Table 4, 13 studies investigated the prevalence of stress among HCWs.[18,19,21,24,27,29,32–36,39,40]

Table 1: Characteristics of the included studies.

Study	Country	Sampling technique	Sample size	Response rate	Population	Related outcomes	NOS quality	JBI score
Abu-Snieneh et al. (2020)[13]	KSA	Convenience sampling	1265	–	Nurses	Anxiety and depression	Good	5
Alahmadi et al. (2020)[14]	KSA	–	108	59%	Ophthalmology residents	Depression	Unsatisfactory	4
AlAmmari et al. (2021)[23]	KSA	Purposive sampling	720	–	HCWs	Anxiety and depression	Satisfactory	4
Alamri et al. (2020)[24]	KSA	–	542 (HCWs only)	–	General population (including HCWs)	Anxiety, depression, and stress	Unsatisfactory	5
Alanazi et al. (2020)[25]	KSA	–	3557	–	HCWs	Burnout	Satisfactory	5
AlAteeq et al. (2020)[26]	KSA	Convenience sampling	502	–	HCWs	Anxiety and depression	Satisfactory	4
Aldarmasi et al. (2021)[27]	KSA	–	377	–	HCWs	Stress	Unsatisfactory	4
Alenazi et al. (2020)[28]	KSA	Convenience sampling	4920	3.4%	HCWs	Anxiety	Good	6
AlMahyijari et al. (2020)[31]	Oman	–	150	–	Nurses and physicians	Anxiety	Unsatisfactory	4
AlMaqbali et al. (2021)[32]	Oman	–	1130	–	Nurses	Anxiety, depression, and stress	Unsatisfactory	6
Almater et al. (2020)[29]	KSA	–	107	30.6%	Ophthalmologists	Anxiety, depression, and stress	Unsatisfactory	4
Almubark et al. (2020)[30]	KSA	–	47	–	Nurses in ICU and ED	Burnout	Unsatisfactory	4
Alsairafi et al. (2021)[37]	Kuwait	Convenience sampling	559 (HCWs only)	–	HCWs and health students	Anxiety and depression	Good	5
Alsaywid et al. (2020)[15]	KSA	–	1528	10.7%	Residents and fellows	Anxiety and depression	Satisfactory	5
Alshekaili et al. (2020)[33]	Oman	Random sampling	1139	–	HCWs	Anxiety, depression, and stress	Unsatisfactory	7
Alsulimani et al. (2021)[16]	KSA	–	646	–	HCWs	Burnout	Unsatisfactory	6
Alzaid et al. (2020)[17]	KSA	–	441	96.7%	HCWs	Anxiety	Very Good	6
Arafa et al. (2020)[40]	KSA and Egypt	Snowball sampling	151 (KSA only)	–	HCWs	Anxiety, depression, and stress	Satisfactory	3
Badahdah et al. (2020)[34]	Oman	Convenience sampling	509	–	Physicians and nurses	Anxiety and Stress	Unsatisfactory	3
Balay-Odao et al. (2021)[18]	KSA	Convenience sampling	281	–	Nurses	Anxiety, depression, and stress	Satisfactory	5
Burhamah et al. (2020)[38]	Kuwait	–	282 (HCWs only)	–	General population (including HCWs)	Anxiety and depression	Satisfactory	3
Cravero et al. (2020)[41]	International (including KSA)	Snowball sampling	76 (KSA only)	–	Residents and fellows	Burnout	Satisfactory	5
Jahan et al. (2021)[35]	Oman	–	327	–	Physicians and nurses in PHCs	Anxiety, depression, and stress	Unsatisfactory	4
Jahrami et al. (2020)[39]	Bahrain	Purposive/convenience sampling	257	94%	HCWs (working directly with patients)	Stress	Satisfactory	5
Joseph et al. (2020)[19]	KSA	–	110 (HCWs only)	–	General population (including HCWs)	Anxiety, depression, and stress	Satisfactory	6
Khamis et al. (2020)[36]	Oman	–	402	–	Female physicians and nurses	Anxiety and stress	Unsatisfactory	5
Shalaby et al. (2021)[20]	KSA	Snowball sampling	1182	–	HCWs in tertiary hospitals	Anxiety and depression	Satisfactory	3
Surrati et al. (2020)[21]	KSA	–	118	–	HCWs	Anxiety, depression, and stress	Unsatisfactory	5
Temsah et al. (2020)[22]	KSA	Convenience sampling	582	71.8%	HCWs	Anxiety	Satisfactory	4

Abbreviations: KSA, Kingdom of Saudi Arabia; NOS, Newcastle-Ottawa Scale; JBI, Joanna Briggs Institute.

Table 2: Prevalence of anxiety.

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
Abu-Snieneh et al. (2020)[13]	KSA	Nurses	1265	End of April 2020. Middle of June 2020	GAD-7	Mild: 31.2% Moderate: 9.7% Severe: 8.8% Moderate to severe: 18.5%
AlAmmari et al. (2021)[23]	KSA	HCWs	720	27 April 2020–4 May 2020	GAD-7	Mild: 28.47% Moderate: 12.77% Severe: 8.33% Moderate to severe: 21.1%
Alamri et al. (2020)[24]	KSA	General population (including HCWs)	542 (HCWs only)	10 May 2020–16 May 2020	DASS-21	20.1% (cut-off 21)
AlAteeq et al. (2020)[26]	KSA	HCWs	502	March 2020	GAD-7	Mild: 25.1% Moderate: 11% Severe: 15.3% Moderate to severe: 26.3%
Alenazi et al. (2020)[28]	KSA	HCWs	4920	15 May 2020–18 May 2020	Dispositional cancer worry scale	Low: 31.5% Medium: 36.1% High: 32.3% Medium to high: 68.3%
AlMahyijari et al. (2020)[31]	Oman	Nurses and physicians	150	–	GAD-7	28.67%
AlMaqbali et al. (2021)[32]	Oman	Nurses	1130	7 August 2020–17 August 2020	HADS	44.2%
Almater et al. (2020)[29]	KSA	Ophthalmologists	107	28 March 2020–4 April 2020	GAD-7	Mild: 25.2% Moderate: 15.9% Severe: 5.6% Moderate to severe: 21.5%
Alsairafi et al. (2021)[37]	Kuwait	HCWs and health students	559 (HCWs only)	May 2020–July 2020	GAD-7	Mild: 19.5% Moderate: 43.1% Severe: 37.4% Moderate to severe: 80.5%
Alsaywid et al. (2020)[15]	KSA	Residents and fellows	1528	–	GAD-7	Mild: 26.7% Moderate: 24.5% Severe: 35.6% Moderate to severe: 60.1%
Alshekaili et al. (2020)[33]	Oman	HCWs	1139	8 April 2020–17 April 2020	DASS-21	34.1%
Alzaid et al. (2020)[17]	KSA	HCWs	441		GAD-7	Mild: 27% Moderate: 13.2% Severe: 7.9% Moderate to severe: 21.1%
Arafa et al. (2020)[40]	KSA and Egypt	HCWs	151 (KSA only)	14 April 2020–24 April 2020	DASS-21	Mild to moderate: 26.5% Severe to very severe: 15.2% Mild to very severe: 41.7%
Badahdah et al. (2020)[34]	Oman	Physicians and nurses	509	1st two weeks of April 2020	GAD-7	Mild: 38.7% Moderate: 17.7% Severe: 8.3% Moderate to severe: 26%
Balay-Odao et al. (2021)[18]	KSA	nurses	281	April 2020–June 2020	DASS-21	Mild: 6.8% Moderate: 37.4% Severe: 12.1% Extremely severe: 7.5% Mild to extremely severe: 57%
Burhamah et al. (2020)[38]	Kuwait	General population (including HCWs)	282 (HCWs only)	25 May 2020–30 May 2020	GAD-7	34%
Jahan et al. (2021)[35]	Oman	Physicians and nurses in PHCs	327	–	DASS-21	Mild: 13.4% Moderate: 27.1% Severe: 10.3% Extremely severe: 10.9% Mild to extremely severe: 61.7%
Joseph et al. (2020)[19]	KSA	General population (including HCWs)	110 (HCWs only)	12 April 2020–10 May 2020	PHQ-4	Moderate to severe (combined anxiety–depression): 20%
Khamis et al. (2020)[36]	Oman		402	April 2020 (first 2 weeks)	GAD-7	Mild: 39.6% Moderate: 18.9%

Table 2 (*continued*)

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
		Female physicians and nurses				Severe: 8.9% Moderate to severe: 27.8%
Shalaby et al. (2021)[20]	KSA	HCWs in tertiary hospitals	1182	1 June 2020–31 July 2020	GAD-7	Moderate: 9% Moderately severe: 48% Severe: 33% Moderately severe–severe: 81%
Surrati et al. (2020)[21]	KSA	HCWs	118	April 2020	HADS	Borderline: 21.2% Abnormal: 35.6% Total: 56.8%
Temsah et al. (2020)[22]	KSA	HCWs	582	5 February 2020–16 February 2020	GAD-7	Mild: 20.8% Moderate: 8.1% Severe: 2.9% Moderate to severe: 11%

The highest prevalence was in KSA at 90%[27] while the lowest was 17.7% among nurses in KSA.[18]

The pooled estimate of moderate to severe stress using the PSS-10 was 81.12% (95% CI = 72.15%, 88.70) with high levels of heterogeneity ($p < 0.001$, $I^2 = 94\%$) (Figure 8). Subgroup analysis was not performed due to the low number of studies in each group. The removal of low-quality studies resulted in only two studies to pool.

For two of the studies that used the DASS-21, we found a lower estimate of 12.29% (95% CI = 9.77%, 15.05%) (Figure 9). However, due to the large difference between the two groups, these were not pooled together.

Other tools included the 6-item Impact of Event Scale; the prevalence for this tool was reported at 68%,[19] and the 4-item PSS (PSS-4), with a prevalence reported at 33.8%.[21]

Prevalence of burnout

Our search identified four studies that assessed the prevalence of burnout among HCWs in GCC countries[16,25,30,41] (Table 5). Each of these used a different tool for

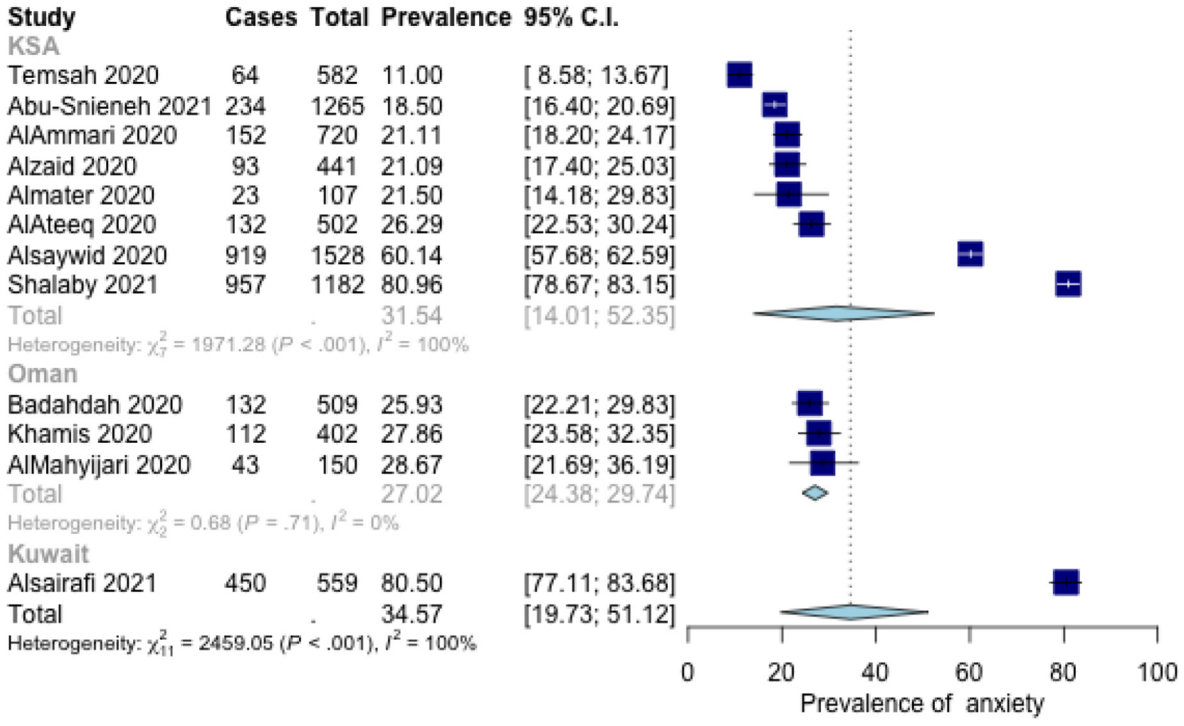

Figure 2: Prevalence of moderate to severe anxiety by country (GAD-7).

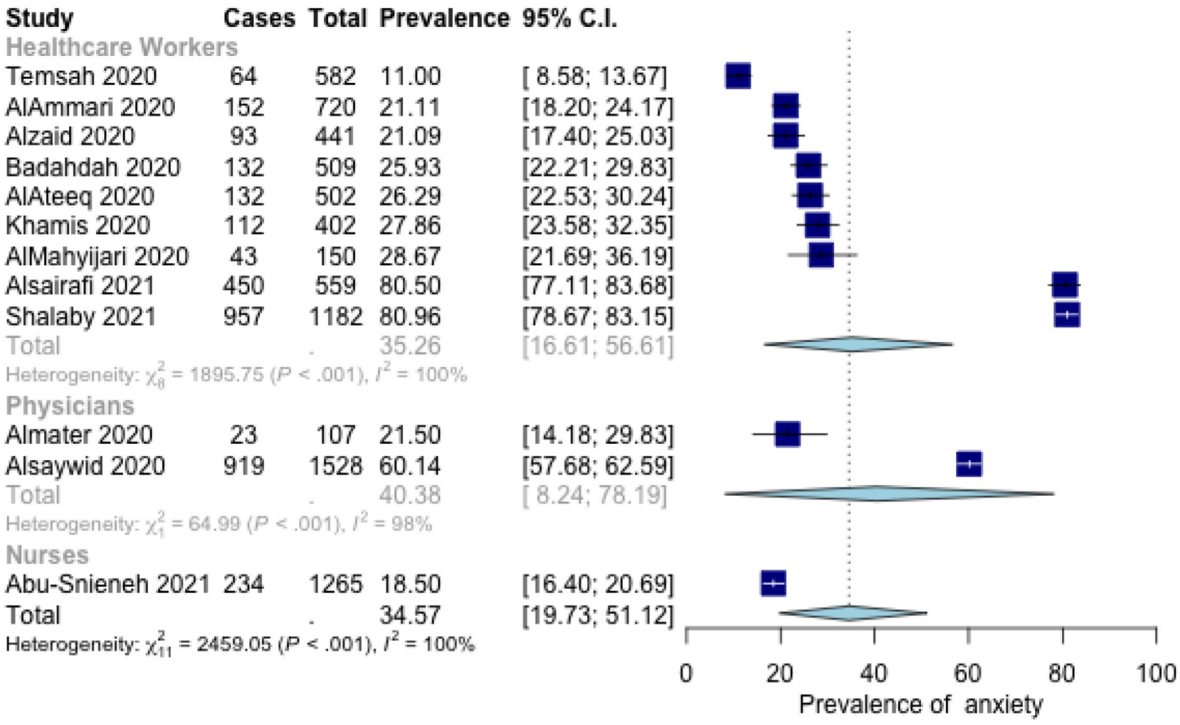

Figure 3: Prevalence of moderate to severe anxiety by population (GAD-7).

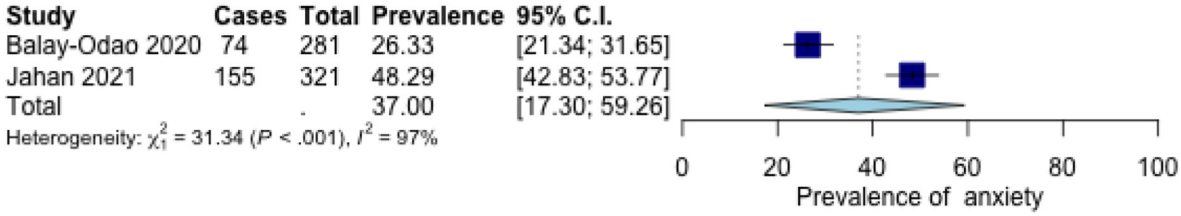

Figure 4: Prevalence of moderate to severe anxiety (DASS-21).

assessment: the Maslach Burnout Inventory,[25] Maslach Burnout Inventory-Human Services Survey,[30] Copenhagen Burnout Inventory,[16] and the Single-item Measures of Emotional Exhaustion and Depersonalization.[41] The highest prevalence (76%) was reported in an international study that included Saudi medical trainees.[41] Due to the small number of identified studies and the use of different tools with different classifications, meta-analysis was not performed.

Meta regression

Prevalence of anxiety

Meta-regression of moderate to severe anxiety using the GAD-7 scale on month of the study revealed positive trend over time with high significance (p = 0.0059) (Figure 10). Neither population nor country of the study were significant when considered as additional moderators.

Prevalence of depression

Meta-regression of moderate to severe depression using the PHQ-9 scale on month of the study also revealed a positive trend over time but with borderline significance (p = 0.0762) (Figure 11). As with the anxiety model, neither population nor country of the study were significant when added as moderators.

Publication bias

Publication bias was assessed using funnel plots of transformed proportions against standard error. Only GAD-7 for anxiety and PHQ-9 for depression categories with ~10 studies were assessed.

Table 3: Prevalence of depression.

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
Abu-Snieneh et al. (2020)[13]	KSA	Nurses	1265	End of April 2020 −middle of June 2020	PHQ-9	Mild: 33.6% Moderate: 14.5% Severe: 11.4% Moderate to severe: 25.9%
Alahmadi et al. (2020)[14]	KSA	ophthalmology residents	142 (PHQ-9: 108)	7 July 2020−14 July 2020	PHQ-9	Mild: 33.1% Moderate: 26.1% Severe: 11.3% Moderate to severe: 37.4%
AlAmmari et al. (2021)[23]	KSA	HCWs	720	27 April 2020−4 May 2020	PHQ-9	Mild: 26.1% Moderate: 13% Moderately severe: 7.91% Severe: 2.08% Moderate to severe: 22.99%
Alamri et al. (2020)[24]	KSA	General population (including HCWs)	542 (HCWs only)	10 May 2020−16 May 2020	DASS-21	32.7% (cut-off: 21)
AlAteeq et al. (2020)[26]	KSA	HCWs	502	March 2020	PHQ-9	Mild: 24.9% Moderate: 14.5% Moderately severe: 10% Severe: 5.8% Moderate to severe: 30.3%
AlMaqbali et al. (2021)[32]	Oman	Nurses	1130	7 August 2020−17 August 2020	HADS	38.5%
Almater et al. (2020)[29]	KSA	Ophthalmologists	107	28 March 2020−4 April 2020	PHQ-9	Mild: 21.5% Moderate: 17.8% Moderately severe: 7.5% Severe: 3.7% Moderate to severe: 29%
Alsairafi et al. (2021)[37]	Kuwait	HCWs and health students	559 (HCWs only)	May 2020−July 2020	PHQ-9	Mild: 4.1% Moderate: 32.2% Moderately severe: 35.6% Severe: 28.1% Moderate to severe: 95.9%
Alsaywid et al. (2020)[15]	KSA	Residents and fellows	1528	–	PHQ-9	Mild: 23.4% Moderate: 24.4% Moderately severe: 22.3% Severe: 19.9% Moderate to severe: 66.6%
Alshekaili et al. (2020)[33]	Oman	HCWs	1139	8 April 2020−17 April 2020	DASS-21	32.3%
Arafa et al. (2020)[40]	KSA and Egypt	HCWs	151 (KSA only)	14 April 2020−24 April 2020	DASS-21	Mild to moderate: 37.1% Severe to very severe: 14.6% Total: 51.7%
Balay-Odao et al. (2021)[18]	KSA	Nurses	281	April 2020−June 2020	DASS-21	Mild: 19.6% Severe: 23.5% Extremely severe: 5.7% Mild to extremely severe: 48.8%
Burhamah et al. (2020)[38]	Kuwait	General population (including HCWs)	282 (HCWs only)	25 May 2020−30 May 2020	PHQ-9	63.8%
Jahan et al. (2021)[35]	Oman	Physicians and nurses in PHCs	327	–	DASS-21	Mild: 14% Moderate: 21.5% Severe: 4.4% Extremely severe: 2.2% Mild to extremely severe: 42.1%
Joseph et al. (2020)[19]	KSA	General population (including HCWs)	110 (HCWs only)	12 April 2020−10 May 2020	PHQ-4	Moderate to severe combined anxiety/depression: 20%
Shalaby et al. (2021)[20]	KSA	HCWs in tertiary hospitals	1182	1 June 2020−31 July 2020	PHQ-9	Mild: 4% Moderate: 14% Moderately severe: 30% Severe: 52%

(*continued on next page*)

Table 3 (*continued*)

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
Surrati et al. (2020)[21]	KSA	HCWs	118	April 2020	HADS	Moderately severe to severe: 82% (cut-off: 11) Borderline: 21.2% Abnormal: 27.9% Total: 49.1%

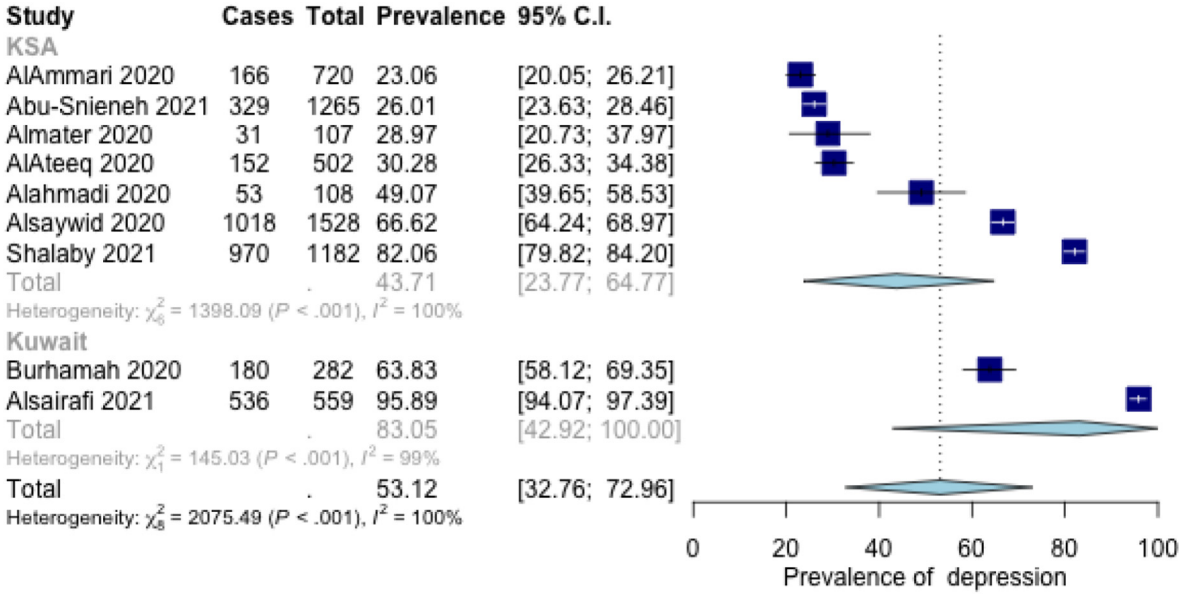

Figure 5: Prevalence of moderate to severe depression by country (PHQ-9).

Despite of the visually apparent unbalanced distributions, the unweighted regression test was not significant for any of the outcomes of interest (moderate to severe anxiety using GAD-7: p = 0.35; and moderate to severe depression using PHQ-9: p = 0.56) (Figures 12,13).

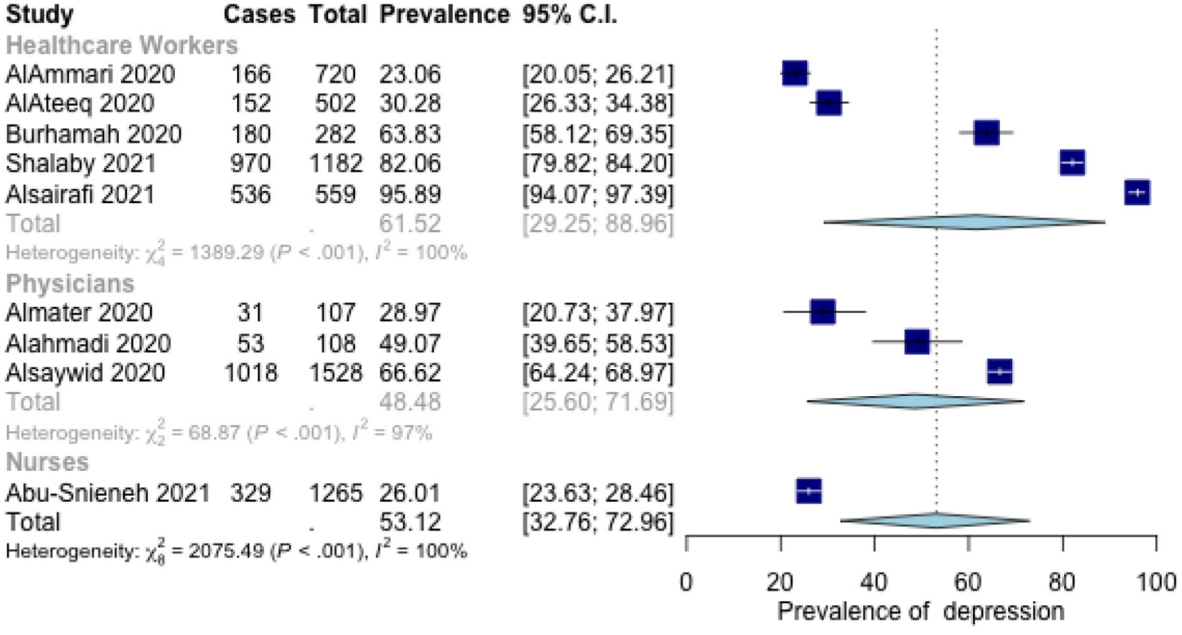

Figure 6: Prevalence of moderate to severe depression by population (PHQ-9).

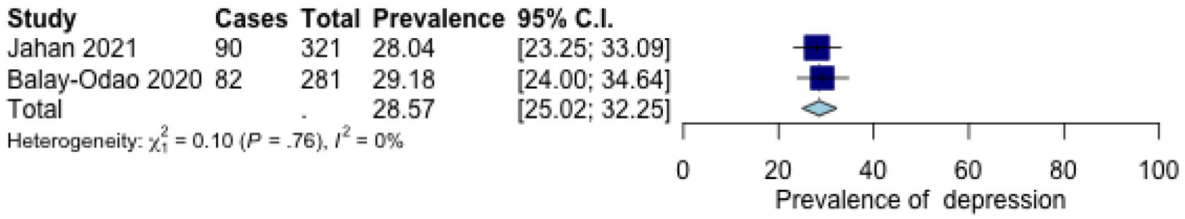

Figure 7: Prevalence of moderate to severe depression (DASS-21).

Table 4: Prevalence of stress.

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
Alamri et al. (2020)[24]	KSA	General population (including HCWs)	542 (HCWs only)	10 May 2020–16 May 2020	DASS-21	22.1%
Aldarmasi et al. (2021)[27]	KSA	HCWs	377	November 2020 –January 2021	PSS-10	Low: 10% Moderate: 82% High: 8% Moderate to high: 90%
AlMaqbali et al. (2021)[32]	Oman	Nurses	1130	7 August 2020–17 August 2020	PSS-10	75.6%
Almater et al. (2020)[29]	KSA	Ophthalmologists	107	28 March 2020–4 April 2020	PSS-10	Low: 28% Moderate: 68.2% High: 3.7% Moderate to high: 71.9%
Alshekaili et al. (2020)[33]	Oman	HCWs	1139	8 April 2020–17 April 2020	DASS-21	23.8%
Arafa et al. (2020)[40]	KSA and Egypt	HCWs	151 (KSA only)	14 April 2020–24 April 2020	DASS-21	Mild to moderate: 22.5% Severe to very severe: 12.6% Mild to very severe: 35.1%
Badahdah et al. (2020)[34]	Oman	physicians and nurses	509	1st two weeks of April 2020	PSS-10	Low stress: 43.6% High stress: 56.4%
Balay-Odao et al. (2021)[18]	KSA	nurses	281	April 2020–June 2020	DASS-21	Mild: 5.7% Moderate: 8.5% Severe: 2.8% Extremely severe: 0.7% Mild to extremely severe: 17.7%
Jahan et al. (2021)[35]	Oman	Physicians and nurses in PHCs	327	–	DASS-21	Mild: 14.3% Moderate: 7.2% Severe: 4.4% Extremely severe: 0.9% Mild to extremely severe: 26.8%
Jahrami et al. (2020)[39]	Bahrain	HCWs	257	April 2020	PSS-10	Low: 15.9% Moderate: 66.9% High: 17.1% Moderate to severe: 84%
Joseph et al. (2020)[19]	KSA	General population (including HCWs)	110 (HCWs only)	12 April 2020–10 May 2020	IES-6	68%
Khamis et al. (2020)[36]	Oman	Female physicians and nurses	402	April 2020 (first 2 weeks)	PSS-10	Low: 46.5% High: 53.5%
Surrati et al. (2020)[21]	KSA	HCWs	118	April 2020	PSS-4	Low: 24.5% Moderate: 72.8% Severe: 2.6% Moderate to severe: 33.8%

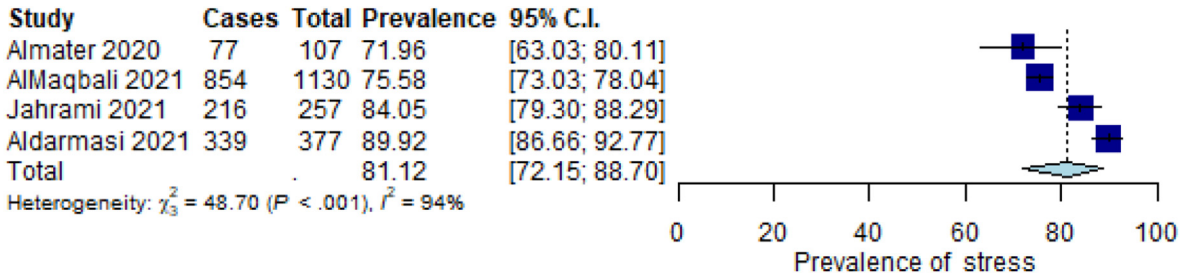

Figure 8: Prevalence of moderate to severe stress (PSS-10).

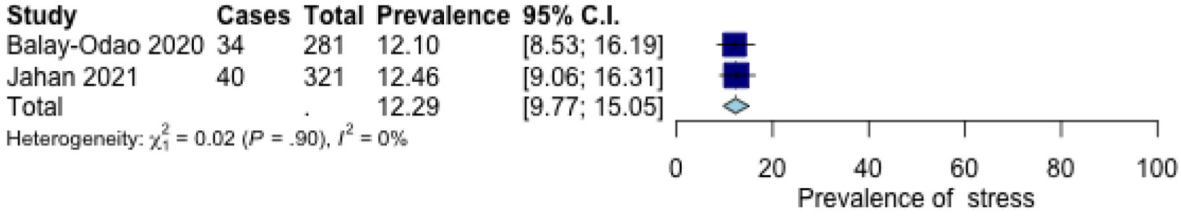

Figure 9: Prevalence of moderate to severe stress (DASS-21).

Table 5: Prevalence of burnout.

Study	Country	Population	Sample size	Period of data collection	Instrument	Prevalence
Alanazi et al. (2020)[25]	KSA	HCWs (all categories)	3557	5 October 2020 −12 October 2020	MBI	Low: EE burnout: 47% Depersonalization burnout: 50% Low personal achievement burnout: 42.9% High: EE burnout: 38.5% Depersonalization burnout: 31.2% Low personal achievement burnout: 33.6%
Almubark et al. (2020)[30]	KSA	Nurses in ICU and ED	47	–	MBI-HSS	Low: 59% Moderate: 30% High: 11%
Alsulimani et al. (2021)[16]	KSA	HCWs	646	June 2020–August 2020	CBI (work-related part)	75.1% (95% CI 0.71–0.78)
Cravero et al. (2020)[41]	International (including KSA)	Residents and fellows	76 (KSA only)	20 April 2020–11 May 2020	Single item measures of emotional exhaustion and depersonalization	76%

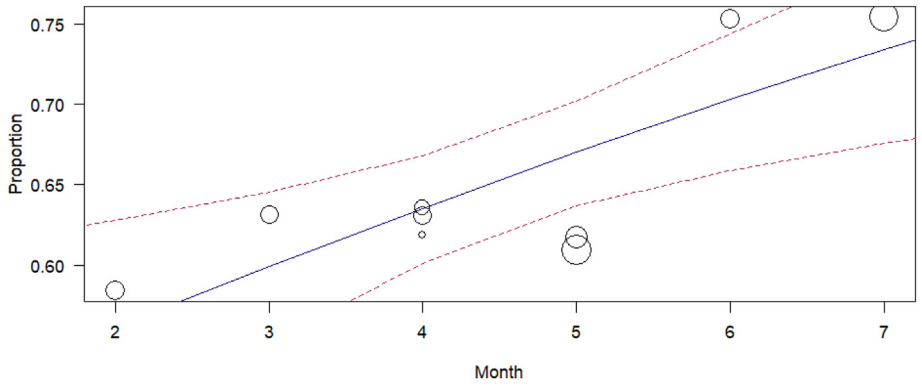

Figure 10: Meta-regression of moderate to severe anxiety (GAD-7) on month of study, 2020.

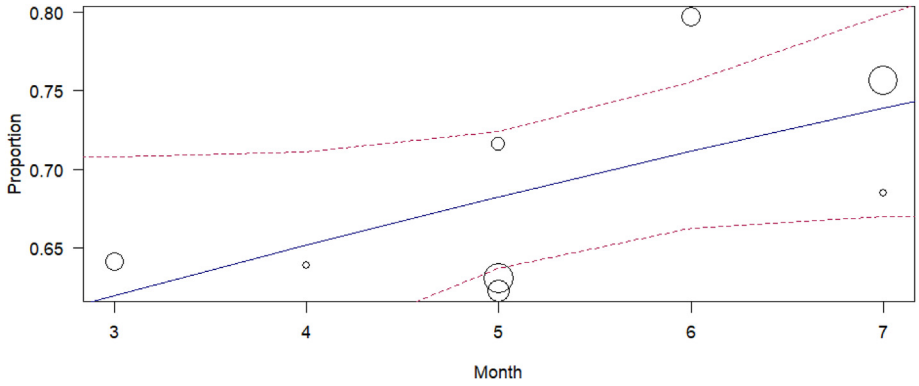

Figure 11: Meta-regression of moderate to severe depression (PHQ-9) on month of study, 2020.

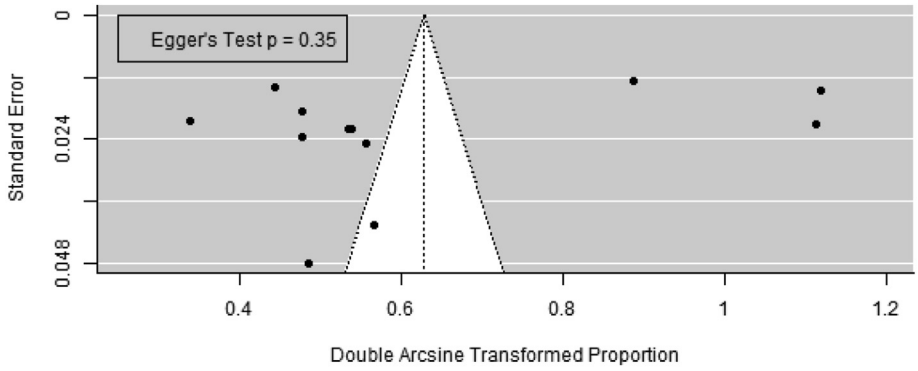

Figure 12: Funnel plot for moderate to severe anxiety (GAD-7).

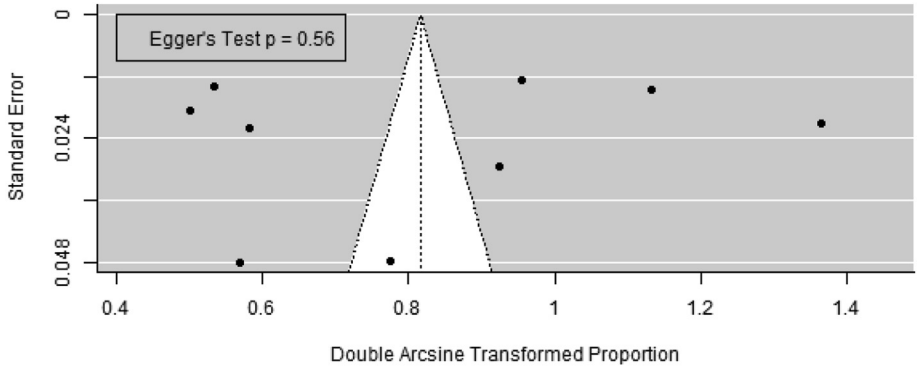

Figure 13: Funnel plot for moderate to severe depression (PHQ-9).

Discussion

The results of this systematic review and meta-analysis indicate a high prevalence of mental health disorders among HCWs in GCC countries during the COVID-19 pandemic. However, there was marked heterogeneity among the studies; this was most likely due to differences in time, population and settings between the studies. This finding also suggests that better-quality studies are needed in the future.

In the present analysis, all four of the evaluated mental health outcomes (i.e., anxiety, depression, stress, and burnout) showed a wide prevalence range. This could be explained by several factors, such as the time of data collection. For instance, the lowest reported prevalence of anxiety was in a study conducted in February 2020 in KSA before the appearance of the first case in the country.[22] Another possible explanation is that different tools and different cutoff points were used to report the prevalence. For example, the lowest prevalence rates of stress using the PSS-10 were reported in two studies that used cutoff points of 25 (36) and 24 (34); these represented the mean scores of the participants. These cutoff points are higher than that used in other studies[14] meaning that some of the participants that could be classified as having stress in other studies were not classified as such in these two studies, thus resulting in an underestimated proportion. Different tools may also result in different prevalence rates.[42] Furthermore, the differences in

the target population and settings may play an important role. Some studies targeted nurses and those working on the frontline. In addition, in many of the studies, the majority of participants were of female gender. These factors were found to be associated with higher rates of mental health disorders during the COVID-19 pandemic.[15,17,18,23,26,28,32,40] This high level of heterogeneity between included studies, along with the low number ($n < 10$) of studies in each category, may have contributed to the discrepancy between non-significant Egger's test results and unbalanced funnel plots.

In comparison to other global systematic reviews conducted between December 2019 and October 2020, our results indicated higher prevalence rates.[43–46] For example, Salari et al. reported the prevalence of anxiety, depression and stress at 25.8% (95% CI: 20.5%, 31.9%), 24.3% (95% CI: 18.2, 31.6%) and 45% (95% CI: 24.3%, 67.5%), respectively.[45] A recent systematic review on the prevalence of mental health disorders among the general population in KSA during the pandemic reported lower rates than those found in our study. The reported rates were 20% (95% CI: 16%, 24%), 30% (95% CI: 22%, 38%) and 29% (95% CI: 11%, 47%) for anxiety, depression, and stress, respectively.[47] This discordance between previously reported data and the present findings could be due to the different search time frame.

The positive time trend for the proportion of anxiety and depression aligns with the increased impact of the pandemic GCC populations over time. This further validates the results of this review.

The limitations of the present study are as follows. First, due to the nature of our cross-sectional design, it remains unclear as to whether the evaluated mental health outcomes were pre-existent; thus, a causal relationship between the high prevalence of mental health disorders and the pandemic cannot be established. Several studies that were conducted in healthcare settings before the pandemic reported high prevalence rates among the participants. For example, Alshardi and Farahat (2019) found that 40% of medical residents in Jeddah, KSA reported moderate to severe depression.[48] A study among ICU nurses in KSA reported a prevalence of 88% for moderate to severe stress.[49] Another study in the United Arab Emirates showed that 70% of medical residents experienced burnout.[50] However, to the best of our knowledge, this is the first study to review the mental health of HCWs with focus on the GCC region. Other outcomes, such as sleep disturbance, were also found to have a high prevalence, but they were not included in this review. Furthermore, to ensure homogeneity in the study population, healthcare students were not included.

Another limitation of this study is the quality of the analyzed studies, although two quality assessment tools were used to avoid bias. The most common weakness point was the representativeness of the samples. In many studies, sampling was performed by the convenience sampling technique; this may have affected the generalizability of the results. In addition, all studies used self-reported questionnaires for the investigated outcomes; however, as explained by some authors, this was due to the restrictions employed during that period, such as social distancing.[16]

A further limitation is that, in some studies, there was unequal representation of genders, with the majority of participants being female; this may simply be due to the fact that the majority of HCWs are females, as reported by Alshekaili et al.[33] Moreover, most of the included studies were conducted in KSA, followed by Oman; no studies were conducted in Qatar or the United Arab Emirates. Consequently, generalizing the results to these countries should be taken cautiously.

Furthermore, due to high publication rates during the pandemic,[51] there could be studies that were not included in our review. For example, a study that was published after our search timeframe, conducted from April 2020 to June 2020, included a total of 554 HCWs from all over the KSA and reported a prevalence of 52% for depression.[52]

Finally, an important limitation is that all studies were based on screening tools. Many of these tools can provide dimensional but not categorical classification. For example, the DASS and GAD-7 can detect different anxiety disorders including panic disorder, social anxiety and generalized anxiety disorder.[53,54] Therefore, specifying an outcome depending only on these tools could be difficult.

Conclusion

This study found a high prevalence of mental health disorders including anxiety, depression, and stress among HCWs in GCC countries during the pandemic which increased over time; however, it also points to the need for higher-quality studies with better sampling methods. Moreover, future studies should focus on studying the developing trends as new factors are evolving, such as the development of effective vaccines and the emergence of new variants. More importantly, particular focus should be paid on developing effective measures to reduce the burden of these mental health disorders among HCWs.

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Conflict of interest

The authors have no conflicts of interest to declare.

Ethical approval

Not applicable.

Authors contributions

RA developed the search strategy, performed the search, screened the articles, reviewed full text articles, extracted data, assessed the risk of bias, and wrote the initial and final drafts. AA contributed to the search strategy, screened the articles, designed and performed the meta-analysis, reviewed the initial and final drafts, and provided supervision. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jtumed.2022.07.014.

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